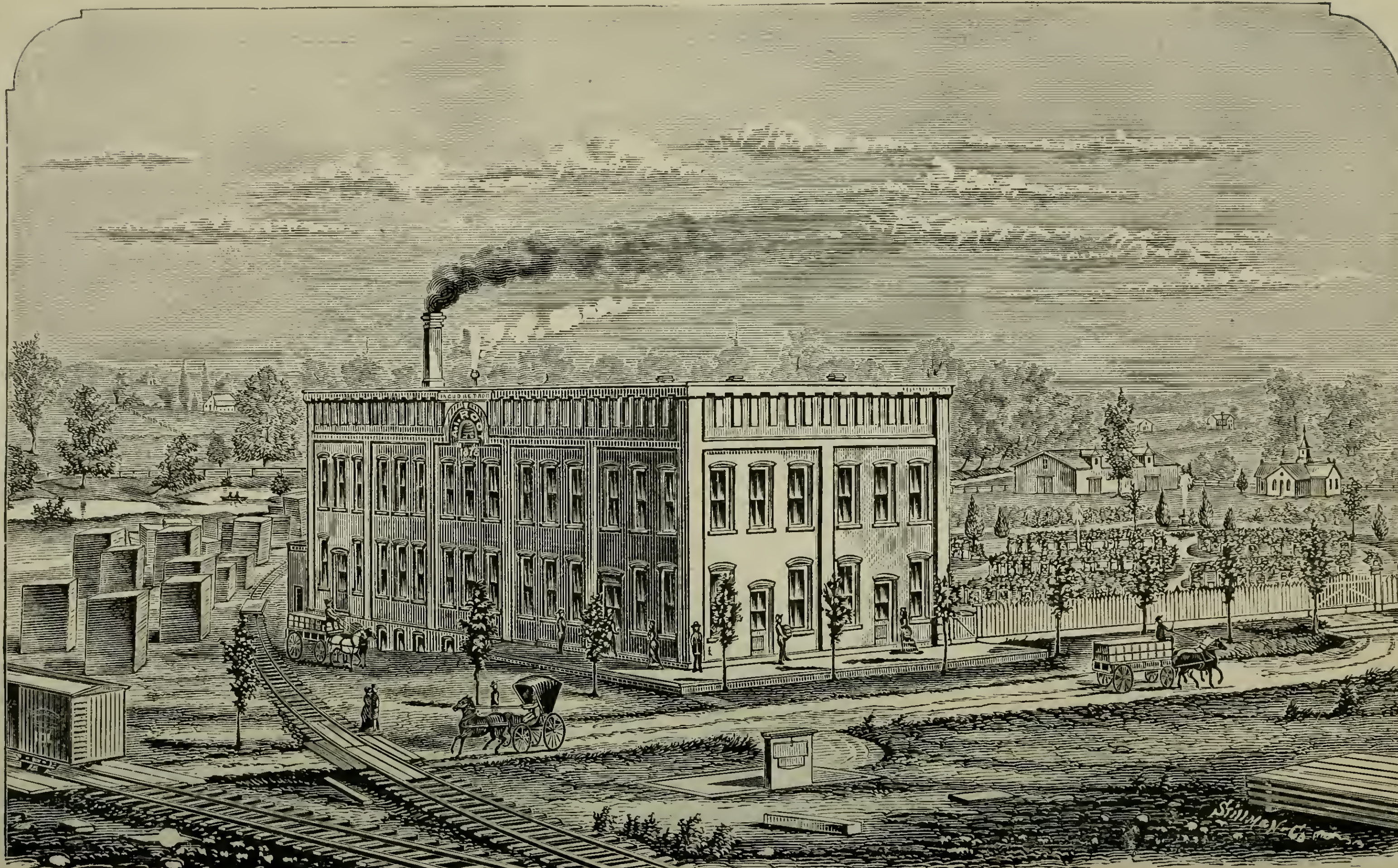
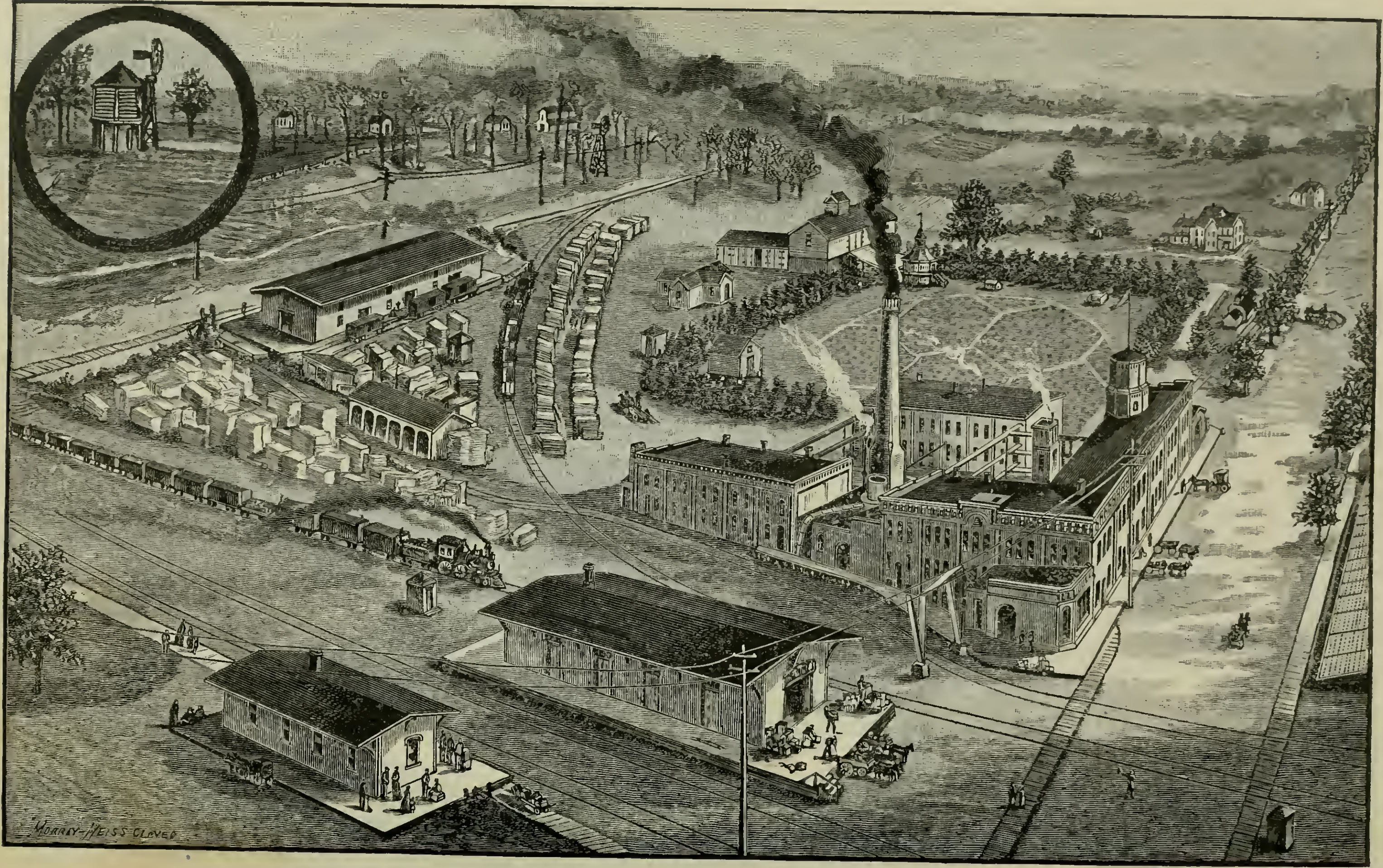
To Percy Hodgson
from
Walter A Taubeneck
President of Northwest Beekeepers Assn.
Marysville, Wash. U.S.A 1958



THE HOME OF THE HONEY-BEES IN 1878.—SEE INTRODUCTION.

THE HOME OF THE HONEY-BEES IN 1884.—SEE INTRODUCTION.

THE HOME OF THE HONEY-BEES IN 1887.—SEE INTRODUCTION.



THE HOME OF THE HONEY-BEES IN 1891.—SEE INTRODUCTION.

THE HOME OF THE HONEY-BEES — THE APIARY.—SEE INTRODUCTION.

[*This view is taken from the roof of the Factory.*]

THE

A B C OF BEE CULTURE:

A Cyclopaedia of Every Thing

Pertaining to the Care of the Honey-Bee;

Bees, Honey, Hives, Implements, Honey-Plants, Etc.,

FACTS GLEANED FROM THE EXPERIENCE OF THOUSANDS OF BEE KEEPERS ALL OVER OUR LAND

And Afterward Verified by Practical Work in Our Own Apiary

BY A. I. ROOT.

52d Thousand.

HEBBLEWHITE & CO.,

Opposite Sydney Arcade,

GEORGE STREET, SYDNEY.

1891.

To the
Throngs of eager, questioning Brothers and Sisters
In the Art of Bee Culture,
In Our Own and Other Countries,
This Work
Is Respectfully Dedicated by
THE AUTHOR

PREFACE.

In preparing this work I have been much indebted to the books of Langstroth, Quinby, Prof. Cook, King, and some others, as well as to all the Bee-Journals; but, more than to all these, have I been indebted to the thousands of friends scattered far and wide, who have so kindly furnished the fullest particulars in regard to all the new improvements, as they have come up, in our beloved branch of rural industry. Those who questioned me so much, a few years ago are now repaying by giving me such long kind letters in answer to any inquiry I may happen to make, that I often feel ashamed to think what meager answers I have been obliged to give them under similar circumstances. A great part of this A B C book is really the work of the people, and the task that devolves on me is to collect, condense, verify, and utilize, what has been scattered through thousands of letters, for years past. My own apiary has been greatly devoted to carefully testing each new device, invention, or process, as it came up; the task has been a very pleasant one; and if the perusal of the following pages affords you as much pleasure, I shall feel amply repaid.

A. I. ROOT.

Medina, Ohio, Nov., 1877.

It is more than 14 years since the first edition of this work was printed. It has passed the experimental stage, and thousands of A B C scholars have reported success, simply from following the instructions given in the body of the work. This edition numbers the 52d thousand; and so great has been the call for it that we have felt warranted in giving it frequent revisions. The present edition is not only enlarged, and illustrated with many new and beautiful engravings, but it has received a careful and most thorough revision. In consequence of overwork and ill health, this work, for the past few years, has devolved upon my son, Ernest R., who is now assistant editor of *Gleanings in Bee Culture.* Some subjects he has re-written, and to others he has made additions and alterations as the spirit of advancement in apiculture seemed to demand, all of which was subject to my approval. As he has made so many additions, it may be interesting to the reader to know what subjects were written by him and what by myself. The new subjects, and some of the old ones that he has almost entirely, and in most cases entirely re-written, are as follows: Chapman Honey-plant; Comb Foundation; Comb Honey; Contraction; Fairs; Feeding and Feeders; Fixed Frames; Foul Brood; Frames, How to Manipulate; Hive-making; Introducing Queens; Moving Bees; Record-keeping of Hives; Reversing; Smokers; Spacing Frames; Veils; Wintering. The subjects to which he has made large additions are these: Alighting-boards; Alsike; Apiary; Basswood; Buying Bees; Candy for Bees; Clover; Drones; Extracted Honey; Extractors; Out-apiaries; Queens; Queen-rearing; Robbing; Stings; Swarming; Transferring; Wax. The remaining subjects were originally written by myself, and have been retained essentially as they appeared in the first edition of 1877. Doolittle's comments in back part of the work have been entirely revised for this last edition. The 37th and 52d thousandth edition was carefully read and revised by Dr. C. C. Miller, of Marengo, Ill., an extensive bee-keeper, and a proof-reader besides. The subject of Honey-plants, Out-apiaries, and the biographical sketches in the latter portion of the work, are from his pen.

August 1, 1891. A. I. ROOT.

WORKER BEE.

INTRODUCTION.

About the year 1865, during the month of August, a swarm of bees passed overhead where we were at work; and my fellow-workman, in answer to some of my inquiries respecting their habits, asked what I would give for them. I, not dreaming he could by any means call them down, offered him a dollar, and he started after them. To my astonishment, he, in a short time, returned with them hived in a rough box he had hastily picked up, and, at that moment, I commenced learning my A B C in bee culture. Before night I had questioned not only the bees, but every one I knew, who could tell me any thing about these strange new acquaintances of mine. Our books and papers were overhauled that evening; but the little that I found only puzzled me the more, and kindled anew the desire to explore and follow out this new hobby of mine; for, dear reader, I have been all my life *much* given to hobbies and new projects.

Farmers who had kept bees assured me that they once paid, when the country was new, but of late years they were of no profit, and everybody was abandoning the business. I had some headstrong views in the matter, and in a few days I visited Cleveland, ostensibly on other business, but I had really little interest in any thing until I could visit the bookstores and look over the books on bees. I found but two, and I very quickly chose Langstroth. May God reward and for ever bless Mr. Langstroth for the kind and pleasant way in which he unfolds to his readers the truths and wonders of creation, to be found inside of a bee-hive.

What a gold-mine that book seemed to me, as I looked it over on my journey home! never was romance so enticing; no, not even Robinson Crusoe; and, best of all, right at my own home I could live out and verify all the wonderful things told therein. Late as it was, I yet made an observatory-hive, and raised queens from worker-eggs before winter, and wound up by purchasing a queen of Mr. L. for $20.00. I should, in fact, have wound up the whole business, queen and all, most effectually, had it not been for some timely advice toward Christmas, from a plain practical farmer near by. With his assistance, and by the purchase of some more bees, I brought all safely through the winter. Through Mr. L., I learned of Mr. Wagner; shortly afterward he was induced to re-commence the publication of the *American Bee Journal;* and through this I gave accounts monthly of my blunders and occasional successes.

Like many others, I could not be content without dabbling in patent hives; and, in spite of good advice to the contrary, as soon as I was fairly started I bought rights and thenceforth kept the most of my bees in American hives. After a trial of both kinds, the American and Langstroth, side by side, for 5 years, the combs were transferred from the American back to the L. frames. In 1867, news came across the ocean from Germany, of the honey-extractor; and with the aid of a simple home-made machine I took 1000 lbs. of honey from 20 stocks, and increased them to 35. This made quite a sensation, and numbers embarked in the new business; but when I lost all but 11 of the 35 the next winter, many said, "There! I told you how it would turn out."

I said nothing, but went to work quietly, and increased the 11 to 48, during the one season, not using the extractor at all. The 48 were wintered entirely without loss, and I think it was, mainly, because I took care and pains with each individual colony. From the 48, I secured 6162 lbs. of extracted honey, and sold almost the entire crop for 25c. per lb. This capped the climax, and inquiries in regard to the new industry began to come in from all sides; beginners were eager to know what hives to adopt, and where to get honey-extractors. As the hives in use seemed very poorly adapted to the use of the extractor, and as the machines offered for sale were heavy and poorly adapted to the purpose, besides being "patented," there really seemed to be no other way before me than to manufacture these implements. Unless I did this, I should be compelled to undertake a correspondence that would occupy a great part of my time, without affording any compensation of any account.[1] The fullest directions I knew how to give for making plain simple hives, etc., were from time to time published in the *A. B. J.;* but the demand for further particulars was such that a circular was printed, and, shortly after, a second edition; then another, and another. These were intended to answer the greater part of the queries; and from the cheering words received in regard to them, it seemed the idea was a happy one.

Until 1873, all these circulars were sent out gratuitously ; but at that time it was deemed best to issue a quarterly at 25c per year, for the purpose of answering these inquiries. The very first number was received with such favor that it was immediately changed to a monthly, at 75 c. The name given it was "GLEANINGS IN BEE CULTURE," and it was gradually enlarged until, in 1876, the price was changed to $1.00. During all this time, it has served the purpose excellently, of answering questions as they come up, both old and new ; and even if some new subscriber should ask in regard to something that had been discussed at length but a short time before, it was an easy matter to refer him to it, or send him the number containing the subject in question.

After GLEANINGS was about commencing its fifth year, inquirers began to dislike being referred to something that was published a half-dozen years ago. Besides, the decisions that were then arrived at perhaps needed to be considerably modified to meet present wants. Now, if we go over the whole matter again every year or two, for the benefit of those who have recently subscribed, we shall do our regular subscribers injustice, for they will justly complain that GLEANINGS is the same thing over and over again, year after year.

Now you can see whence the necessity for this A B C book, its office, and the place we purpose to have it fill. In writing it I have taken pains to thoroughly post myself in regard to each subject treated, not only by consulting all the books and journals treating of bee culture, which I have always ready at hand, but by going out into the fields, writing to those who can furnish information in that special direction, or by sacrificing a colony of bees, if need be, until I am perfectly satisfied. Still further: this book is all printed from type kept constantly standing, and as the sheets are printed only so fast as wanted, any thing that is discovered, at any future time, to be an error, can be promptly righted. For the same reason, all new inventions and discoveries that may come up — they are coming up constantly — can be embodied in the work just as soon as they have been tested sufficiently to entitle them to a place in such a work. In other words, I purpose it to be never out of date or behind the times.—*Dec., 1878.*

HOME OF THE HONEY-BEES IN 1879.

The business increased and developed so much that in 1879 we located on a piece of ground of 18 acres, and the pictures in the front give you a little idea of our building and surroundings at that date. The apiaries, of which you get a little glimpse, cover about 2½ acres; there are seven of them, like the hexagonal apiary shown in the back of this book. The central one has a flag in the center of it, on which are the words, "BY INDUSTRY WE THRIVE." The whole seven apiaries will accommodate 500 hives. Three or four boys and girls are, during the season, constantly employed in rearing and shipping the queens. More are employed in making the hives and implements, and still more are at work on the journal, making this book, etc., etc. In fact, there are now over a hundred of us, all together. Almost every trade and industry is represented in the building and on the grounds. We make all kinds of wood-work, have a tin-shop, carpenter-shop, blacksmith-shop, machine-shop, printing-office, book-bindery, sewing-room, paint-shop, varnishing and japanning room, wax-room where the foundation is made, a room where leather is worked considerably in making smokers, a well-patronized lunch-room, and we have almost every thing except a grog-shop. There used to be two of these just across the railroad, but both have closed up business now. I rather suspect the atmosphere we have brought into this part of the town was more than they could stand. If you should happen along here about noon, you would find that the engineer always stops the engine promptly at 10 minutes of noon, and that the hands then gather in the largest room in the building around an organ that they have purchased with their own money. In fact, it was purchased by each one giving a day's work. After all join in singing a hymn, your humble servant is expected to read a verse or two from the Bible, and close the 10 minutes devotional exercise with a few brief remarks and prayer. I am often asked by visitors if this noon-day service was an idea of mine. I reply that it was as unexpected to me as to any one else. It would be a long story, to tell how it originated. God brought it about, I am firmly persuaded. Do you wonder saloons do not prosper near us? Right over the open window at which I sit writing, is a stone bee-hive which you can see in the picture. Over the hive is this inscription: "IN GOD WE TRUST." So long as we continue to trust in him, and look to him daily for help, the business will continue to prosper, and we shall be of use to ourselves, and to all those about us; but just so soon as we cease to trust in him, the business will go down; saloons will spring up about us; and ruin and devastation will be the end. There are quite a number of us who know what it is to be frequenters of saloons, and who realize that it is by the grace of God we are kept where we are now. "It is not by might, nor by power, but by my Spirit, saith the Lord of hosts."

[OCTOBER, 1879.]

The following, descriptive of the picture of our apiary a few leaves back, is extracted from the November GLEANINGS:

Isn't it pretty? Had you worked and planned and studied over it as we have, dear reader, you might perhaps appreciate it in a different way from what you do; but I am pretty sure you admire it, any way. You observe there are 6 apiaries surrounding a central one, making 7 in all. There are 61 hives in each apiary, and the small apiaries of 7 hives each, in the corners, make the number nearly 500. The hives in each apiary are exactly 7 feet from center to center, and the streets are 24 feet broad. The gravel walks in the center of each street are 4 feet wide. The hives face different points of the compass, as explained in the back of this book. Coal cinders are placed around each hive to keep the weeds down, and then the space before and around the entrance is covered with clean, white sand. To keep the weeds from springing up through this it is sprinkled once or twice a year with common salt. This is not only to give the bees a clean and pleasant door-yard, but it is to enable us, in passing, to see if all is right. For instance, if robbing has been going on, you will see the dead bees on the white sand, even if you are quite a distance away. Day before yesterday, in passing, I saw a young queen on the sand near the entrance of a hive, and out near the grass was another one.

"Hallo, Will," said I, "what does this mean?"

"Oh! I forgot to cut out those queen-cells," said he: and he opened the hive "quicker," and found nine good cells, and two torn down. You see, the white sand saved me 9 queen-cells, that one time.

The grass is all kept in nice trim with the lawn-mower, and the labor is very much less, for so large an apiary, than to keep the ground clean with a hoe, as I have formerly recommended. It is now the middle of October; but the grass, in consequence of the frequent mowings, is as fresh and green as in June. To add to the beauty of it, dandelions have sprung up, and their bright yellow blossoms dotting the green here and there make a prettier picture than I can describe, especially as one or more Italians are found on every blossom, on pleasant days.

On the outside of the row of evergreens, which are planted for a windbreak, is a carriage-drive, and this drive extends off to the south, down by the pond, and through my creek-bottom garden. We planted 100 evergreens, ten feet apart; only five of them died, which the nurseryman replaced. Of 500 grapevines, planted last fall, I believe only about 7 died. The building with the wings is the honey house, as we call it. There we store all the tools and implements, all the empty hives, the sugar for feeding, etc. We are talking of a railroad to run through the apiary into this house, but the light wheelbarrow seems to answer so well, we may not build it.

You will notice that the house-apiary has changed so much that one would hardly recognize an old acquaintance. The old wooden roof used to leak some, and so we have put on a tin one. Leaking is a very bad feature for any roof, for hive or building. Tin, if kept painted, makes a sure thing of it. The chaff tenement-hive looks as large as life, or a little larger, and perhaps "twice as natural." You will observe, in the center of each apiary, or near the center, four chaff hives. These are to assist in giving landmarks both to the bees and the apiarist.

I wanted the artist to get the inscription on the flag, but the letters would have been so small you probably could not have read it. Instead of a dozen or more rows of mammoth sunflowers, he has made only one, and these resemble some tropical plant more than those out in the field. The masses of foliage this side of the sunflowers represent the borage. It is yet in full bloom, and fairly covered with bees from morning till night, but nothing like the Simpson honey-plant and the Spider-flowers. The Spider-flowers are growing right down at the right-hand corner; the Simpson-plant, at the upper right-hand corner of the honey-farm. The highway, where the man is riding along on horseback, runs east and west. I wish I could take you down by the pond and show you my creek-bottom garden; perhaps I will some day. I was at work in it this morning with my hoe, so early that I had to work by the light of the stars. I knelt in the soft rich ground (where the cultivator had been running the night before among the plants) and thanked God for this honey-farm, and the opportunities it gives me of helping you all.

Sept. 2, 1880.—We have had another year's experience with honey-plants, and the result is such that I have decided to plant the whole of the available ground to Simpson and Spider plants. I have just been enjoying the dull season amazingly in underdraining our creek-bottom garden, and setting out Simpson-plants. From seed planted in a cold frame in March, we now have beautiful plants humming with bees from daybreak until dark. A little less than one-fourth acre of Spider-plants makes the most beautiful floral sight I ever beheld, and creates such a panic among the bees at dawn that you would think them robbing. The honey from them is very white, and beautiful in flavor.

Jan., 1883.— During the season that is past, some of the largest crops of honey have been harvested ever known. The industry has in several directions begun to assume massive proportions. The demand for one-pound section boxes has been so great that single shipments have gone across the ocean of nearly 100,000. Wax for comb foundation is getting scarce, and we begin to fear the product of the world will not supply the demand. A kind Father seems still smiling on us at the Home of the Honey-Bees.

Sept., 1883.—Our new factory is now nearly ready for occupation. During the summer we have employed between 140 and 150 hands. Two shorthand writers now take down what your humble servant dictates in regard to business and the matter for the journal, and each one is supplied with one of the latest improved type-writers, for copying the short-hand notes. The new factory is built on to the old one, on the right-hand side of the picture, so as to form a sort of wing, or L (see frontispiece), and extends from the old factory to the gate, seen in the margin of the picture. The trade in implements for bee culture has been larger than ever before known, and the production of honey has been correspondingly increased.

HOME OF THE HONEY-BEES IN 1884.

April, 1884.—Again we are called upon for another edition of our A B C. Since its first issue we have *tried* to keep it fully up to the times by constant additions and alterations. During this time, over 15,000 copies have been sold in this and other countries, and the demand is still unabated. The subscription list of GLEANINGS has swelled, until at the close of last year we had 6388 subscribers. Our general business has also increased since last year, so that, even with the new addition to our factory (a cut of which we take pleasure in showing you in frontispiece), we are crowded for room. We are glad to note the continued improvement and increase in apiculture during the year past, throughout our country, especially in Texas, and also throughout the world; and with this advance in our science we have been pleased to see a correspondingly increased demand for honey.

It may be well to add, that in the preparation of this work I have been greatly indebted to the valuable services of my friend Walter B. House, of Saugatuck, Mich. The Glossary and Index are largely his work. He has also added many important suggestions in various parts of the body of the book.

One of the lady clerks in our office, who has been helping us in the business almost from ts infancy, has written the following lines, suggesting the growth of what was, not long ago, but a grain of mustard seed. It was written to be read at the dedication of our new factory, mentioned above.

When Novice first began to tell
  Some facts about the bee,
The story pleased the folks so well,
  "I'll edit it," said he.

The GLEANINGS of ten years ago
  Was small; and placed beside
The GLEANINGS of to-day, doth show
  How great has been its stride.

Though "Barney" was a novice then,
  And "Boss" was typo too,
And wrote his copy with a pen,
  Still GLEANINGS lived and grew.

And when the windmill ruled the day,
  And sometimes rather failed,
The foot-press often came in play,
  That GLEANINGS might be mailed.

All hands were called to come and fold
  When GLEANINGS went to press;
And paper day, in times of old,
  Was one of pasty mess.

When the type-writer's click was heard,
  The pen was put in rack;
The windmill flew off like a bird,
  An engine took the track.

Subscriptions came and brought good will,
  And business multiplied;
Our Homes made GLEANINGS stronger still;
  'T was on the Savior's side.

And we have garnered golden sheaves,
  Which steady grew in store,
Which, in the A B C book, make
  Us rich in bee-man's lore.

The busy little engine steamed,
  And puffed both night and day;
For orders, more than we had dreamed,
  Poured in from far away.

Two busy years went flitting by,
  And found our space too small;
So then we built a factory
  We thought would hold us all.

While our new engine, stately, strong,
  Its shaft of belting moved,
Which made the buzz-saws hum their songs,
  While cutting out their grooves.

While from our large new printing-press,
  Which filled so well its place,
Came GLEANINGS forth in its new dress,—
  'Twas worn with smiling face.

Her "Heads of Grain" were full indeed;
  Her "Blasted Hopes" were small;
Because success would write with speed;
  But failure, scarce at all.

The boys and girls wrote letters too,
  To say that "Pa keeps bees;"
Until a barrowful they grew,
  And yet they did not cease.

So JUVENILE came on behind,
  To carry them along,
Impelled by aid of Hasty mind,
  It soon grew large and strong.

But, oh! the factory is too small—
  With joy we build again;
We now behold the rising wall,
  Built up by busy men.

And then the cheerful buzz of biz
  Will fill the new wing too,
And Novice's contented phiz
  A broader field will view.

And at the sacred hour of noon,
  Ten golden minutes spend,
Where swells the organ's sweetly tune,
  While prayer and praise ascend.

May GLEANINGS have, and JUVENILE,
  A fat subscription list!
Be full of blessings all the while,
  The helpless to assist.

When Novice has grown old and gray,
  Serving the Master here,
Oh may he hear the Savior say,
  I'm with thee — never fear!

Feb. 1, 1886.—Bee culture is still progressing, although the disastrous losses of the winter of 1884–'85 proved quite a setback, and induced many to give up the business. Our most successful bee-keepers have, however, either wintered safely as usual, or have speedily made up for what losses they may have met. The present edition of this book brings it up to 27,000, and many improvements have been made, not only here in the Home of the Honey-Bees, but in methods of working, and appliances, that will be found explained in the pages of the book.

Quite a stir has been made in the newspapers, in consequence of false statements having been made to the effect that Yankee ingenuity had succeeded in making nice-looking comb honey by machinery. The statements are utterly false, of course; and although we have not been able to make the newspapers at large recall their damaging sensational statements, I believe they have pretty much dropped the matter, although the effect has been quite discouraging on the sale of genuine honey. The immense crops of honey that American bee-keepers are now putting into every market of the world has perhaps had something to do with these fraudulent newspaper articles. Excellent liquid honey is now sold in market as low as 10 cts. per lb., or 9 cts. for 5 lbs. or more. Comb honey brings about a half more. A choice article in one-pound sections will, however, command double the price of liquid honey in many markets.

HOME OF THE HONEY-BEES IN 1887.

It is now May, 1887, and this edition of the A B C book numbers the 32d thousand, accompanied with an increased subscription-list to *Gleanings in Bee Culture.* The Home of the Honey-Bees, as seen a few leaves back, has been greatly enlarged, as you notice, for 1887, and our floor-room now aggregates over an acre of ground. The new addition to the works was built in 1886, and is seen just below the large main building. It is 44 × 96 feet, two stories and a basement. It is in this structure that all our hives, sections, crates, etc., are made. In the upper story of the building is the tinning department. The machinery in both buildings is now run by an engine of 90 horse-power, which keeps 250 feet of line shafting humming, to say nothing of counter-shafting and belts. Our capacity is now so increased that we can turn out daily from 20,000 to 50,000 sections or 1000 hives, besides a vast quantity of other work. As fast as the hives, sections, etc., are turned out they are loaded on to trucks and shoved into the main building, on the elevated sidewalk, as seen back of the locomotive coming up our side-track. In the main building are the packing-rooms where the goods are marked ready for shipment. The draw-bridge then carries them across the track over to the freight depot, as seen in the left—a structure which was built by the railroad company largely to accommodate the increase in our business. We are now shipping about a carload of goods daily, and we have not yet reached our busiest season. Last season we shipped, during the month of June, about a carload and a half of goods daily, to go by freight, and about a carload to go by express, to say nothing of the mail orders. I give you these few facts relative to the work at the Home of the Honey-Bees, that you may know the present status and demands of bee-keeping.

Now, dear reader, I do not know how it seems to you; but when I take a look at the scene of activity as shown in the engraving of the Home of the Honey-Bees for 1887, it seems to me almost as if it could not be reality. It was only a very short time ago that I was a blundering boy — yes, a boy who cried over his plans because they did not work just as he had figured out they ought to work. When this blundering boy, however, stopped working for himself, and began working for the kingdom of God and his glory, giving employment to those who seemed to be in sad need of it, etc., then, by some strange process, success seemed to crown his humble efforts. It seemed as if some great and mighty power had the control and management; and who shall say that such has not been the case while the motto still remains, cut in the solid sandstone right over the arch, in the center of the main building—"*In God we trust*"?

Sept. 1, 1888.—At this date we are called upon to record the poorest crop of honey I have ever known since I have been familiar with honey-bees. The most discouraging feature connected with it is, that the two seasons previous were also poor. This present year, 250 colonies in the apiaries at the Home of the Honey-Bees have given scarcely 250 pounds of surplus, and at the same time almost no increase. This state of affairs is pretty much the rule, not only throughout all the United States, but also in Canada and Great Britain. A few favored localities have reported good yields of honey; but the crop is, for the most part, a failure. As our readers are aware, however, we hold fast to the promise that "all things shall work together for good to those who love God;" and no doubt good will result, even from these dull seasons for honey. It may be that too many are embarking in the bee-business; perhaps too many have been investing with the hope of immediate, sure, and safe returns. If so, these poor seasons, even a succession of them, may teach us a healthful moral lesson. Uncertainty is the rule with things in this world; but although even heaven and earth may pass away, we have God's promise that *his* word and *his* promises *shall never* pass away.

April, 1890.—The season of 1889 was in some localities exceedingly good; in others fair, and in others, again (our State of Ohio included), rather poor. A good many have abandoned bee-keeping entirely; but I do not know that the numbers are much greater than those who are continually abandoning other pursuits because they have their ups and downs. The veterans, and those who started out to make bee culture a specialty, have overcome most of the difficulties attendant upon wintering, and have, as a rule, secured pretty fair crops of honey. Our own business has continued to increase and develop. This edition of the A B C book is printed on a beautiful new Campbell oscillating press, which does more than double the work of the press used heretofore. As an illustration of the amount of work it will do, it prints a complete copy of our journal, *Gleanings in Bee Culture*, 32 pages the size of this, in six seconds, except the cover, and keeps on doing it hour after hour. My son Ernest, and John (my son-in-law) have charge of the principal part of the business of the establishment; and the credit is greatly due to their faithful work, having established pleasant business relations not only with the bee-keepers of our land, but with supply-dealers as well. In order to save expensive freight-bills, hives and sections are now being shipped from different points in the United States, instead of going entirely from our establishment. Many of the bee-friends are troubled, and justly so, at the destruction of our basswood timber for the purpose of making honey-boxes; and I have been urging not only to plant basswoods, but to fence off and preserve the young basswood-trees that are coming up in our forests. These will grow with great rapidity if cattle and other stock are fenced off from them. During a visit through Wisconsin in July, 1889, I witnessed the taking of enormous crops of basswood honey, both comb and extracted; and the large groves belonging to Wisconsin come pretty near placing her among the foremost of our honey-producing States. A visit to California toward the close of the year 1888 gave me an insight into their wonderful climate and resources for honey as well as other things. During the past year our attention has been called to enormous crops of beautiful honey from the alfalfa of the desert of the Great West. As this is raised now by means of irrigation, the honey crop is a permanent affair; and not only is it producing beautiful honey by the ton, but even by the carload. Just now the alfalfa regions promise an encouraging future for honey-producers. Our noonday services, mentioned in the fore part of this introduction, are still prospering. Each Thursday noon is entirely devoted to repeating texts. The organization known as "King's Daughters" has given it quite an impetus, and some one of the Daughters of the establishment selects texts to be read by the different ones present. These texts very often form a sort of Bible-reading, and sometimes occupy the entire ten minutes that are devoted to the services, and occasionally more. More ground has been added to our original 18 acres; and as I dictate these words my eye rests fondly on a piece of work that has been a special hobby of mine. On a gentle hill forming the highest ground in our neighborhood is an enormous water-tank, kept full by a beautiful windmill of modern make. This tank is elevated on a brick basement, and stands sentinel over our entire establishment, to guard it in case of fire; that is, the Grinnell automatic sprinklers are now placed over the ceilings of every room of our large buildings; and just as soon as a fire starts anywhere, in the night or on Sunday, even if no one is around, suitable automatic machinery commences to shower the contents of the water-tank right over the fire and nowhere else. Some of my friends say that Providence favored me in my project of drilling a well on top of a hill, for I found beautiful water within 100 feet of the surface, and the windmill sends us a constant stream of pure water right from the bottom of the well, for the health and enjoyment of all the members of our establishment when thirsty. I have most abundant reason to close these remarks with the words I used last: "Heaven and earth may pass away; but God's promises and his word shall never pass away."

HOME OF THE HONEY-BEES IN 1891.

August 1, 1891.—The season of 1890 was generally poor, while that of 1891 was in most localities good. The clover was prolonged by frequent rains, and the basswood yielded well. The Home of the Honey-bees, likewise, has prospered, as will be seen by the bird's-eye view shown in the frontispiece engravings. In the fall of 1890 we erected a fireproof building, 36 x 98, two stories and basement. It stands just in the rear of the main building, and helps to complete the hollow square. In this building all the metal work is done. On the first floor is a well-equipped machine-shop; on the second floor is the tin-shop, and the basement is used for storage. Runways connect the upper and lower stories of the machine-shop and wood-working building and the main building; and three modern freight elevators, besides the stairways, communicate with the three floors. While the several buildings are separated from each other by fire-walls, and fifty feet of intervening space, they are practically all in one on account of these runways. Several Smead odorless water-closets are conveniently situated at different parts of our bee-plant.

In order to obtain the requisite power to run our machinery, new boiler power had to be added, and, with this, more engines. One large 150-horse-power engine runs the wood-working department; a 10-horse-power, the tin-shop; a 10-horse-power, the wax-room and dynamo; a 7-horse-power, our press and printing department. During the mornings and evenings of the winter months our whole establishment is lit up by electricity. It is also used when we run nights.

In 1891 an east and west railroad was built, and is shown at the upper left-hand corner of the picture. This enables us to secure reduced fr ight rates to all parts of the country. A switch connects the two roads, and, besides, we have a couple of independent switches of our own, with a short line of track to each as shown. Cars are loaded by our own men, right on the track next to the manufactory, and this insures careful handling of goods at our end of the route. This is considerable advantage in handling honey, and other goods that require to be handled with care.

In 1891 we erected a large warehouse, two stories and basement, 48x96, alongside of the east and west railroad, and within easy access of our two switches. It is shown on the left. Hives, sections, etc., are made up during our dull season, and stored there until the busy season, when the already packed goods are marked and sent off. This not only insures careful workmanship, when we can give our undivided care and attention, but also prompt shipment.

In addition to the Grinnell automatic sprinklers mentioned above, in the summer of 1891 we put in an immense Hewes duplex fire-pump, 7x12x14, and 500 ft. of 2½-inch rubber hose. Six large underground pipes connect as many hydrant-houses at various points. within easy access of the buildings and lumber-piles. Steam pressure is kept up constantly, ready for a fire. In such an emergency one man can jerk out the hose, open the hydrant, and a stream of water will be sent from a 1¼-inch nozzle. Our supply of water not only comes from the large tank on the hill, spoken of above, and shown in one corner of the cut, but from a large cistern containing 2000 barrels; and in case of emergency, from our town waterworks supply. About 5000 barrels of water hangs over our plant, ready at any moment for a fire.

Six years ago our north and south road erected a big freight depot, largely for our purpose, so, as you might say, it is really a part of our plant. It is shown in the foreground.

Our home apiary, just the other side of the buildings, consisting of some 200 or 300 colonies. is devoted exclusively to the rearing of queens and bees, largely from imported Italian stock. The business of shipping bees by the nucleus is still a large industry. Our apiary is inadequate for supplying all our needs, and so we draw on three or four other apiaries in our locality, besides receiving large numbers of queens for mail orders from the South. A large bank barn, with some good horses, besides smaller warehouses, help to make up our equipment. Our general office and storeroom, bee-hive factory, machine-shop. warehouses, lumber-yards, etc., together with the barn, cover about five acres; and this entire amount is devoted almost exclusively to the interests of the little bee. A visitor at the Home of the Honey-bees in 1878 would hardly recognize it in its enlarged proportions. Outside of these five acres the rest of the land, over 15 acres, is devoted to high-pressure gardening, and is the hobby of the founder of the Home of the Honey-bees. After reading the mail, and taking a general bird's-eye view of the business in the office, he re-creates himself out in the garden, while the "boys" as he calls them, Ernest and John and their efficient helpers, look after the details of the general business. The former has charge of the bees and the experimental work, hive construction, the printing and publishing department; while the latter has the supervision of the orders, general business, and office work. From ten to fifteen clerks, mostly ladies, keep the books, open the letters, etc., while five Remington typewriters answer most of the correspondence and general billing. It takes fifteen large ledgers to keep track of the accounts. Over all this the "big boss" and founder of the Home of the Honey-bees has a *general* supervision.

ERNEST.

A COLONY OF BEES LIVING AND PROSPERING WITHOUT A HIVE,
AS SOMETIMES SEEN IN CALIFORNIA.

The A B C of Bee Culture.

A.

ABSCONDING SWARMS.—Perhaps nothing is more aggravating in bee culture than to have your bees all on a sudden "light out" for parts unknown, without so much as stopping to give you a parting word of farewell, or a single token of recognition of the debt they owe you, in the shape of gratitude for your past kindnesses in providing them with a home, shelter, etc. Perhaps no part of animated creation exhibits a greater love of home than does the honey-bee; no matter how humble or uninviting the surroundings, they seem much attached to their home; and as they parade in front of their door-way after a hard day's work,[3]* plainly indicate that they have a keen idea of the rights of ownership, and exhibit a willingness to give their lives freely, if need be, in defense of their hard-earned stores. It is difficult to understand how they can ever be willing to abandon it all, and with such sudden impulse, and common consent. No matter if they have never seen or heard of such a thing as a hollow tree, but have for innumerable bee generations been domesticated in hives made by human hands, none the less have they that instinctive longing that prompts them to seek the forest, as soon as they get loose from the chains of domestication. It is possible that the bees, as they go out foraging, keep an eye out for desirable places for starting new homes, and it may be that they have the hollow trees picked out some time before they decide to leave.[4] Many incidents have been reported that pretty clearly show this to be the case. We once found our bees working strongly on a particular locality about a mile and a half from the apiary, where the white clover was blooming with most unusual luxuriance. Very soon after, a colony swarmed, and the bees, after pouring out of the hive, took a direct line for a tree in this clover-field, without so much as making any attempt to cluster at all. Did they not figure out the advantage of having only a few rods instead of over a mile to carry their honey, after having patiently gathered it from the blossoms, little by little? Perhaps it will be well to remark here, that it is very unusual for a swarm to go to the woods without clustering; they usually hang from 15 minutes to an hour, and many times several hours; in fact, we have known them to hang over night; but perhaps it would be well to take care of them inside of 15 or 20 minutes, if we would make sure of them. Long before swarming-time, hives should all be in readiness, and they should also be located just where the new colony is to stand, with the sawdust, grapevines, or whatever we decide to have, all in nice trim. If you are going to have a model apiary, please do not think of waiting until the bees swarm before you lay it out, but take time by the forelock, and with careful deliberation decide where every hive shall be before it is peopled with bees, if you wish to keep ahead and keep your bees from taking "French leave."

But they sometimes go off, even after they *have* been carefully hived, some will say. We are well aware they do often go off after being hived, sometimes the same, and sometimes the next day; but are you sure the hiving was carefully done? We never feel satisfied unless we have given the new swarm at least one comb containing unsealed brood, and we have seldom had a swarm desert a hive when thus furnished, nor do we often hear of one's doing so. With such hives as we shall describe, it is a very simple task, and takes but a minute to open a hive and get such a comb. And besides, if by any chance you should fail to get the queen when you hive the swarm, they would be supplied with the means of rearing another.

This plan of giving them unsealed brood

*Whenever these small figures occur, the reader is requested to turn to Doolittle's and Miller's comments at the close of this book.

does very well. if you can once get them into the hive, but it is necessarily somewhat like the one of catching birds with a handful of salt; how are we to obviate losing the occasional swarm that goes off without clustering at all? or the quite frequent cases of coming out unobserved, or when no one is at home? We are happy to say there is a very certain and sure remedy for all cases of first swarming, in having the wings of the queen clipped so she can not fly; this plan is in very general use, and answers excellently for all first swarms; but, alas! the after-swarms are the very ones that are most apt to abscond, and we can not clip the wings of *their* queens, because they have not yet taken their wedding-flight. What shall we do? Candidly, I don't know of any better way than to watch carefully when they are to be expected, and then chase after them, climb trees, etc., until they are once got safely into a hive. If you think this too much trouble, prevent having after-swarms as we advise under that head.

Clipping the wings of the queen prevents losing first swarms by absconding, it is true; but it does not always prevent losing the queen. She goes out with the bees as usual, and, after hopping about in front of the hive, sometimes gets ready to go back at about the same time that the bees do, after having discovered she is not in the crowd. Even if she gets some little distance from the hive, the loud hum they make as they return, will guide her home many times; but unless the apiarist is at hand at such times to look after affairs, many queens will be lost,[6] and the bees will rear a lot of young queens, and go into after-swarming in good earnest, making even the first swarm an "after-swarm." A German friend, who knows little of bee culture, once told me my bees were swarming, and if I did not ring the bells, etc., they would certainly go to the woods. As I quietly picked up the queen in passing the hive, I told him if they started to go away, I would call them back. Sure enough, they did start for the woods, and had gone so far that I really began to be frightened myself, when, away in the distance, we saw them suddenly wheel about, and then return to the hive at our very feet. While he gave me credit of having some supernatural power over bees, I felt extremely glad I had taken precautions to clip all our queens' wings but a few days before. After this, I felt a little proud of my control over these wayward insects, until a fine swarm of Italians started off under similar circumstances, and, despite my very complacent, positive remarks, to the effect that they would soon come home, they went off and stayed "off." In a humbler, and, I dare say, wiser frame of mind, I "investigated," and found they had joined with a very small third swarm of black bees, that had just come from one of a neighbor's hives. I tried to "explain," but it required a five-dollar bill to make matters so clear that I could carry back my rousing swarm of yellow bees, and sort out the black unfertile queen, that they might be made to accept their own. Thus you see, my friends, how many a slip there is, in bee culture, between cup and lip, and how very important it is that you keep posted, and also "post" yourself in some conspicuous place near or in the apiary if you allow natural swarming, and do not want your golden visions—and bees—to take to themselves wings and fly away.

ABSCONDING FOR WANT OF FOOD.

Perhaps bees oftener desert their hives because they are short of stores, than from any other cause; and many times, in the spring, they seem to desert because they are nearly out. The remedy, or, rather, preventive, for this state of affairs, is so plain that we hardly need discuss it. After they have swarmed out, and are put back into the hive, give them a heavy comb of sealed stores if you can; if not, feed them a little at a time, until they have plenty, and be sure that they have brood in the combs. If necessary, give them a comb of unsealed larvæ from some other hive, and then feed them until they have a great abundance of food. You should be ashamed of having bees abscond for want of food.

ABSCONDING IN EARLY SPRING.

This seems to occur just at a time when you can ill afford to lose a single bee; and, worse still, only when our stocks are, generally, rather weak, so that we dislike the idea of losing any of them. In this case they do not, as a general thing, seem to care particularly for going to the woods, but rather take a fancy to pushing their way into some of the adjoining hives, and, at times, a whole apiary will seem so crazy with the idea, as to become utterly demoralized.

A neighbor, who made a hobby of small hives—less than half the usual size—one fine April day had as many as 40 colonies leave their hives and cluster together in all sorts of promiscuous combinations. To say that their owner was perplexed, would be stating the matter very mildly.

Similar cases, though perhaps not as bad, have been reported from time to time, ever since novices commenced to learn the science of bee culture; and although cases of swarming out in the spring were known once in a great while before the new improvements, they were nothing like the mania that has seemed to possess entire apiaries—small ones—since the time of artificial swarming, honey-extractors, etc. We would by no means discourage these improvements, but only warn beginners against making too much haste to be rich. Do not divide or commence swarming your bees, until they are abundantly strong; have them go into winter quarters with an abundance of sealed honey in tough old combs as far as may be; give them hives with walls thick and warm, of some porous material, such as chaff or straw, with a good thickness of the same above, and you will have little cause to fear any trouble from bees absconding in the spring.

ABSCONDING NUCLEUS SWARMS.

This, like the above, seems an outgrowth of the artificial system of working with bees, especially the plan of rearing queens in nuclei formed of two or three frames five or six inches square. This small-hive system was much in vogue about the year 1865. For awhile all worked finely; but soon complaints began to be heard that the bees left their hives in a body, with the queen, whenever she attempted to take her flight to meet the drones. Giving them unsealed larvæ, to amuse and console themselves with while she was absent, was then advised, and it answered very well for a time; but eventually one after another began to declare they wanted no frame in the apiary for queen-rearing, smaller than the ordinary brood-frame. Since this, but little has been heard in the way of complaints of this kind of absconding. Where one has the time to study these little swarms, there is something very interesting and amusing about them. We have had them do finely for several weeks, with perhaps no more than a good pint of bees. A good day's work during clover-bloom would fill the hive completely, and the young queen, after commencing to lay, would often fill the combs by her second day's work; then if she turned up missing on the third day, we used to wonder what in the world was the matter. Sometimes these little swarms would be found hanging on a currant or raspberry bush, as quietly and demurely as if that was the way bees always did; at other times, when we had hunted through all available places for a truant colony, and given them up in despair, they would come circling back and cluster quietly almost under our very (inexperienced) noses.

There is still another kind of absconding that seems to be for no other reason than that the bees are displeased with their hive, or its surroundings, and, at times, it seems rather difficult to assign any good reason for their having suddenly deserted. I have known a colony to swarm out and desert their hive because it was too cold and open, and we have known them to desert because the combs were soiled and filthy from dysentery in the spring. They very *often* swarm out because they are out of stores, and this generally happens about the first day in spring that is sufficiently warm and sunny. I have known them to swarm out because their entrance was too large, and, if we are not mistaken, because it was too small. We have also known them to swarm out because they were so "pestered" with a neighboring ant-hill—see ANTS—that they evidently thought patience ceased to be a virtue.

They often swarm out in spring where no other cause can be assigned than that they are weak and discouraged, and in such cases they usually try to make their way into other colonies. While it may not always be possible to assign a reason for such behavior with medium or fair colonies, we may rest assured that good strong colonies, with ample supplies of sealed stores, seldom, if ever, go into any such foolishness.

By way of summing up, it may be well to say: If you would not lose your bees by natural swarming, clip the wings of all queens as soon as they commence laying; then look to them often, and know what is going on in the apiary every day during the swarming season; if you would not have runaway swarms in the spring, and while queens are being fertilized, confine your experiments to pecks of bees instead of pints.

AFTER-SWARMING.—We might define this by saying that all swarms that come out, or are led out by a VIRGIN QUEEN, are termed after-swarms; and all swarms that come out within ten or fifteen days after the first swarm, are accompanied by such queens. There may be from one all the way up to a half-dozen or even more, depending on the yield of honey, amount of brood or larvæ, and the weather; but whatever the number, they are all led off by queens reared from one lot of queen-cells, and the number of bees accompanying them is, of a necessity, less each time. The last one frequently contains no more than a pint of bees, and, if hived in the old way, would be of little use under almost any circumstances; yet when supplied with combs already built and filled with honey, such as every enlightened apiarist should always keep in store, they may be made the very best of colonies, for they have young and vigorous queens, and often are equal to any in the apiary, the next season. This after-swarming is often considered a great nuisance, or misfortune; but where bees can be sold, at even tolerable figures, we would advise taking care of all that may come out in the manner indicated.[7] In fact, we know of no easier or simpler way of raising bees; but unless the apiary and bees in the vicinity are pretty thoroughly Italianized, there is much greater risk of getting poor hybrids than by the different ways of artificial swarming, where we rear our queen-cells from choice selected brood.

There is one very amusing feature in regard to these after-swarms. When they have decided to send out no more swarms, all the young queens in the hive are sent out, or, it may be, allowed to go out with the last one: and every few days during the swarming season, some "new hand" writes us about the wonderful fact of his having found three or four, or it may be a half-dozen queens in one swarm.[8] On one occasion, a friend, who weighed something over 200, ascended to the top of an apple-tree during a hot July day to hive a very small third swarm. He soon came down, in breathless haste, to inform us that the swarm was *all queens;* and, in proof of it, brought two or three in his closed-up hands.

The queens, with these after-swarms, seldom lay in the drone-cells at all the first season, and the bees therefore build almost entirely worker-comb, which is additional reason for taking care of them, and supplying them with stores from other colonies. However, we would advise, as a general rule, preventing too much after-swarming if it can be done without much trouble; but, if they will come out in spite of all we can do, take care of them in the manner indicated. While first swarms usually come out in the middle of the day, and take things in a regular, methodical way, as indeed we might expect a laying queen of age and experience to do, these after-swarms, that have queens not yet fertilized, are to be looked for at almost any time of day, from early in the morning until after sundown, and they may also be expected to do all sorts of eccentric things, and to cluster in all sorts of places, or to go off into the woods without clustering at all.[9]

Preventing after-swarming can generally be accomplished, at least temporarily, by cutting out all queen-cells but one, after the old queen with the first swarm has left.[10] There are two objections to this plan, however. The first is, that if the single cell left fails to produce a perfect queen, the colony is left queenless. The second is, that they will sometimes—especially the Italians—swarm out with the only queen left, leaving the colony entirely queenless.[305] With the extractor, or by the use of empty combs, we can almost invariably keep down the swarming fever; but if we work entirely for comb honey, even if the boxes are all supplied with foundation, we must expect to have more or less swarming. With box hives, perhaps the best we can do is to hive the after-swarms near the old stock, and let them set until the next day; by this time all the queens will have been killed but one, and we can then kill her, shake the bees in front of their old hive, and all will be "lovely," or about as nearly so as things ever are with box hives.

Giving the old swarm a young fertile queen as soon as the first swarm has left, will usually prevent all second swarming, at least for the time being, for the laying queen will soon destroy all queen-cells, or induce the bees to do so. A simpler method, and one that we believe succeeds almost invariably, is to move the old colony away as soon as the first swarm is out, and set the new one on the same stand. This has the effect of getting all the flying bees into the new swarm, and leaving the old one so destitute that the queen that hatches first is allowed to destroy all the rest of the cells. By this plan we are spared the trouble of opening the hive, but are obliged to carry each hive to a new stand as soon as it has swarmed. If the queen's wing is clipped, and we are at hand, we can manage swarming by this method very expeditiously. As soon as they commence swarming, pick up the queen and carry away the hive they are coming out of; place the new one in its stead; and as soon as the bees commence coming back to look for her, put the queen among them, and your swarm is hived without their clustering at all. This plan works excellently, and the bees go right to work, apparently as perfectly satisfied as if they had clustered in the usual way. The only objection is, that an inexperienced person might not find the queen readily, and she might be lost; also, we are obliged to be on hand or risk losing our queens. It should be borne in mind, that a swarm that issues a month or more after the first swarming, is not to be considered an after-swarm; for in this case it will be led out by a laying queen, or one that is old, compared with the queens just hatching. In regard to the oft-repeated advice to prevent after-swarming by removing all queen-cells but one, it may be well to say that the Italians frequently swarm without constructing queen-cells at all, and the beginner is sadly puzzled at finding nothing of the kind when he looks his hive over. Also, we may have several after-swarms without having any first swarm at all, where the queen is killed or removed by accident. We once had a box-hive neighbor who was so much taken up with an observatory-hive he saw at our house that he at once went home and made one, and, to get the bees, drummed out about a quart from one of his hives. He got the queen, and had a very fine one-comb hive in his parlor; but in a few days the box hive she came from commenced swarming, and furnished him with more queens and small colonies than he knew what to do with.

Perhaps it is not best to leave entirely out of sight the old-fashioned way of returning all swarms that issue when no more swarms are desired. It is a troublesome, but entirely effectual way, if persisted in, and was practiced with box hives before the advent of the movable comb. All that is necessary is to put the swarm back into the parent hive as often as it issues; and when only one young queen is left alive in the hive, the swarming will cease. Sometimes putting back an after-swarm once is all that is necessary.

AGE OF BEES.—It may be rather difficult to decide how long a worker bee would live, if kept from wearing itself out by the active labors of the field; six months certainly, and perhaps a year; but the average life during the summer time is not over three months, and perhaps during the height of the clover-bloom, not over six or eight weeks. The matter is easily determined, by introducing an Italian queen to a hive of black bees, at different periods of the year. If done in May or June, we shall have all Italians in the fall; and if we note when the last black bees hatch out, and the time when no black bees are to be found in the colony, we shall have a pretty accurate idea of the age of the blacks.[14] The Italians will perhaps hold out under the same circumstances, a half longer. If we introduce the Italian queen in September, we shall find black bees in the hive until the month of May following—they may disappear a little earlier, or may be found some later, depending upon the time they commence to rear brood largely. The bees will live considerably longer if no brood is reared, as has been several times demonstrated in the case of strong queenless colonies. It is also pretty well established that black bees will live longer in the spring than Italians; probably because the latter are more inclined to push out into the fields when the weather is too cool for them to do so with safety; they seldom do this, however, unless a large amount of brood is on hand, and they are suffering for pollen or water.

During the summer months, the life of the worker-bee is probably cut short by the wearing-out of its wings, and we may, at the close of a warm day, find hundreds of these heavily laden, ragged-winged veterans making their way into the hives slowly and painfully, compared with the nimble and perfect-winged young bees. If we examine the ground around the apiary at nightfall, we may see numbers of these hopping about on the ground, evidently recognizing their own inability to be of any further use to the community. We have repeatedly picked them up, and placed them in the entrance, but they usually seem only bent on crawling and hopping off out of the way, where they can die without hindering the teeming rising generation.

AGE OF DRONES.

It is somewhat difficult to decide upon the age of drones, because the poor fellows are so often hustled out of the way, for the simple reason that they are no longer wanted; but we may be safe in assuming it something less than the age of a worker. If kept constantly in a queenless hive, they might live for three or four months perhaps.[15]

AGE OF THE QUEEN.

As the queen does little or no out-door work, and is seldom killed by violence as are the drones, we might expect her to live to a good old age, and this she does, despite her arduous oviparous duties. Some queens die, seemingly of old age, the second season, but generally they live through the second or third, and we have had them lay very well, even during the fourth year. They are seldom profitable after the third year, and the Italians will usually have a young queen "helping her mother" in her egg-laying duties, before she becomes unprofitable.

If a very large amount of brood is found in a hive, two queens will often be found, busily employed, and this point should be remembered while seeking to introduce valuable queens.

ALFALFA, OR LUCERNE (*Medicago sativa*). At the present writing, May, 1890, there is considerable difference of opinion in regard to this plant, especially in reference to its adaptability to the average soils of the different States. In the great deserts of the West, California, Arizona, Idaho, and wherever irrigation is depended upon to raise crops, alfalfa is the great honey-plant —perhaps one of the greatest in the world—certainly *the* greatest for artificial pasturage. In the Great American Desert, where the weather is always favorable for the flight of bees, and where alfalfa is grown in fields of thousands of acres, the bee-keeper can hardly ask for any thing more. The irrigation needed to grow it for forage, makes the crop almost certain. In these rainless regions, hot, sunny days, with cloudless skies, are continuous—the very thing needed to make alfalfa do its best. Indeed, although it has been grown successfully in Wisconsin and elsewhere without irrigation, yet no report has been made of honey obtained from it without irrigation, except perhaps in Kansas.

We have tested the plant on a small scale on our own grounds, but gave it up, as it did not seem to bear honey with us. Very likely, however, it is because the amount planted was too small, and may be because other sources furnished so much honey at the same time, that the bees did not notice it. It wintered over without any trouble, and gave a considerable amount of foliage. In digging a cellar for one of our new buildings, a bed of it was torn up; but we found the roots down three or four feet in the soil. We have tried since, and it stands our winters here in Ohio without any trouble. As it is cut several times during the season, there is an almost constant yield of honey in the range of the bees' flight. We have reports already of not only honey by the *ton* but honey by the *carload;* and the quality is probably superior to any thing that the world has ever produced from any other source. In fact, it resembles so much a fine article of white-clover honey that it will probably sell in almost any market as clover honey, which, in fact, it is, as alfalfa is a species of clover.

One man mentions a great tendency to granulation in the honey, but this may not be general. An editorial in GLEANINGS for August, 1890, speaking of a sample of the honey received from Broomfield, Col., says, "It is not only the finest in appearance of any honey I ever saw in my life, but it is also equal in flavor. It is almost if not quite as clear as water, and yet during a hot July day it will scarcely run. It is clear as crystal and exquisite, in flavor."

ALFALFA, OR LUCERNE, SHOWING THE WAY IN WHICH THE ROOT GOES DEEP IN THE GROUND, SEEKING FOR MOISTURE.

In Colorado, the honey-flow from alfalfa is reported as lasting from June to September. In Idaho it is considered the most paying crop, yielding three cuttings. The second cutting is sometimes for seed, yielding five to ten bushels per acre. It takes about three years to get it to its best yield. It succeeds on poor rocky soil, and one man reports so much sweet in it that he has seen bees by the thousand working on the dry hay in spring. From some parts comes the report that it can be readily plowed under, while others say that the roots are hard and must be carefully picked out of each furrow and carted off, otherwise they will grow again. A report comes from Mr. Ball, of Reno, Nevada, of a yield of 17,000 lbs. of alfalfa honey from 200 colonies; and from Mr. Gregg, of Tempe, Arizona, of an apiary of about 200 colonies storing 485 lbs. per colony from alfalfa and mesquite. It seems that there must be a mistake somewhere in this last report.*

The cuts are copied from V. H. Hallock & Sons' (of Queens, N. Y.), seed catalogue for 1890. The large one, giving the size of the root, the way in which it grows deep in the soil, is probably exaggerated, although such plants may have been grown in the loose sandy soils of the desert.

We condense the following in regard to its cultivation, from a pamphlet published by Hallock & Sons, 1889: It is better sown in drills, and cultivated, unless the land is quite free from other seeds, and is in very fine condition. It can, however, be sown broadcast, the same as other clovers. In our locality it should be sown in the spring, or at least a sufficient time before fall so it may get root enough to stand being thrown out by the frost, especially if the ground is clayey. After it gets a good start it can be cut every four or five weeks. It should be put on rich land, well drained. It will not stand too much water. This is indicated by its preference for the desert wastes in the rainless regions. Some writers tell us that there should be a depth of soil above the rock, ten or fifteen feet, and some go even so far as to claim that the roots will go down in search of moisture as much as twenty feet. If sown early, and a good stand obtained, it may be cut the first year. The second year it yields two cuttings, and afterward three and four cuttings, in a season. It has been grown successfully in Wisconsin, but no report has been made of honey obtained from it there.

It yields from three to five tons per acre, and some reports go as high as eight or ten tons. It gives from three to five cuttings to the season, and, under favorable circumstances, even six or seven have been made. For drill planting, 10 or 12 lbs. of seed per acre is sufficient. For broadcast, however, 15 or 20 lbs. is better. For the best hay it should be cut when blooming commences. If raised by bee-keepers, however, they will prefer to leave it until the bees have made a pretty good crop of honey from the bloom.

ALFALFA BLOOM AND FOLIAGE.

The hay is said to be better, however, when cut about as soon as it is in full bloom. All kinds of stock, even poultry, take to it with avidity at first sight. For soiling purposes it is probably unequaled, especially if cut and wilted two or three hours in the hot sun. Thus a supply may be kept for morning, noon, and night feeding. Working animals will get along with very little grain when supplied in this way with alfalfa. Nothing gives better results for milch cows. Pigs, lambs, and colts, are very fond of it, and thrive when so fed. It may be grazed moderately, but heavy close grazing will destroy it. Properly managed, it will yield

* *January, 1891* —During the past season we purchased of Mr. W. K. Ball, of Reno, Nevada, a carload of pure alfalfa honey; and my opinion is, at the present date, that there is no honey produced in the world superior to it. Some people would at first give the beautiful flavor of the mountain-sage honey the preference; but after having had it on the table month after month, the alfalfa honey seems to be a sort of staple, like bread and butter. It candies just about like white clover; but when melted it is so thick it hangs to the spoon like a ball of clear amber-colored delicious wax. At present we are retailing it at 10 cts. per lb. It cost us by the *carload*, delivered here, about 8 cts. Nobody knows, at the present time, what is to be the future of alfalfa honey; but inasmuch as the demand for alfalfa hay and feed promises to be unlimited, and as the number of acres in the great West, that can be used for growing alfalfa by means of irrigation, are unlimited, it seems as if the bee-keepers' great rallying-place in the future is to be the alfalfa fields of what has formerly been called the Great American Desert.

honey crops for 40 years. We are told that there are heavy fields of it in South America that have been growing continuously for centuries. It has been tested by the States more or less for perhaps 50 years past. From the fact, however, that it has been mostly abandoned, except in the great West, I am inclined to think it will not come into general favor unless under very favorable conditions, or because it yields honey as well as hay.

Some writers claim that the amount of rain we have here would be fatal to it during the majority of seasons. Others say, however, that the rain will do no harm, providing the land is thoroughly underdrained. It is quite certain, I believe, that great quantities of seed have been sold by seedsmen at enormous prices, because of exaggerated accounts given in the seed catalogues—that is, exaggerated in regard to the great depth to which the root grows in ordinary soils, and also in regard to its adaptability to all localities. At the present writing, the seed is worth with us about $8.00 per bushel; but we see it advertised in the Pacific States as low as three or four dollars a bushel. The price of the seed will, however, probably be very soon equalized, to the advantage of both parties. In rainless regions, where irrigation is depended upon, there is none of the difficulty in growing it perfectly that we have here. On this account it has been suggested that alfalfa hay may sometimes be shipped from the Great American Desert to Chicago, and possibly other points, cheaper than hay of equal quality can be produced in regions where rain is plentiful. Indeed a shipment of alfalfa hay from Colorado to New York is already reported.

ALIGHTING - BOARDS. — A few years ago it was common to see bee-hives perched upon benches on legs, with grass and weeds so thick on the ground below, that, if a heavily laden bee missed the hive, it was a chance if it picked its way out in a full half-hour; but at present we usually see the hives so near the ground that those heavily laden with pollen or honey may go in on foot, if they find it more convenient so to do. If you doubt the utility of having the ground smooth and clean in front of the hives, it may be well to take a look at a hive set in the weeds and grass, and then at one prepared in the way we advise. Several years ago we had a fine colony suspended from a pair of spring balances. It was in the height of the clover-bloom, and the hive gained in weight during the day an even 10 lbs. As the hive was raised a couple of inches from the ground to suspend it, the bees, at about 9 o'clock, had fallen on the ground in quite a little cluster, where they paused to take breath until they could again take wing to get into the hive. At this time, the spring balance showed a gain of an ounce every five minutes. To help them, a cloth was tacked from their old alighting-board to the entrance of the hive; they then crawled in in a steady stream, and the dial of the balance at once showed a gain of one ounce in every *four* minutes.[307] Other experiments seem to indicate very clearly that a good alighting-board, or, rather, a free and unobstructed passage to the hive, is an important matter.

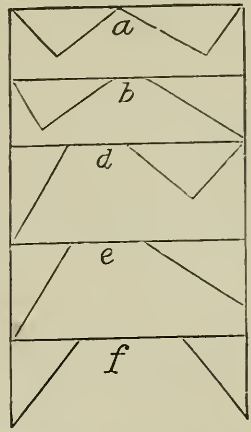
If any kind of a board is placed on the ground in front of the hives, it is sure to warp under the influence of the hot sun on one side, and the damp earth on the other. If we clamp it to prevent this, we have a place for toads, mice, and other vermin to lurk, and, taking all things into consideration, we prefer white sand, spent tan-bark (as advised by some), or sawdust spread directly on the ground. When this is first put down, it is blown about by the winds, and beaten down by the rains; but if you press it down when damp or wet, it will, when dry, hold its place nicely, is not affected by the weather, affords no lurking-place under it, and gives an excellent foot-hold for the bees when returning during a windy day. Should weeds come up at the entrance in the sawdust or sand you can kill them with an occasional spraying of salt.

After the day's work is over, the sight of the bees congregated about in their "door-yard" is suggestive of peace and tranquility, to any one who has studied the queer ways of these "little busybodies." So much attached, in fact, do they seem to become to the idea of keeping this little dooryard clean and tidy, that they will labor by the hour in trying to pull up any tiny blade of grass or weeds that may have the audacity to attempt to grow anywhere within a foot of their hives. This sawdust idea is also an excellent one, when we are watching or hunting queens with clipped wings in natural swarming. With a nicely kept dooryard, you can get your eye on the queen, when several yards from the hive, when, otherwise, you might have to hunt in the grass for an hour, and then not find her.

With the house-apiary, we are compelled to have a regular door-step, or alighting-board, and these should be as broad as we can conveniently have them. Our own are

14x10 inches, and are securely clamped, and painted on both sides. While the bees do fall to the ground, to some extent, during a heavy yield of honey, there is less trouble than we imagined, for they generally strike the broad alighting-board. Another point that favors their easy ingress to the hives, is the 2-inch auger-hole entrances. Many of the bees will shoot right into them, and alight safely on the combs; the auger-hole seems to be a plain mark for them to aim at, even when some distance from their hive. Very likely it accords with their natural disposition of seeking hollows in the forest-trees, and these entrances are not very unlike the knot-holes they many times have for entrances in forest-trees. It will be an excellent plan to keep the ground clean about the house-apiaries also, that we may see when queens are being brought out during natural swarming, superseded, etc.

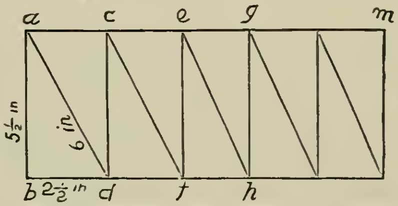
The old style of Langstroth hive, with its portico, furnishes a very convenient alighting-board; but aside from the expense, and inconvenient projections on the front of the hive, we have found them very annoying on account of the excellent harbor they afford for spiders with their attendant webs. We prefer hives without porticos, for this reason; but it is an advantage to have an alighting-board, and hence we make our hives with a projecting bottom (see HIVE-MAKING). This leaves a full-width entrance. With strong colonies, such as there should be, such an entrance will rarely if ever need contracting. For winter I would have the full width; and when bees are bringing in honey, it's an expense to have the poor heavily loaded bees crowd by each other, or wait for a chance to get in at a narrow passageway. There are times in the spring and fall when it is advisable to contract, especially with nuclei. Under these circumstances the old triangular entrance-blocks, made out of ⅞-inch stuff, are as good as any thing, although, in the absence of these, a strip of wood about an inch square, and of the right length, may be made to answer. Having three sides of as many different lengths, the triangular blocks offer any degree of contraction, from a full entrance to space for even one bee to pass at a time, and, besides, guide the bees to the entrance. By putting the two longest sides next to the entrance it can be closed entirely. The accompanying diagram, taken from that excellent work, "Dadant's Langstroth Revised," shows how this may be accomplished. Blocks will in time become stuck down with propolis; and, if the apiarist is not on the



ENTRANCE-BLOCKS.

a shows the entrance entirely closed; and b, d, e, f, the manner of increasing the width.

watch, moth-worm cocoons will be built under them, particularly if he keeps hybrids or blacks.



HOW TO MAKE ENTRANCE-BLOCKS.

You want to figure so that the two longest sides of the blocks, as at *a*, *d*, in the preceding figure, will just close the entrance. The entrance to the 8-frame Dovetailed hive is just 12¼ inches. The hypothenuse of one of the blocks will be then $6\frac{1}{16}$ inches. The other two sides (which will be at right angles to each other) will be then respectively 2½ and 5½ inches. To cut these out most expeditiously, cut ⅞-inch boards (preferably wide ones) into lengths of 5½ inches. By nailing a strip on the gauge of your saw-table, cut the lengths of boards into triangles, as shown in the diagram, *a*, *b*, *c*, *d*, etc.: i. e., first rip the board off square, then cut it on a diagonal. By the exercise of a little ingenuity you can arrange the gauge to do both. Use a rip-saw, of course.

ALSIKE CLOVER.—This was formerly supposed to be a hybrid, since in appearance it is so nearly intermediate between the white and red clover; hence its name, *Trifolium hybridum*, Linn. It is now known that it is not a hybrid. While it furnishes full as much honey as the red, the petals are so short that the bees find no difficulty in reaching it. If you imagine a large head of white clover, with the extremities of the petals tipped with a beautiful pink—equal in beauty to a dahlia if they were not so common—you will have a very good idea of the alsike.[308] The leaf is much like that of other clovers, except that, in color, it is a soft clean bright green, without the spots of down that are seen on the white or red.

If alsike clover came into bloom at a season when bees could get little else, as buckwheat does, I should place it, instead of buckwheat, first on the list of plants for artificial pasturage.* Where white clover does not grow spontaneously, alsike is, undoubtedly, ahead of every thing else now known. It not only produces honey in large quantities, but the quality is not excelled by any thing known in the world.[17] It is true, many people will prefer basswood, mountain sage, and other aromatic flavors, at first taste, but I believe every one tires of these after a time, and clover stands almost alone, as the great staple for every-day use, with, and like, our "bread and butter."

CULTIVATION, AND SOWING THE SEED.

The cultivation is so much like that of red clover, that what applies to the one will do for the other. As the seed of the alsike is much smaller, a less quantity is required; the general rule is four pounds to the acre. As it blossoms only the second year, or very sparingly the first, with ordinary cultivation, it may be sown almost any time, and in fact it is often sown on wheat on the snow in March. In this way, we can see just how evenly we are getting it on the ground. The farmers near me who furnish the finest seed, say they have the best success with that sown with their oats in the spring. Although alsike will produce some honey with almost any cultivation, it is important to have the ground nicely prepared, if we wish to get large yields of either hay or honey. With good mellow ground, finely pulverized, we may get a growth of 3 feet in height, and a profusion of highly colored blossoms, that will astonish one who has never seen such a sight; especially when the field is roaring with the hum of the busy Italians. As a heavy growth is liable to lodge badly during wet weather, it may be well to sow a sprinkling of timothy seed with it. If put in early, it may on good soil produce considerable bloom the first season, but not much is to be expected until the second year, when it is at its height. It will give a fair crop the third year; but after that, if we would keep up a yield of honey, it must be sown again.[18] It may be sown in the spring on fall wheat; but where timothy has been sown with the wheat in the fall, it is apt, on some soils, to choke out the alsike.

*If alsike is cut, or even pastured off, just before coming into bloom, it will blossom again, just after white clover is gone, and give a crop of clover honey just when we most need it. One of our leading honey-men says this fact alone, learned at a convention, has been worth more than $50.00 to him.

SAVING THE HAY.

If raised for the hay and honey, without any reference to saving the seed, it will give at least two good crops every season; in this case, it is cut when in full bloom. In our locality it usually blooms the last of June, and sometimes furnishes considerable honey before the white clover is out. The hay is admitted by all to be equal to any of the grasses or clovers in use,[309] and the pasturage, after the clover is cut, is most excellent for all kinds of stock.

Its value for milch cows is shown by the following, taken from GLEANINGS for March, 1885, page 161:

AS A FORAGE-PLANT

It has no superior, producing a large flow of very rich milk. June 15th, when I shut the stock out of the alsike, I allowed them to run in a field of red clover that was just coming into blossom, and at the end of the third day the five cows had shrunk their milk to the amount of 9 quarts to the milking. Again, in October, to test it further for feed, as there was quite a growth of leaves on the ground I again allowed the cows in the field. You may judge of my surprise when I found, at the end of a week, they had made a gain of 10 quarts to the milking.

Millington, Mich., Feb., 1885. M. D. YORK.

SAVING THE SEED.

The seed is always saved from the first crop of blossoms, and it should be allowed to stand about two weeks longer than when cut for hay. If you wish to get a good price for your seed, it must be very nicely cleaned. It is thrashed out with a clover-huller, made expressly for clover seed, and then cleaned by a fanning-mill, with the appropriate sieves. As timothy seed is very nearly of the same size, it is difficult to remove it all, unless by a fanning-mill having the proper blast arrangement. As the alsike weighs 60 lbs. to the bushel, and timothy only 45, there is no great difficulty in doing it effectually.

I need scarcely add, that whoever raises seed for sale should exercise the most scrupulous care to avoid sending out foul seeds of any kind; and where Canada thistles or weeds of that class prevail, I would, under no circumstances, think of raising seed to be sent all over the land. If they are in your neighborhood, raise hay and honey, and let seed be furnished by some one who is differently situated.

PROFIT OF THE CROP.

The seed has for a number of years sold readily for about $8.00 per bushel, and the average yield of seed is about four bushels per acre. It retails for about 18 cents per pound, and 60 lbs. is reckoned as a bushel. See CLOVER.

The following, taken from *The Farmer*, of St. Paul. Minn., not only shows what profit may be realized in raising alsike, but is another proof of its value as a hay crop. The reader will observe that the writer is in no way interested in bees.

WILL IT PAY FARMERS TO RAISE ALSIKE WITHOUT ANY REFERENCE TO BEE-KEEPING AT ALL?

About 20 years ago I bought my first alsike clover seed, and sowed it alone on the south side of a hill. The season was dry, and it grew only about a foot high; and as it was said the first crop produced the seed, I cut it for seed and felt disappointed at getting so little that I was ready to pronounce it a humbug, and plowed it up the same fall. Some years afterward I saw a bushel of seed at the Dane County Fair, at Madison. I inquired of the owner, Mr. Woodward, how he liked it, and if it was a profitable crop. He said he got four bushels of seed per acre, and sold it at $10 per bushel; that the hay, after being hulled, was better than the best red-clover hay, and that his cattle ate it in preference to any other hay. I bought two bushels of the seed and sowed about one bushel to twelve acres, mixing one-third timothy, by measure, where I wanted it for pasture or hay, and about the same quantity of pure alsike where I wanted it for seed. It does not raise seed the same year it is sown, but, like red clover, the next year. I have sown it with wheat, barley, and oats. It does best with spring wheat or barley.

I hulled 110 bushels this year from 20 acres. I expect to get $7.00 per bushel, and I have at least 25 tons of good hay, after hulling, worth enough to pay all expenses of cutting and hulling. Some years ago I sold my whole crop on the Board of Trade in Chicago for $11. 00 per bushel.

Mr. George Harding, of Waukesha, a breeder of Cotswold sheep and short-horn cattle, and one of Wisconsin's most wide-awake farmers, showed me a small field of one of his neighbors that he said produced seven bushels of alsike seed per acre, and that he sold it in Milwaukee for $12.00 per bushel. I have 80 acres in alsike; and so long as it pays me as well as it has done, I will sow it.

The first crop the next year after sowing is the seed crop. It can be cut for seed for several years. It is not a biennial plant like red clover, but a perennial. It has one tap root with many branches, and does not heave up by frost, like red clover, which has but one tap root.

I prefer it to red clover for several reasons. When sown with timothy it matures with timothy. (Medium red clover matures before timothy is fit to cut.) I cut about the 10th to 15th of July; red clover should be cut (here) about the 20th of June. Alsike is not easily injured by dew or light rains after being cut. It has none of the "fuzz" that red clover has, making it so unpleasant to handle as hay or seed. The stem is not so coarse nor so hollow, and has more branches, leaves, and blossoms. The blossom is of a pink color. Red clover must be cut when we are in the busiest time working our corn. Alsike is cut after corn work is over. This is of great advantage in a corn region.

Alsike makes a good fall pasture after the seed is cut. My stock will eat it in preference to red clover, timothy, or blue grass. Blue grass, or, as it is often called in this country, June grass, is a good early and late grass, but in midsummer it dries up; and had it not been for clover we should have been badly off for pasture this dry year.

HON. MATT. ANDERSON.

Dane Co., Wis., Nov. 1886.

The next, from GLEANINGS for April 15, 1886, page 327, is of so much importance in regard to raising alsike or other honey-yielding plants, that we give it here entire:

A SUGGESTION TO BEE-KEEPERS IN REGARD TO HAVING ALSIKE RAISED BY THE FARMERS OF THEIR OWN NEIGHBORHOOD.

I have managed to supplement the natural supply for my bees during the last five or six years as follows: I first tried sweet clover with but poor success, so I took up alsike clover, and this is the way I work:

About this time of the year I buy from 200 to 400 lbs. of best alsike clover seed in Montreal at wholesale price. This year I can get it for 12 cts., perhaps less. I expect to buy my supply next week. It will cost me ½ ct. freight, and I shall probably sell it to the farmers who are *within two miles of my apiary*, for 10 cts. per lb. At this price it is readily taken up by all who are "seeding down" land suitable for alsike, as the price in the stores here is from 16 to 18 cts. Three pounds mixed with timothy will seed an acre very well, so you see I get pasturage which will last from two to five years, of the very best quality of honey, at the small cost of $7.50 for one hundred acres. I can not conceive of any plan which, with me, would be cheaper, less trouble, or that would give as quick and reliable returns. I could get a good deal of seed sown by selling it at cost; but I find that taking off two or three cents per pound makes a great difference in the amount sown. As white and alsike clover are the most reliable honey-plants we have here — very rarely failing entirely—the results have been very marked and satisfactory.

To those who wish to try this plan I would say, Work up the matter personally; canvass every farmer within two miles and more in every direction from your apiary (those living more than two miles should pay cost of seed), showing them a sample of your seed, pointing out its advantages, etc. Although alsike clover hay will not weigh so heavy as red clover, it is far sweeter and better, and all stock far prefer it to eat. One pound of seed, also, will go as far as two pounds of red clover, as the seeds are so much smaller.

Canvassing the farmers should be done *at once*, as every good farmer plans his work and buys his seed early. After you have finished canvassing, add up your orders, send to a reliable seedsman, distribute, and get pay for your seed, and your work for the season is done; but it should be repeated every season, to enlarge your "base of supply" as much as possible. Of course, you will have to wait one season before the alsike will bloom.

In localities where different apiaries are near together, if the seed is furnished under cost the parties should make up the amount of the difference *pro rata*, according to the number of colonies they have.

A WORD OF CAUTION ABOUT SOWING ALSIKE.

First, get the *very best* seed you can find. Poor seed is an abomination. Don't sow it on dry, sandy land, for alsike delights in a moist soil.

This simple plan of increasing pasturage may not be new, but I never heard it mentioned, though doubtless some have tried it. GEO. O. GOODHUE.

Danville, Quebec, Canada, Mar. 30, 1886.

We need hardly add, that the above plan can be carried out with buckwheat, rape, and any other honey-yielding plants that are of value to farmers.

ANGER OF BEES. I confess I do not like the term "anger," when applied to bees, and it almost makes me angry when I hear people speak of their being "mad," as if they were always in a towering rage, and delight in inflicting exquisite pain on every thing and everybody coming near them. Bees are, on the contrary, the pleasantest, most sociable, genial and good-natured little fellows one meets in all animated creation, when one understands them. Why, we can tear their beautiful comb all to bits right before their very eyes, and, without a particle of resentment, but with all the patience in the world, they will at once set to work to repair it, and that, too, without a word of remonstrance. If you pinch them, they will sting, and anybody who has energy enough to take care of himself would do as much, had he the weapon.

We as yet know very little of bees comparatively; and the more we learn, the easier we find it to be to get along without any clashing in regard to who shall be master. In fact, we take all their honey now, almost as fast as they gather it; and even if we are so thoughtless as to starve them to death, no word of complaint is made.

There are a few circumstances under which bees seem "cross;" and although we may not be able to account exactly for it, we can take precautions to avoid these unpleasant features, by a little care. A few years ago a very intelligent friend procured some Italians, an extractor, etc., and commenced bee culture. He soon learned to handle them, and succeeded finely; when it came time to extract, the whole business went on so easily that they were surprised at what had been said about experienced hands being needed to do the work. They had been in the habit of doing this work as I had directed, toward the middle of the day, while the great mass of the bees were in the fields; but in the midst of a heavy yield of clover honey, when the hives were full to overflowing, they were one day stopped by a heavy thunder-shower. This, of course, drove the bees home, and at the same time washed the honey out of the blossoms so completely that they had nothing to do but remain in the hives until more was secreted. Not so with their energetic and enthusiastic owner. As soon as the rain had ceased, the hives were again opened and an attempt made to take out the frames, as but a few hours before; but the bees that were all gentleness then, seemed now possessed of the very spirit of mischief and malice; and when all hands had been severely stung, they concluded that prudence was the better part of valor and stopped operations for the day.[19] While loads of honey were coming in all the while, and every bee rejoicing, none were disposed to be cross; but after the shower, all hands were standing around idle; and when a hive was opened, each was ready to take a grab from his neighbor, and the result was a free fight in a very short time.

I know of nothing in the world that will induce bees to sting with such wicked recklessness, as to have them get to quarreling over combs or honey left exposed when they have nothing to do. From a little carelessness in this respect, and nothing else, I have seen a whole apiary so demoralized that people were stung when passing along the street several rods distant. During the middle of the day, when bees were busily engaged on the flowers, during a good yield, I have frequently left filled combs standing on the top of a hive from noon until supper time without a bee touching them; but to do this after a hard rain, or at a time when little or no honey is to be gathered in the fields, might result in the ruin of several colonies, and you and your bees being voted a nuisance by the whole neighborhood.

Almost every season, we get more or less letters complaining that the bees have suddenly become so cross as to be almost unmanageable, and these letters come along in July, after the clover and linden have begun to slack up. The bees are not so very unlike mankind after all, and all you have to do is to avoid opening the hives for a few days, until they get used to the sudden disappointment of having the avenues through which they were getting wealth so rapidly, cut off. After a week or ten days, they will be almost as gentle as in the times when they gathered half a gallon of honey daily, if you are only careful about leaving hives open too long, or leaving any bits of honey or comb about.

Within a few feet of me sits a young man who once laughed about being afraid of bees, and commenced work in the apiary with such an earnest good will that I had high aspirations for him. One beautiful morning he was tacking rabbets into the hives in front of the door to the honey-house, whistling away, as happy as the bees that were humming so merrily about his head. Pretty soon I saw some honey and bits of combs that had dropped from one of the hives, scattered about on the ground. I told him he had better stop and clean it up, or he would certainly get stung; as the bees seemed very peaceable while licking it up, he thought he would let them have it, in spite of my warning. After they had taken all the honey, they began buzzing about for more; and not finding any, in a very ungenerous way commenced stinging him for his kindness. His lesson was a more severe one than I had expected, for they not only drove him from the apiary that morning, but I fear for all time to come; for although years have passed, he has never since wanted any thing more to do with bees. I regret that he did not, at the time, also learn the folly of insisting on having his own way.

I can not tell you, at present, why bees sting so coolly and vindictively just after having had a taste of stolen sweets, yet nearly all the experience I have had of trouble with stinging has been from this very cause. Bees from colonies that have a habit of robbing, will buzz about one's ears and eyes for hours,[20] seeming to delight in making one nervous and fidgetty, if they succeed in so doing, and they not only threaten, but oftentimes inflict, the most painful stings, and then buzz about in an infuriated way, as if frantic because unable to sting you a dozen times more after their sting is lost. The colonies that furnish this class of bees are generally hybrid, or perhaps black bees having just a trace of Italian blood. These bees seem to have a perfect passion for following you about, and buzzing before your nose from one side to the other (until you get cross-eyed in trying to follow their erratic oscillations), in a way that is most especially provoking. One such colony annoyed us so much while extracting, that we killed the queen, although she was very prolific, and substituted a full-blood Italian. Although it is seldom a pure Italian follows one about in the manner mentioned, yet an occasional colony may contain bees that do it; at least we have found such, where the workers were all three-banded. That it is possible to have an apiary without any such disagreeable bees, we have several times demonstrated, but oftentimes you will have to discard some of your very best honey-gatherers, to be entirely rid of them.

With a little practice, the apiarist will tell as soon as he comes near the apiary whether any angry bees are about, by the high key-note they utter when on the wing. It is well known, that with meal feeding we have perfect tranquillity although bees from every hive in the apiary may be working on a square yard of meal. Now, should we substitute honey for the meal, we should have a perfect "row;" for a taste of honey found in the open air during a dearth of pasturage, or at a time when your bees have learned to get it by stealing instead of honest industry, seems to have the effect of setting every bee crazy. In some experiments to determine how and why this result came about, we had considerable experience with angry bees. After they had been robbing, and had become tranquil, we tried them with dry sugar; the quarrelsome bees fought about it for a short time, but soon resumed their regular business of hanging about the well-filled hives, trying to creep into every crack and crevice, and making themselves generally disagreeable all round. If a hive was to be opened, they were into it almost before the cover was raised, and then resulted a pitched battle between them and the inmates; the operator was sure to be stung by one or both parties, and, pretty soon, some of the good people indoors would be asking what in the world made the bees so awfully cross, saying that they even came indoors and tried to sting. Now, why could they not work peaceably on the sugar as they do on the meal, or the clover-blossoms in June? We dampened the sugar with a sprinkler, and the bees that were at work on it soon started for home with a load; then began the high key-note of robbing, faint at first, then louder and louder, until I began to be almost frightened at the mischief that might ensue. When the dampness was all licked up, they soon subsided into their usual condition. The effect of feeding honey in the open air is very much worse than from feeding any kind of syrup, and syrup from white sugar incites robbing in a much greater degree than that from brown sugar; the latter is so little relished by them that they use it only when little else is to be found. It is by the use of damp brown sugar that we get rid of the greater part of what are usually termed angry bees, or bees that prefer to prowl round, robbing and stinging, rather than gather honey "all the day," as the greater part of the population of the apiary does. The sugar should be located *several rods away*, and should be well protected from the rain, but in such a way as to allow the bees to have free access. When no flowers are in bloom, they will work on it in great numbers; but when honey is to be found, you will see none but the prowling robbers round it. These, you will very soon notice, are mostly common bees and those having a very little Italian blood. We have seen Italians storing honey in boxes, while the common bees did nothing but work in the sugar-barrels. Where you work without a veil, it is very convenient to have these annoying bees out of the way, and, even if they belong to our neighbors, we prefer to furnish them with all the cheap sugar they can lick up.

The remarks that have been made are particularly for large apiaries; where one has only a single hive and no neighbors who keep bees, the case is something like Robinson Crusoe on the island; no chance for stealing, and consequently nothing to be cross about. Bees are seldom cross or angry, unless through some fault or carelessness of your own. See Robbing; also Stings.

ANTS. Although I have given the matter considerable attention, I can not find that ants are guilty of any thing that should warrant the apiarist in waging any very determined warfare against them. Some years ago a visitor frightened me by saying that the ants about my apiary would steal every drop of honey as fast as the bees could gather it. Accordingly, I prepared myself with a tea-kettle of boiling water, and not only killed the ants but some of the grapevines also. Afterward there came a spring when the bees, all but about eleven colonies, dwindled away and died, and the hives filled with honey, scattered about the apiary unprotected, seemed to be about as fair a chance for the ants that had not "dwindled" a particle, as they could well ask for. I watched to see how fast they would carry away the honey, but, to my astonishment, they seemed to care more for the hives that contained bees, than for those containing only honey. I soon determined that it was the warmth from the cluster that especially attracted them; and as the hives were directly on the ground, the ants soon moved into several that contained only a small cluster and for awhile both used one common entrance. As the bees increased, they began to show a decided aversion to having two families in the same house, although the ants were evidently inclined to be peaceable enough, until the bees tried to "push" matters, when they turned about and showed themselves fully able to hold possession. The bees seemed to be studying over the matter for a while, and finally I found them one day taking the ants, one by one, and carrying them high up in the air, and letting them drop at such a distance from their home, that they would surely never be able to walk back again. The bees, as fast as they became good strong colonies, drove the ants out, and our experience ever since has been, that a *good* colony of bees is never in any danger of being troubled in the least by ants.[21] One weak colony, after battling awhile with a strong nest of the ants, swarmed out; but they might have done this any way, so we do not lay much blame to the ants.

Ants sometimes annoy us very much by getting into barrels of honey, sugar, etc., and I do not know of any way of remedying the mischief except to get them out, and then keep them out. The cloth covers we use for our extractors, we find very convenient for keeping them out of barrels. Slip the cloth over the top of the barrel and press the upper hoop over it, and no ant can force its way in. Sugar-boxes are made with tight-fitting covers on purpose. Sometimes it is quite convenient to protect the contents of a table by setting the feet in dishes of water; but we have seldom found them so troublesome as to be obliged to resort to such measures.

Ants frequently kill the young grapevines, and young plants and trees of different kinds, and it may be well therefore to know how to get rid of them pleasantly and easily. I really can not feel like recommending boiling water, on account of its cruelty, besides the danger of killing our vines, etc., by its use. It is well known, that where things do not please them, they are much disposed to "pull up stakes" and "abscond," very much in the way the bees do; and the simplest way we know of inducing them to do this, is to sprinkle powdered borax about their hills.* After the first rain,

*The application of turpentine to the hills is also very efficient in inducing the ants to leave.

you will see them forming a "caravan," lugging their larvæ, stores, etc., to a place where they are not annoyed by the disagreeable soapy borax. Spots in our apiary, where they have been on hand every season for years, have been permanently vacated after one application of this simple remedy. If they make troublesome "trains" running into the pantry, honey-house, etc., you are to follow them out to their nest, and there apply the borax. Prof. Cook recommends "to put a sweet, poisonous mixture in a box and permit the ants to enter through an opening too small to admit bees, and thus poison the ants. Or we may find the ants' nest, and, with a crowbar, make a hole in it, turn into this an ounce of bisulphide of carbon, and quickly plug it up by packing clay in the hole and on the nest."

There is a kind of large black ant that may be specially mentioned. These ants are troublesome, and sometimes even dangerous. They burrow in the wood of bottom-boards; and I have seen a bottom-board that looked sound on the exterior, so thoroughly riddled by these pests that a very little touch would make it crumble. Think what a time you might have, if such a bottom-board should crumble while being hauled on a wagon!

These ants seem to start their burrows best between the surfaces of two boards, so it may be best, if their depredations are feared, to have such a stand as to let the bottom-board rest only on its outer edges. Painting the bottom-board with coal tar is said to be a preventive.

I have not been able to discover that ants have any particular liking for honey, and I should take very little trouble to drive them away, unless they got into the liquid honey and got drowned or something of that kind. By making their habits and instincts a careful study, we shall probably get at the readiest means of banishing them, and we may also discover that they are no enemy after all, as has often been the case with many of the insect and feathered tribes. Let us try to be as neighborly as we consistently can, with all these wonderful little creatures, that, in a certain sense, are fellow-travelers in this world of ours.*

*Since the above was written, several cases have been reported from the South, of ants killing caged queens, and queens that have been liberated on hatching brood, as per directions in INTRODUCING QUEENS. These cases, of course, occurred when the number of bees was too small to properly protect themselves. Other cases in the South have been reported where they would destroy an entire colony, but it should be said that such cases appear to be rare.

APIARIST. One who keeps bees, or a bee-keeper; and the plot of ground, including hives, bees, etc., is called an

APIARY. As you can not well aspire to be the former until you are possessed of the latter, we will proceed to start an apiary.

LOCATION.

There is scarcely a spot on the surface of the earth where mankind find sustenance, that will not, to some extent, support bees, although they may do much better in some localities than in others. A few years ago it was thought that only localities especially favored would give large honey-crops; but since the introduction of the Italians, and the new methods of management, we are each year astonished to hear of great yields here and there, and from almost every quarter of the globe. It will certainly pay to try a hive or two of bees, no matter where you may be located.

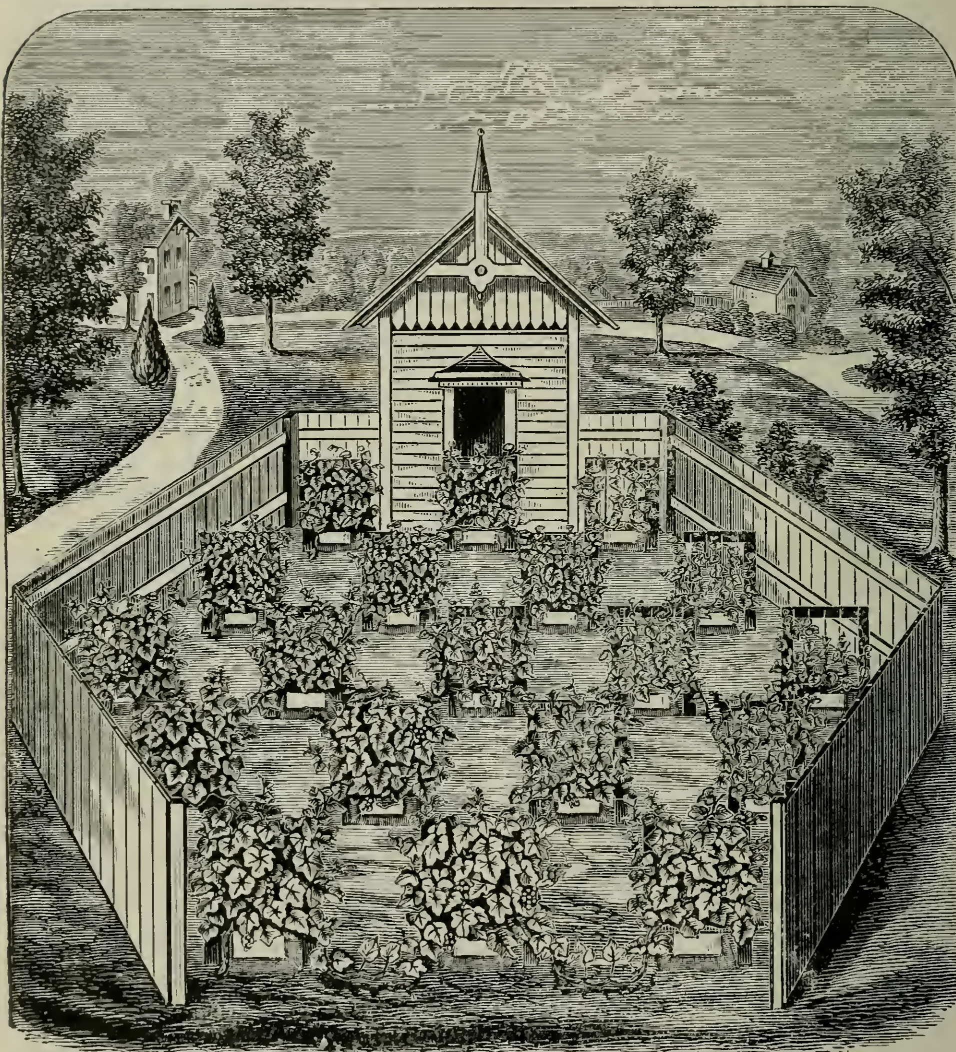
Bees are kept with much profit, even in the heart of some of our largest cities. In this case, the apiary is usually located on the roof of the building, that the bees may be less likely to frighten nervous people, and those unacquainted with their habits. Such an apiary would be established like those on the ground in all essential points.

Select a spot near the dwelling, and, if possible, have it where you will be likely to cast your eye every time you pass out or in. Although trees can scarcely be said to be objectionable, I believe I should prefer a clear piece of ground, that we might supply the shade to our liking. It will be an excellent investment of your time or money to have the plat nicely cleaned of all rubbish, and the ground leveled as far as may be; if you can get it in the condition of a brick-yard all the better; a gentle slope would be desirable; and although a slope to the south and east has been thought best, we are not sure that it makes any particular difference. As we wish the ground to dry quickly after showers, it will be an excellent plan to have it all underdrained. If you can not well do this, make open ditches around the outside, or wherever water seems disposed to stand. The ground should be a little higher than the surrounding land, for this very reason, and you should be careful that no low places are left where the water may collect and stand around or near the hives.

Bees ascend with difficulty when heavily laden, and on this account we would have the apiary located in a valley, rather than on a hill, that they may rise as they go in quest of stores, and then have a downward slope as they come in with their loads. They will also suffer less from the effects of heavy winds, when given a home on rather low ground.

WINDBREAKS.

The most perfect windbreak is an inclosure of woods on three sides, with an opening to the south. This, however, is not available to all. An apiary so situated that there is a clump of woods on one side and buildings on the other two sides, leaving only a southern aspect, is well sheltered from the prevailing winds. In the absence of any natural or accidental protection whatever, it is quite essential that some sort of windbreak be provided. If I desired to put up something permanent, and something which would not rot out or require repairs, I would outskirt the apiary with rows of hardy-growing evergreens, such as are seen in the apiary of the Home of the Honey-Bees, in frontispiece. These, for the first few years, would afford but a scanty protection; but in ten years' time they answer their purpose admirably. In 1879, as the reader will see by the Introduction, we inclosed our apiary with evergreens. They have proved to be very thrifty, and now (1891) are quite good-sized trees, averaging 18 feet in height. In a few years more their branches will be tightly interwoven; and a more solid and lasting phalanx could hardly



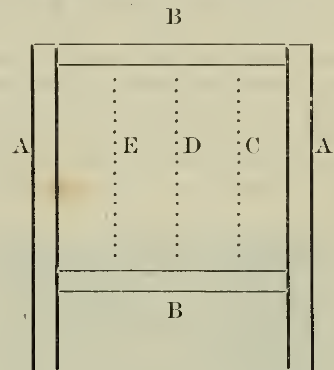
THE VINEYARD APIARY, AND "SWARMING" THE GRAPEVINES.

be desired as a windbreak. Only a few of my readers will feel disposed to go to this expense when the benefits of such outlay are so far ahead, and as the prospective apiarist is not sure that ten years hence he will still be following bee-keeping as a pursuit. I will recommend a tight board fence to such as he. It should surround the plat, at least on the north and west sides, to keep off cold winds; and if it can be made strong enough to stand the prevailing winds it will be all the better to have it as much as eight feet high. I would by all means advise having some kind of an inclosure that will exclude poultry, dogs, etc. A flock of enterprising hens will make more disorder in a few hours in a well-kept apiary than the owner can restore in half a day. We wish to have the ground so clean that we can get down on our knees, in front of any hive, at any time. This we can not do in any inclosure where poultry have free access. The high strong fence will also do much to discourage thieves from attempting to pillage the honey, for climbing into such an inclosure is quite risky business when it adjoins a dwelling. If a part of the dwelling could open directly into the apiary, it would be a fine thing on many accounts.

THE VINEYARD APIARY.

Get two posts 6 feet long and three inches square; these must be of some durable wood, white oak for instance. If you can afford the trouble and expense, we really should prefer that you have them planed and painted; at any rate, do not expect your apiary ever to be any thing you may be proud of, if you push down some old sticks temporarily, one longer than the other, perhaps, and both askew, for such work soon becomes unattractive, and is shunned. Many visitors have admired our apiary, and thought it no wonder we enjoyed bee-keeping in such a place, and these same persons have declared their intention of tipping their poor neglected hives of bees up square and true, removing the weeds, starting grapevines, etc., but, alas! their attempts were too often but a couple of sticks picked up hastily as we have mentioned, and a few vigorous strokes in the battle with old dame Nature, and then they desisted, before the "coy old lady" had even had time to yield and bless her devotees with such smiles as only the successful cultivator of the soil knows she can give.

Select the site of your workshop, for such we shall expect it to be, near the center of your plat of ground, and drive these posts or stakes so that they stand east and west, and just three feet from each other, measuring from outside to outside. They are to be driven in the ground so that just four feet is left above, and they must stand plumb and square; if you can't make them true otherwise, get a lever and strong chain and twist them until they are so. Now nail a strip of pine board 1x3 inches and 3 feet long, on the south of both, and just level with the top, from one to the other; just three feet below this, nail a similar one. When the whole is square, true, and plumb, stretch three wires from one strip to the other; these are to be at equal distances from the posts and from each other, and we would then have something like the following figure.

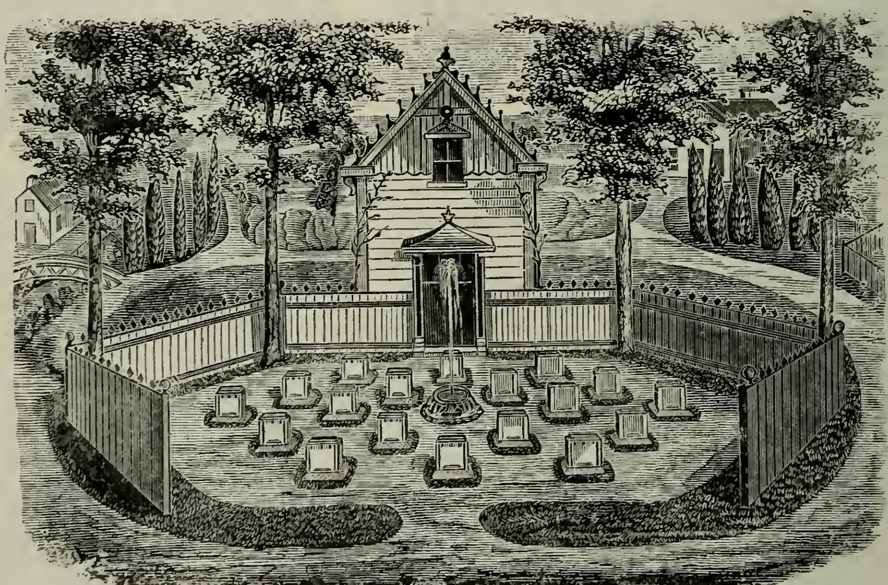


Let A, A, represent the posts; B, B, the 1x3 strips nailed on the south side of the posts, and C, D, E, the wires. These wires should be galvanized iron wire, about No. 16 or 17; larger would be more expensive and no better. Now we are all ready to have a fine thrifty Concord grapevine planted directly underneath the central wire D. Of course some other grape will do, but we have found none so hardy and thrifty, and that gives us the strong rapid growth that is so desirable for making a shade for our hives, as soon as extreme hot weather comes on. Vines are usually planted only in the spring and fall; but we should have very much more confidence in your success, if we knew you were one of those clever individuals who can plant a vine and make it grow, at *any* season of the year.[311] You can surely do it if you have a mind to. Go to your nearest nurseryman (don't ever buy of peddlers), tell him what you want, and get him to help you take up the vine, roots, dirt, and all, soaking the soil with water to make it stick together if need be, while you place the whole in a bushel basket for transportation. Make a large hole beneath your trellis, and lift your vine into it as carefully as you took it up, fill in with good soil, and, after cutting off all the top but one shoot with three or four leaves, treat it just as you would a hill of corn that you wish to do extra well.[312] If the operation is done in hot dry weather, it will probably need watering, and may be shading, until it gets started. We expect you in future to see that no weed or spear of grass is allowed to make its appearance within a yard, at least, of this grapevine. Those accustomed to making rustic work would doubtless be able to make very pretty trellises at a trifling expense for materials. This vine is to have its one shoot tied to the central wire, D, as fast as it grows, pinching off all side shoots after they have made one leaf. When it gets to the top of the trellis, pinch it off also, and it will soon throw out side shoots. Pinch all off again except one on each side near the bottom-bar B. Train these by tying, straight out, horizontally, until they reach the posts, then train them up the posts and pinch them off like the middle one. Now get two more shoots to train up the wires, C and E, and we are done. The future treatment of the vines consists only in cutting the upright shoots all back to the horizontal arms tied to the lower bar, B, every winter, training *two* new shoots up each wire and post every summer, and pinching them off whenever they get to the top.

Very well; your one vine is supposed to have become strong and vigorous, and not only to have covered the trellis completely, but to have become impatient, seemingly, of being restrained by the continual pinching back necessary to keep it within such narrow limits. Perhaps it has in fact manifested this by blossoming and attempting to bear grapes out of season near the top bar of the trellis. It is precisely like a colony having too many bees for the size of the hive. Very likely, each one of the ten upright canes has produced three or four fine clusters of extra large nice berries, but still the vigor of the vine (if our directions have been carefully complied with) is equal to something more; and, accordingly, we encourage one of the outside canes by allowing it to send a new shoot up above the rest of the trellis. When this is well started, the whole cane is bent over so as to go straight down to the ground, and then curved outward so as to lie in a trench a few inches deep, that it may be covered with soil enough to protect it from injury.

A new trellis is now to be constructed, if it has not been done before, just 4 feet from the old one; that is, the two trellises are to have a walk of just 4 feet in width between them. The new shoot grows very rapidly and can soon be tied up to the first post of the new trellis and across the lower bar. Now select a side shoot for each wire, and, almost before you are aware of it, you have another complete grapevine. The engraving will make it all plain.

The view is taken from the south side, and the hives are just visible through the



THE LAWN OR CHAFF-HIVE APIARY.

foliage in their proper places. One strong vine will furnish shoots for not only a new one at the right and left, but even for the whole six that are to surround the original one, and in a single season, if need be. As the new vines take root almost as soon as laid down, the old vine suffers but little loss, and we have known new ones, started in this manner the 4th of July, to be well loaded with fine grapes the next season, their connection with the old vine enabling them to become bearing vines in one year only. Although their remaining attached to the old vine does not seem to impair its productiveness, the aid they receive from it is quite important. This matter we tested by chopping one of the new vines off where it left the old one, as we were hoeing about them. It had been growing with great vigor, and had considerable fruit on it, but the next day the sun hung its foliage like wilted cabbage-leaves. By heavy mulching and buckets of water, we induced it to look up again, but it is far behind its comrades, and we have decided not to sever "parental ties" in future at all, and if we are careful in laying them down to tie them close to the posts, they are never in the way.

The idea, that the culture of bees in any way interferes with that of grapes, is a joke entirely outside of our experience.[23] Where grapes are trained thus, fowls, if allowed, will make sad havoc among them; the bees of course then work on the bruised ones, but seldom otherwise.

LAWN OR CHAFF-HIVE APIARY.

With chaff hives we can dispense with the grapevines, as their thick, chaff-packed walls protect them from the sun, as well as from the frosts of winter. Such an apiary may be made very pretty, for it is in reality a miniature city, with its streets and thoroughfares. During the swarming season, it will probably, at times, be quite a busy little city. Some expense and care is avoided by this plan, it is true, but the hives cost considerably more, and are rather unwieldy to handle when bees are to be moved about, sold, etc.[24] The fact that they can be safely wintered on their summer stands, and that very little preparation is needed to enable them to winter safely, is much in their favor.

OBJECTIONS TO THE HEXAGONAL APIARY.

The foregoing instructions are intended for those who propose to keep only a few colonies, or a small apiary, and who can therefore afford more expense in the way of ornamentation and suitable and artistic shade. Where one intends to manage a large number of colonies, or, as is more often the case, the pocketbook can not stand a very large expense, the vineyard apiary already described will be rather too expensive. The price at which honey is now sold is so low that we can not afford much expense for hive-stands or ornamentation; and he who would keep bees solely for the *money* there is in them will be obliged to lay out his apiary as simply and cheaply as possible.

This is economical of space where one hive stands by itself, but the arrangement of hives is inconvenient for the lawn-mower. For reasons already given, we can not afford, in large apiaries, to cut the sod off and level the ground like a brickyard. As grass *will* grow, it becomes a necessity, of course, to mow it occasionally; long grass on dewy mornings is unpleasant; and the hives should be arranged in such a way that a scythe (or, better, a lawn-mower) can run in betwixt the rows; and on that account many apiarists incline to the straight-row idea.

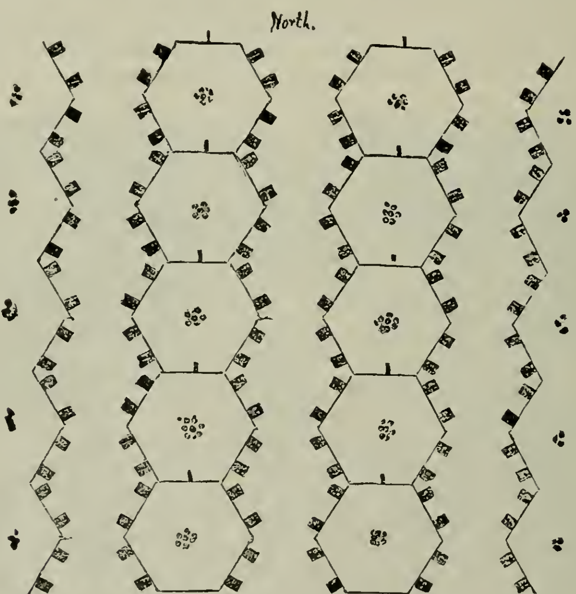
The hexagonal plan is also objectionable, in that the bees are liable to get confused as to their entrances. To obviate this difficulty we years ago arranged the entrances pointing toward the north, south, east, and west, in such a way as to make as great a diversity as possible—see Introduction. But even then the bees become more or less confused. Having the hives pointing in so many ways makes it necessary for the apiarist to encounter the bee-flight from all points of the compass. It is desirable to have the hives so arranged in large apiaries, or in a system of out-apiaries, that there shall be one alley in which the bees can have a highway exclusively to themselves in passing out from and into the entrances; and it is equally important that another alley be left free, or comparatively so, from the flight of bees, so that the apiarist can pass back and forth with wheelbarrows, carts, or even a horse and wagon, unmolested.

M'INTYRE'S PLAN FOR AN APIARY.

The following plan is that of the Sespe apiary, belonging to J. F. McIntyre, of Fillmore, Cal.; and although it departs from the straight-row idea, it very nicely provides for an alleyway for the bees' flight and another one for the apiarist.

You will observe that it is something of a modification of the hexagonal plan, and that the rows of hives are about as straight as—well, a rail fence. The small dots in the center of each hexagon represent stones used for holding the covers down when required. It is in this alleyway from north to south that the apiarist can do all his work. The entrances of the hives face each other, so that the flight of the bees, as they pass over the lane for the apiarist, is clear above his head, while the next one may be filled with bees flying in all directions, to and from their entrances. This rail-fence idea rather helps the bees to locate their entrances. Starting with the end of one of the rows from north to south, the fronts of the first two hives diverge *from* the second pair. The second pair converges *toward* the third, so that a bee, in order to find an entrance pointing in the same direction as his own, in the same row, has to go a good many feet away. The next row is so far away that he is not likely to get into that.

When I visited this apiary in 1888 I thought it was one of the prettiest I ever saw. The honey-house is at the foot of the

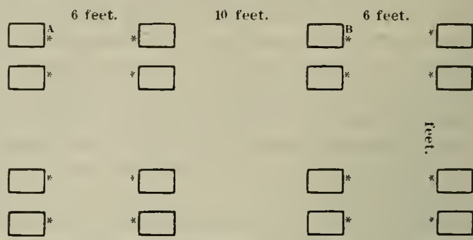


PLAN OF THE SESPE APIARY.

incline, just below the bee-hives, on the south, so that a wagonload of honey goes down through those open lanes without encountering bee-flight. Between the honey-house and the road is a great iron tank. These iron tanks are to be seen near every honey-house in California. A gas-pipe runs from the extractor into the tank. Then a gate at the bottom of the tank lets the honey into square cans, standing on a platform just right to load into a wagon. Perhaps it is unnecessary to state, in this connection, that the Sespe apiary is run for extracted honey.

PLANS FOR APIARIES ON THE STRAIGHT-ROW IDEA.

Dr. C. C. Miller, of Marengo, Ill., and C. A. Hatch, of Ithaca, Wis., both prominent and extensive bee-keepers, arrange their hives on the plan shown below :



A PART OF AN APIARY ARRANGED ON THE STRAIGHT-ROW PLAN.

The stars in the above diagram indicate the entrances. As in the Sespe apiary, there are two lanes, or alleyways, one six feet wide, for the bees, and one ten feet wide, for the apiarist, and his horse and wagon, etc. You will observe that the hives are arranged in pairs, in such a way that they face each other with entrances six feet apart. In the next alley their *backs* are toward each other. An apiary on this plan can be made as large as desired.

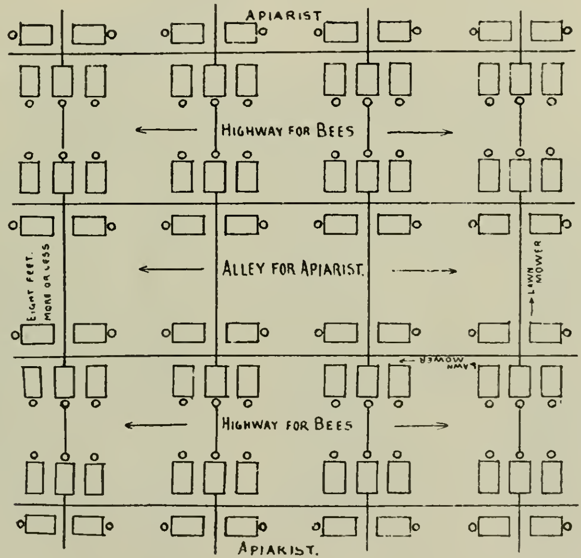
S. E. MILLER'S PLAN OF AN OUT-APIARY.

The plan above is similar to the one used by Mr. Hatch, but is arranged with a view of still greater economy of space, not losing sight of the scheme of a highway for bees, and an alley for the apiarist. Instead of being in pairs they are arranged in groups of five each. Little circles in front of the hives indicate the entrances. The hives should be 18 inches apart, to give room for a lawn-mower. It would hardly do to put them closer than 12 inches, for long timothy grass will grow up between, and then it is a big job to clean it out; and if not cut out it is in the way of putting on the supers or covers. The groups can be anywhere from 10 to 20 feet apart; but if put exactly 16 feet apart, and each hive in the group 18 inches apart, an apiary of 80 colonies can be accommodated on a plot 75 feet square, or in the back yard of an ordinary town lot. One advantage of this grouping plan is, that the apiarist can sit on one hive while he is working on another; and his tools, such as smoker, honey-knives, bee-brushes, etc., are right at hand for the whole 5 hives. Where there is only one hive on a stand, the tools have to be carried to each hive.

course, in this case the honey-house or work-shop should be at the hub, or center, of the system.

SHADE FOR HIVES.

So far, among these latter plans shade isn't mentioned; but a good many times it is convenient to put the hives in a young orchard. Old apple-trees have rather too dense a shade to be advantageous to the bees in breeding; but young trees will give just about the right shade. If it is intended to set out young trees, you will notice that the grouping plan will save a good many. Take, for instance, Mr. S. E. Miller's plan. Sixteen trees will answer. Or, if preferred, 16 grapevines trellised on the plan mentioned under the "Vineyard apiary" can be put up, and be made to answer a very excellent purpose. One trellis, made a little larger, would shade five hives as well as one; and instead of 80 trellises of vines to keep trimmed, or 80 trees, there would be only 16.



S. E. MILLER'S PLAN OF AN OUT-APIARY.

We have not tested the plan for apiaries arranged, one alleyway for bee-flight and one for the apiarist; but a good many competent bee-men have, and they say the bees seem to recognize this narrow alleyway as their own allotted highway; and when they are working heavily, said highways are literally full of bees, while the broad ones are comparatively free. In some apiaries in California I found double rows of hives, with a double alleyway between them, instead of being parallel, diverge from a common center, like the spokes of a wheel. Of

A good many times it is convenient to locate an apiary on the edge of a piece of woods, so that a part of the day we can work with the bees in the shade. This will do if the shade be not too dense.

SHADE-BOARDS.

A great many apiarists prefer to dispense with shade-trees and trees of all kinds, and use what is called "shade-boards." They are large covers, cleated on the ends, made of two or three boards, out of the cheapest lumber that can be had. If they are made of ⅜ stuff they will be lighter to handle. It is necessary to have a weight or something to hold them down. In most localities an occasional wind will blow them in all directions. Mr. James Heddon, of Dowagaic. Mich.; Mr. J. F. McIntyre, owner of the Sespe apiary, and other prominent apiarists, use stones. I rather object, however, to the use of shade-boards. They entail just so much more labor in working over a hive, to say nothing about lifting a 15-lb. stone every time you wish to look inside the hive. Besides all this, they are unsightly. For an apiary with shade-boards, see Picture Gallery in the back part of this work, that of Mr. W. H. Shirley, of Glenwood, Mich., as a good example. I do not wish to convey the impression that Mr. Shirley's apiary is unsightly, but I think it would look neater with some sort of shrubbery, such as, for instance, grapevines, instead of a shade-board and a good-sized stone.

THE HOUSE-APIARY.

This is a very old idea, having been recommended and used at different times for something more than a century past. The objections to the house-apiary are, first, the expense; especially the *first* expense; for one can make a start in bee culture with a very small amount of capital, with the out-door hives, and the sales of honey and bees will at once furnish all the capital needed, for a moderate yearly increase. With the house, the capital to put up the building must be furnished at the outset, and a house for 50 colonies will cost much more than the same number of hives. Most apiarists prefer working in the open air to being cramped up in a building (no matter how large it may be), even at the expense of having to perform more labor and take more steps. Secondly, in a building, we are obliged to get all the bees out of a room every time we open a hive, and bees are very untidy when crushed by careless footsteps on the floor of a room.

To avoid this necessitates an almost incessant use of the broom. Again, when young bees are just sallying out for their first flight, they will, if the hive is opened at just the right time, come out in the house in great numbers, and to try to stop them by any other means than closing the hive, is like trying to stop the rain from falling. These bees, after having had their "play-spell," will insist on returning to the hive in the same way that they came out, and if they are driven out of the house and the door closed, they will sometimes collect in a large cluster on or about the door. It is true they are seldom lost, for they will usually be allowed to enter the hives nearest the door; but it weakens the hive from which they came, and is very apt to puzzle a novice in the business sorely. To obviate this trouble, we can avoid opening the hives during the afternoon, or at such times as the bees are likely to rush out for a play; after a shower for instance.

On page 23 we give a picture of the house-apiary that we once used for several years. A more accurate cut of the building as it now appears will be found in the picture of our apiary—see Frontispiece. The interior will be readily understood from the accompanying diagram; the upper story was formerly occupied by the children as a play-room. Perhaps the most difficult part to make in the whole building is the roof, unless we make it of tin; this is somewhat expensive; but if kept well painted, it will last almost indefinitely. The ornamental work is, of course, in no way essential to the success of the establishment pecuniarily.

Some house-apiaries are constructed of a square or oblong shape, but our objections to such would be the difficulty of getting the bees out of the corners of the room (this might be obviated by having a square house with the doors at two opposite corners), and the increased danger of having both bees and queen get into the wrong hives. From the engraving of the house-apiary, and diagram of the ground plan given below, it will be seen that only 3 hives are on a side. The bees from the central one will, of course, recognize their own entrance, and those at each side, being the end of the row, will also find theirs without trouble. To make the entrance to each hive still more conspicuous we take advantage of the battens on the building, as will be seen from the diagram. The building is made of pine or other boards one foot in width, and these boards, which are put on up and down, constitute the entire frame of the building. Six of them, put as close together as they will come conveniently, form one of the eight sides, and the cracks are covered with a beveled batten, one edge of the corner boards being beveled slightly, that the batten may close the corner crack also.

A represents one of the heavy outer doors, and B, the light door with glass sash; these doors are the same, on both the east and west sides of the building. G is the shelf that runs entirely around the room, on which the hives are placed. It is about 3½ feet from the floor, and should be about 18 inches wide. The hives are made by a simple division-board, E. that holds a pair of metal rabbets on its upper edge, one facing each way; the combs are hung on these; and when all are in place, a sheet of glass, F. bound with tin around its edges, closes the hive by being hung in the rabbets the same as are the frames. The top of the hive is closed by the usual sheet of duck. During comb just back of these glass division-boards, the effect is more beautiful than can well be imagined. The room should afford as few corners, where stray bees may get a lodging, as possible; and to this end, we close the triangular corners by bits of board, I. I. They may have a knob on top, and these boxes will then serve for little cupboards, in which to keep various utensils. If the room is open a great deal, the bees are inclined to waste time in buzzing

A MODERN HOUSE-APIARY.

winter and spring, the bees are protected by thick chaff cushions laid on the duck sheets. It will be seen that these sheets of glass face the spectator on all sides of the room, and when we can see the bees, during the working season, filling sections and building against the glass; therefore it may be well to have a cloth curtain to drop over them, except when we wish to examine the progress of the colony. To prevent the house from becoming damp, we need a ventilator, H, in the center of the ceiling, about a foot square;

we can also have a trap-door in the center of the floor to admit cool air from the cellar, during very hot weather. D is the

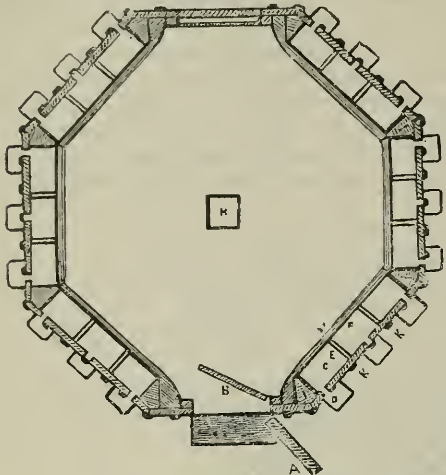


DIAGRAM OF INTERIOR OF HOUSE-APIARY.

door-step, and the entrances are shown through the walls, just by the battens. It will be observed that the middle hive on each side has its entrance through, or rather under, the batten; this is that the bees may have an additional mark for their own hive, for the entrances (2-inch auger-holes) at the sides are made at the right and left of the battens. The plan seems to work well, for we have never lost many young queens in the house-apiary. The battens are also a shade darker in color than the rest of the house; thus making them ornamental well as useful. A light drab is a very pretty color for such a building.

Besides the hives we have just described on the shelf, we have precisely the same arrangement of them on the floor, or, if preferred, raised on a platform a couple of inches above the floor. In extracting, we can get along very well with the lower tier by removing the sheet of glass and shaking the bees on the floor close to their combs; with the upper ones, we find it best to stand on a chair or box, and shake them on top of the frames close to the wall. If they scatter about, and threaten to run all over the walls and ceiling, take the next hive from the other side, until they get back, assisting them meanwhile with a little smoke. For comb honey, we work just as we do with the outdoor hives.

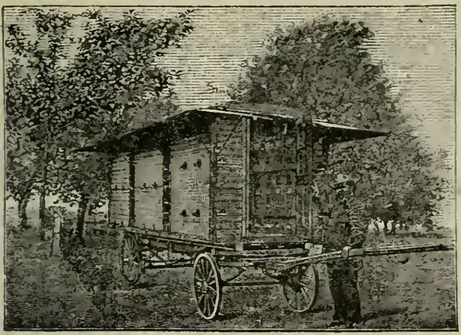
The upper story will be found very convenient for storing various things about the apiary, such as the chaff cushions during the summer, and empty sections and combs during the winter; for we wish to have our lower room, at least, always neat and tidy.

The good and desirable qualities of the house-apiary are, first, it is always sheltered and dry, and if the building is kept painted the hives will always be in good repair; this is quite an advantage over out-door hives.[313] The hives can be much more quickly opened, as they need no other covering than the chaff cushions in winter, and a single sheet of cloth in summer. Secondly, surplus honey, either extracted or comb, can be removed in much less time, for we have only to remove it and store it in the center of the room, instead of the laborious carrying that has to be done with outdoor hives.[314] Also empty combs, combs filled for destitute colonies, empty frames, frames of section boxes, and, in short, everything needed in working about the hives may be stored in the center of the room, within arm's reach of every one of the 36 hives. Furthermore we can handle the bees and do all kinds of work with them during rainy and wet weather when the outdoor hives could not be touched.[315]

Again, Mr. J. Vandervort, of Laceyville, Pa., says he can contro the temperature, and so prevent, largely, swarming; and this same control causes the bees to go into the boxes sooner.

Nay, further! we can handle the bees by lamplight after the duties of the day are over; we have repeatedly made new colonies thus, to avoid the robber bees that were so annoying in the day time, during a dearth of pasturage. See ROBBING. By closing the glass doors, and opening the outer doors, we can work in perfect freedom from robbers at any season of the year. Artificial swarming, queen-rearing, etc., can be carried on very expeditiously, and at a small expense for the reasons we have mentioned. It has been said, that the bees sting worse in the house than in the open air.

There is still another advantage in the house-apiary, and it is perhaps the most important of all. It is that the bees, honey, and all the implements, can be easily kept under lock and key; a very important item where thieving is very prevalent. Where the apiarist becomes the owner of more colonies than can profitably be kept in one place, he can establish house-apiaries at almost any point, and I have long had visions of a large central apiary, with 6 house-apiaries arranged hexagonally all about it; say three miles from the center, and three miles from each other. Nay, further, Mr. Vandervort has already house-apiaries arranged on this plan, and he reports it a success. See OUT-APIARIES.



PORTABLE HOUSE-APIARY.

In Germany they use a house-apiary on wheels, to some extent. When the pasturage becomes scarce in one locality the thing is drawn to a new field. The above cut illustrates the idea.

OBJECTIONS TO A HOUSE-APIARY.

It should be said, perhaps, in this connection, that house-apiaries are not now generally used. They are expensive; and where one has plenty of land it is better to adopt one of the outdoor apiaries. As already stated at the outset, the bees get down on the floor, get mashed, and have an unpleasant fashion of crawling up one's trowsers legs. In the summer time they are hot, unpleasant places to work. The bees, in returning, are more or less confused as to their entrances; and the most unpleasant part of all is the use of a smoker inside. This can be remedied to a great extent by having a ventilating-shaft at the top, to carry off the smoke as fast as it accumulates. We used our house-apiary for several years; but on account of the greater convenience outdoors, and the other objections already given, we have abandoned its use as a place for keeping bees. It is used now entirely for the storage of tools, honey, etc.

THE RAILWAY APIARY.

The honey-house is placed at the lowest side of the apiary, and a track or tracks with proper switches made to run between each two rows of hives. A barrel is fixed low down in the car, and extractor and implements placed over it. The whole is covered with a light square tent, made of canvas and wire cloth, for an assistant to work secure from robbers. Roll your car to the top of the slope, hand the full frames from the hive through a slit in the canvas to your assistant until the hive is finished; then roll your car to the next two hives, and so on until you get to the house, when your barrel should be full and ready to roll off for another.

The same arrangement would answer for avoiding the labor of removing comb honey from the hives; and if the bees are wintered indoors, the hives can be placed on the car, and run directly into the wintering-house.

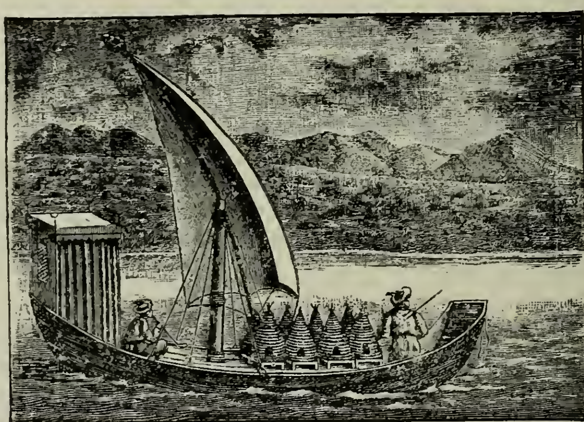
Some experiments have been made with hives permanently located on small low cars, which are to be run into a frost-proof house for wintering, or whenever the weather is such as to make it advisable to house them. See Railway apiary in Picture Gallery in the back part of the book.

WHAT STYLE OF APIARY TO ADOPT.

If you have plenty of money, and wish to go in for artistic effect, the vineyard apiary will please you. Of course, with single-walled hives you must either put them in the cellar or protect them with some outside cases during winter. If you desire to keep only a limited number of colonies, and wish to manage them with the least labor possible, a chaff-hive apiary would suit you. These hives require no shade, no moving about, into and out of the cellar, and are, to a large extent, always prepared for winter. To put them into the best possible condition, all the apiarist has to do is to see that they have sufficient stores, contracting the brood-nest to the smallest possible space, put on the chaff cushion, and they are ready for the cold. If you live in a city, or where land is expensive, or in places subject to the depredations of thieves or the visitations of mischievous boys, the house-apiary would be the thing for you to adopt. If you can not afford any very great outlay, or there is a possibility that you may wish to increase your apiary to several hundred colonies, and you are not particular about the artistic effect, Mr. McIntyre's plan, Mr. Hatch's, or that proposed by S. E. Miller, should have your preference. Apiaries arranged on these plans are not artistic; but grapevines or shrubbery adds greatly to the effect, *providing* that said shrubbery is kept trimmed down and in order; otherwise it makes the apiary look disorderly, unkept, and uncared-for. If grapevines are not kept trimmed they are an intolerable nuisance, and you will feel as though you wanted to yank them up, root and branch, when an unlucky sprout happens to stick you in the eye. The plans, then, that I would recommend for ordinary bee-keepers are those of Mr. McIntyre, Mr. Hatch, or Mr. S. E. Miller. It is much more economical to so arrange apiaries when you are keeping bees for the bread and butter there is in them.

FLOATING APIARY.

This project, we believe, has never as yet been put in practice in our own country. The idea is to have an apiary on a large flat-bottomed boat or raft, which is to be floated along on some of our large rivers, so as to be constantly in the midst of the greatest flow of honey almost the season through. It is well known that the white clover commences to bloom first in the extreme south, and then gradually moves northward; if we could be in the midst of this yield during its height, for 3 or 4 months, it would seem enormous crops might be obtained. We are informed by history, that the ancient Egyptians of the Nile made a practical success of these floating apiaries, and that they were warned when it was time to return home, by the depth to which the boat sank in the water, under the weight of the cargo of honey. That the bees might not be lost, the apiary was floated to a new field during the night.



A FLOATING APIARY, AS THEY USED TO DO IT ON THE NILE.

Since the above was written, Mr. C. O. Perrine, formerly in the honey business in Chicago, has put the project into practice, on a rather large scale. Between four and five hundred colonies were put on a couple of barges, and towed by a steamer up the river from New Orleans. The establishment started out in the spring of 1878; but as the affair terminated, I think the enterprise can hardly be called a success. In consequence of several accidents, the hives were finally taken from the barges and carried by the steamer until a favorable point was reached, and then set out on the land, like an ordinary apiary, the process being repeated as often as the forage began to fail. As near as I can gather from newspaper reports, the loss of bees, while flying on the water, was one of the principal drawbacks. Our friend Perrine declared it his intention to try again, until all difficulties had been met and overcome; and although many years have gone by, so far he has not done so. Those interested will find further particulars in the April GLEANINGS, and in the August *Bee-Keepers' Magazine*, for 1878.[317]

MOVING WHOLE APIARIES TO MORE NORTHERN LOCALITIES IN ORDER TO STRIKE THE CLOVER AND BASSWOOD BLOOM.

During the year of 1884 much was said about moving bees so as to strike the honey-flow; and several experiments were made that seemed to indicate there was no difficulty in making it a success. For instance, we have had a single colony in one day bring in as many as 18 lbs. of honey from the basswood-bloom. Now, this great honey-flow lasts but a few days. If it could be prolonged for months, or even weeks, wonderful things might be done. After the colony above mentioned gave me 18 lbs. of honey in a day, the honey-flow soon gradually went down, and finally stopped altogether. After a lapse of perhaps two weeks, when basswood was entirely gone, and our bees were trying to rob each other's hives, I happened to make a visit in the northern part of Michigan. There I found a brother bee-keeper rejoicing in the height of the basswood season. Now, by moving colonies every ten days or two weeks, so as to strike points where basswood flourished largely, it seems to me we might secure immense crops of honey — enough to repay with good interest all the expenses of transportation, by rail or otherwise. Of course, the idea is alluded to under the head of FLOATING APIARY; but there seems to be a little difficulty or inconvenience in transporting bees by water.

Within the past few years some progress has been made in this matter, and it now seems that those who have had sufficient experience may successfully bring bees rom the South to the North in time to profit by the clover and basswood. Byron Walker, of Capac, Mich., can not successfully winter his bees, on account of unwholesome food gathered in his locality, and he has made a practice of buying up bees in the spring in the South, and transporting them by rail to the North. See OUT-APIARIES.

APHIDES. It is with that class of these insects that produce honey (or, rather, a sweetish substance that bees collect and store as honey), that we have to do. They are a kind of plant-lice, and are to be seen in almost all localities, and during nearly all the summer and fall months, if we only keep our eyes about us, and notice them when they are right before us. If you examine the leaves of almost any green tree, you will find them peopled by small insects, almost the color of the leaves on which they live; while some are quite large, others are almost or quite invisible to the naked eye. Now all these bits of animated nature, while they feed on the green foliage, are almost incessantly emitting a sort of liquid excrement; and as this is usually thrown some distance from the insect, it often falls from the leaves of the tree, like dew. If this matter is new to you, I would ask you to examine the stone pavements early in the morning, under almost any green tree; an apple or willow will be pretty sure to show spots of moisture, something as if water or rain had been sprinkled over it in a fine spray. The leaves of the trees will also be found somewhat sticky where the exudation is sufficient to make it noticeable.

This substance is, I believe, not always sweet to the taste, but usually so. The quantity is often so small as to be unnoticed by the bees; but occasionally they will seem quite busy licking it up. I have several times found them at work on the leaves of our apple-trees very early in the morning, but never to such an extent that it might really be called honey-dew. I have seen them also on a willow fence, making it hum like a buckwheat field, and at the same time the ground under the trees looked as if molasses had been sprinkled about. The bees were at work on the ground also; the honey tasted much like cheap molasses. The strange part of the matter was that this occurred during a warm day late in the month of Oct.; it proceeded entirely from the aphides, for they literally covered the leaves of the willow, and could be plainly seen ejecting the sweet liquid, while they fed on the leaves. This was plainly the cause of the honey-dew in this case, but it is by no means clear that such is always the case. See HONEY-DEW.

During the year 1884, the honey-dew prevailed over a larger extent of territory, and in much greater quantity, than was ever known before. Some of our bee-friends, in fact, extracted it in May and June to the amount of several tons, and its presence in the finest and whitest comb honey did a very great amount of damage by making the honey of only a second or third quality, while otherwise it would have been first quality. Careful investigation showed that it originated principally if not entirely through the agency of the aphides. We give place to the following paper on the subject, from Prof. Cook, of the Agricultural College, Lansing, Michigan:—

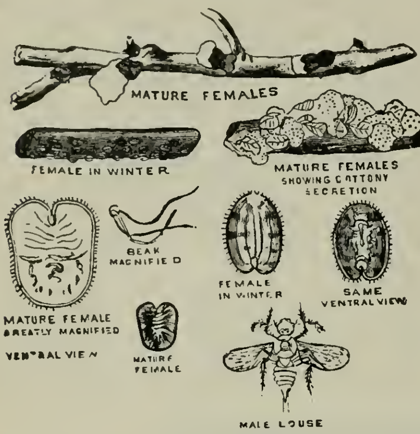
THE MAPLE-BARK LOUSE.

From very numerous inquiries as to name, habit, etc., regarding this louse, I have for some weeks intended to write you. Pres. E. Orton writes me that this insect is killing the soft-maples, and wishes a remedy. Mr. O. Terrell, from North Ridgeville, says they are affording much nectar, which attracts the bees, and seems excellent, and wishes to know if it is probably wholesome. The editor of the Coldwater (Michigan) *Republican*, asks if there is any way to save the maples. These are samples of a score of inquiries coming thick from Ohio, Illinois, Indiana, and Michigan.

DESCRIPTION.

The maple-tree scale or bark louse (*Pulvinaria innumerabilis*, Rath.) consists at this season (1884) of a brown scale about five-eighths of an inch long, which is oblong, and slightly notched behind. On the back of the scale are transverse depressions, marking segments. The blunt posterior of the insect is raised by a large dense mass of fibrous cotton-like material, in which will be found about 800 small white eggs. These eggs falling on to a dark surface look to the unaided eye like flour; but with a lens they are found to be oblong, and would be pronounced by all as eggs at once. This cotton-like egg-receptacle is often so thick as to raise the brown scale nearly a fourth of an inch. These scales are found on the under side of the limbs of the trees, and are often so thick as to overlap each other. Often there are hundreds on a single main branch of the tree. I find them on basswood, soft and hard maple, and grapevines, though much the more abundant on the maples.

Another feature, at this mature stage of the insect, is the secretion of a large amount of nectar. This falls on the leaves below, so as to fairly gum them over, as though they were varnished. This



nectar is much prized by the bees, which swarm upon the leaves. If such nectar is pleasant to the taste, as some aver, I should have no fear of the bees collecting it.

From the middle to the last of June, the eggs begin to hatch, though hatching is not completed for some weeks after it begins, so we may expect young lice to hatch out from late in June till August.

The young lice are yellow, half as broad as long, tapering slightly toward the posterior. The seven abdominal segments appear very distinctly. The legs and antenna are seen from the other side. As in the young of all such bark lice, the beak, or sucking-tube, is long and thread-like, and is bent under the body till the young louse is ready to settle down to earnest work as a sapper. Two hair-like appendages, or setæ, terminate the body, which soon disappear.

The young, newly born louse, wanders two or three days, then inserts its beak into the leaves where it first locates. It prefers the middle under side of the leaf. In autumn the much-enlarged louse withdraws from the leaves and attaches to the under side of the twigs and branches, while on the leaves they sometimes, though rarely, withdraw their beak, and change their position. In winter, the young lice remain dormant; but with the warmth of spring, as the sap begins to circulate, the lice begin to suck and grow. The increase of size as the eggs begin to develop is very rapid. Now the drops of nectar begin to fall, so that leaves and sidewalks underneath become sweet and sticky. In the last *Ohio Farmer*, a Mr. Singleton states that leaves of the maple do secrete honey-dew. It is on the leaves, and there are no aphides or plant-lice. Mr. Singleton's honey-dew is, without doubt, this same nectar from bark-lice. Had Mr. S. looked on the under side of the branches, instead of on the leaves, he would have found, not aphides, to be sure, but bark-lice.

If these spring lice are examined closely with a low magnifying power, a marginal row of hairs will be seen.

MALES.

Some few of the scales in late July will be noticed to be dimmer, lighter in color, and somewhat more convex above. In these the setæ do not disappear, but may be seen projecting from the posterior end of the scale. In August, the mature males appear. These have the scales, have two wings, and are very active. Although the females are to continue to grow till the next June, coition now takes place. The males are seen for two or three weeks, though probably each individual does not live as many days. It is quite probable that, as in case of production of drone-bees and aphides, the males of these scale-lice are not absolutely necessary to reproduction. We know they are not in some species.

The basswood, the tulip (see my Manual, p. 249), the elm, the hickory, the blue-ash, etc., are all suffering from bark-lice, much like the above, except that the cottony substance is wanting. It is a comforting truth, that all these species are often destroyed by their enemies before they entirely kill our trees, though they often do great harm.

Lansing, Mich., June 17, 1884. A. J. COOK.

ARTIFICIAL COMB. Although several attempts have been made to produce comb for the bees of full depth of cell, I believe all have resulted in failures; the bees either leave them untouched, or gnaw them down, and build their own in place. If given the base of the cell, however, with only shallow walls of such depth that the bees can reach to the bases with their mandibles so as to shape and thin the bottom as they wish before the walls are raised, the case is quite different; for they are used then as readily, perhaps, as their own natural comb, as has been abundantly proven by the COMB FOUNDATION, which see. Announcements have been made from time to time of an invention just about completed by which combs with cells of full depth were about to be thrown on the market, but somehow it never gets any further than "just going to be." It is doubtful if it ever does get any further.

WOODEN BROOD-COMBS.

Brood combs of wood have been invented and manufactured by a Mr. Aspinwall, of Three Rivers, Mich. Cells of the proper width and depth are bored by a nicely adjusted gang of drills, and the whole coated with beeswax. The claim made for such combs (and they have been sufficiently tried to show that bees will accept and use them) is, that it makes a sure thing of having the brood-nest entirely filled with worker comb, there being no possibility of raising any drones, and that without drones no swarming will occur. It is asserted, however, by others, that absence of drones will not prevent swarming, and that drones may be admitted from other hives. As yet these combs have not been tested by a great many, and the difficulty of making any but one size stands in the way of any general testing.

ARTIFICIAL FERTILIZATION. Much time and money has been expended in wire-cloth houses, and glass fixtures, to accomplish this result, the more, perhaps, because a few sanguine individuals imagined they had succeeded in having the queens meet the drones in confinement, thus securing the advantage of choice drones, as well as queens, to rear stock from.*[25] A friend of mine was quite sure he succeeded; but after examining into the matter it was found that the queens got out and took their flight in the usual way through the passage that was left for the worker-bees; he having based his calculations on the oft-repeated statement that a queen could not pass through a passage $\frac{5}{32}$ of an inch in width. The queen just before her flight is very slender, and will get through a passage that an ordinary laying queen would not, and those who claimed to have succeeded, being rather careless observers, might have supposed that the fertilization had in reality taken place in the hive. Again, one of those who claimed to have succeeded states that a queen will always take exercise in the open air, after she has been fertilized in confinement; this seems to render the whole matter ridiculous, especially if she takes this flight before she commences to lay. About the year 1870, hundreds of bee-keepers were busily at work trying this project, with a view of keeping the Italian blood in a state of absolute purity, in neighborhoods where black or common bees were kept in considerable numbers; and the subject affords a fair illustration of the mischief which may be done by careless or unscrupulous persons, in reporting through the press what has been guessed at rather than demonstrated by careful experiment.

Taking into view the in-and-in breeding that would have resulted had the experiments really been a success, it is doubtful if it would have been a benefit after all. When it was found that the Italians speedily became hybrids where so many black bees were all about us, as a matter of necessity frequent importations from Italy began to be made; and when it was discovered that stock fresh from their native home at once showed themselves superior as honey-gatherers, the business assumed considerable proportions, and now almost every apiarist of 50 hives has an imported queen of his own to rear queens from.[26] This has the effect of not only giving us the best stock known, but of giving frequent fresh strains of blood, and is perhaps very much better all around than it would have been had artificial fertilization been a success.

ARTIFICIAL HEAT. As strong colonies early in the season are the ones that get the honey and furnish the early swarms as well, and are in fact the real source of profit to the bee-keeper, it is not to be wondered at that much time and money has been spent in devising ways and means whereby all might be brought up to the desired strength in time for the first yield of clover honey. As market gardeners and others hasten the early vegetables by artificial heat, or by taking advantage of the sun's rays by means of greenhouses, etc., it would seem that something of the kind might be done with bees; in fact, we have, by the aid of glass and the heat of a stove, succeeded in rearing young bees every month in the year, even while the weather was at zero or lower outside; but so far as we can learn, all artificial work of this kind has resulted in failure, so far as profit is concerned. The bees, it is true, learned to fly under the glass and come back to their hives; but for every bee that was raised in confinement, two or three were sure to die, from one cause or another, and we at length decided it was best to wait for summer weather, and then take full advantage of it.

Later, we made experiments with artificial heat while the bees were allowed to fly out at pleasure; and although it seemed at first to have just the desired effect, so far as hastening brood-rearing was concerned, the result was, in the end, just about as before; more bees were hatched, but the unseasonable activity, or something else, killed off twice as many as were reared, and the stocks that were let alone in the good old way came out ahead. Since then we have rather endeavored to check very early brood-rearing, and, we believe, with better results.

A few experiments with artificial heat have apparently succeeded, and it may be that it will eventually be made a success; but our impression is, that we had much better turn our energies to something else, until we have warm settled weather. Packing the hives with chaff, sawdust, or any other warm, dry, porous material, so as to

* Since the above was written the matter has been revived, and an account of at least a partial success is given in the *American Bee Journal* for Nov., of 1878, and GLEANINGS, May 15, 1886, page 382.

economize the natural heat of the cluster, seems to answer the purpose much better, and such treatment seems to have none of the objectionable features that working with artificial heat does. The chaff needs to be as close to the bees as possible; and to this end, we would have all the combs removed except such as are needed to hold their stores. Bees thus prepared seem to escape all the ill effects of frosty nights in the early part of the season, and we accomplish for brood - rearing exactly what was hoped for by the use of artificial heat.

For the benefit of those who may be inclined to experiment, I would state that I covered almost our entire apiary with manure, on the plan of a hot-bed, one spring, and had the satisfaction of seeing almost all die of spring dwindling. At another time, I kept the house-apiary warmed up to a summer temperature with a large oil-lamp, for several weeks, just to have them beat those out of doors. The investment resulted in losing nearly all in the house-apiary with spring dwindling, while those outside stayed in their hives as honest bees should, until settled warm weather, and then did finely, just because I was "too busy to take care of them" (?), as I then used to express it. After you have had experience enough to count your profitable colonies by the hundred, and your crops of honey by the ton, it will do very well to experiment with greenhouses and cold-frames: but beginners had better let such appliances alone, unless they have plenty of money to spare for more bees.[28]

ARTIFICIAL PASTURAGE. Although there is quite a trade springing up in seeds and plants to be cultivated for their honey alone, and although we have about 4000 young basswood - trees of our own, growing finely and promising to be the basis of a honey-farm at some future time, yet we can at present give little encouragement to those who expect to realize money by such investments. There is certainly a much greater need of taking care of the honey that is almost constantly wasting just for lack of bees to gather it. A field of buckwheat will perhaps occasionally yield enough honey to pay the expense of sowing, as it comes in at a time when the bees in many places would get little else; and if it does not pay in honey, it certainly will in grain. If one has the money, and can afford to run the risk of a failure, it is a fine thing to make some accurate experiments, and it may be that a farm of one or two hundred acres, judiciously stocked with honey-bearing plants, trees, and grains, would be a success financially. It has been much talked about, but none, so far as we know, have ever put the idea in practice. To beginners we would say: Plant and sow all you can that will be sure to pay aside from the honey crop, and then, if the latter is a success, you will be so much ahead ; but beware of investing much in seeds that are for plants producing nothing of value except honey. Alsike, and white Dutch clover, buckwheat, rape, mustard, and the like, it will do to invest in ; but catnip, mignonnette, Rocky-Mountain bee-plant, etc., etc., we would at present handle rather sparingly. It should be borne in mind that we can hardly test a plant, unless we have one or more *acres* of it in bloom, and that small patches do little more than to demonstrate that the blossoms contain some honey, giving us very little clue to either quantity or quality. Bees will work on blossoms, and at times with great apparent industry, when they are obliged to make hundreds of visits and consume hours of time, in getting a single load; we therefore should be intimately acquainted with the interior of the hive, as well as the source from which the bees are obtaining the honey, before we can decide what is profitable to sow as a honey-plant.

By way of encouragement, we may say that both plants and trees, under thorough cultivation, yield honey in much larger quantities than those growing wild, or without attention. Our basswoods that have commenced to blossom have shown a larger amount of honey in the nectaries than we ever saw in any that grew in the woods or fields. The question, "How many acres of a good honey-bearing plant would be needed to keep 100 colonies busy?" has often been asked. If ten acres of buckwheat would answer while in full bloom, we should need perhaps ten other similar fields sown with rape, mustard, catnip, etc., blossoming at as many different periods, to keep them going the entire warm season. It would seem 200 acres should do nicely, even if nothing were obtained from other sources, but at present we can only conjecture. A colony of bees will frequently pay for themselves in ten days during a good yield from natural pasturage; and if we could keep up this state of affairs during the whole of the summer months, it would be quite an item indeed. Buckwheat, rape, and alsike clover, are the only cultivated plants that have given paying crops of honey, without question, so far as we have been informed. See HONEY-PLANTS in Index.

ARTIFICIAL SWARMING. To attempt to give all the various plans and modifications that are recommended and practiced successfully, would make a book of itself; we shall therefore give only those we think safest and simplest.

If you are a new hand with bees, you had better not undertake to do such work until you find that bees are swarming naturally in the neighborhood. At such a time you will probably succeed by almost any plan. If you have plenty of money and not much time, you had better buy your queens, and the untested queens will do very well; if you should get them killed, it will be no serious loss. If you also have plenty of empty combs, you can make an artificial swarm in a very few minutes, by simply moving any strong colony several rods away, and placing a new hive filled with empty comb (or, better, with one frame of hatching brood), in its place. That the returning bees may not kill the strange queen they find in place of their accustomed mother-bee, we protect her for a day or two in a cage. See CAGES FOR QUEENS. As they enter with their loads of pollen and honey, they seem very much perplexed and astonished, scramble out of the hive, and, after a few turns about the premises to reassure themselves, they go in again, repeating this until too tired, apparently, to bother their little heads any further with a matter that is altogether beyond their comprehension. Wisely concluding that "what can't be cured must be endured," they unload in the empty combs near the queen, and go after more spoils. We have had a colony of this description bring in over 20 lbs. of honey, during the first two days. Let the queen out after they get friendly to her—see INTRODUCING—and your work is done. Should the colony get weak before the young bees begin to hatch out, give them a comb of hatching brood from some strong stock. This plan is only for the swarming season.

COMBS OF HATCHING BROOD.

As these combs of hatching brood are a very important item in building up, or strengthening stocks, and as we shall have need of referring to them often, we will explain that you are to look over the combs of a very populous colony and select one that has bees just gnawing through the caps of the cells. At the proper season, you should find combs that will hatch out a dozen bees while you are holding them in your hand; it should contain little or no unsealed brood, for the new colony might not be able to feed all the larvæ. One L. frame, if full of capped brood, will make a very fair swarm of bees; and as these newly hatched downy bees—like newly hatched chickens for all the world—are ready to take up with anybody or any thing, we can put them safely anywhere without fear of their being hostile to either queens or workers.

Can we not get along without the empty comb by using foundation in its stead? Yes, we can, but it is hardly advisable unless we can have two or three old combs to start with, or a *full* hive of bees.

If you prefer to rear your own queens, which every apiarist should do, move your colony as before; but instead of the queen, give them a frame of *eggs* from your choicest queen. Now if you want fine queens, equally good as those reared in natural swarming, be sure you do not give them any large larvæ, with the eggs. The best and safest way is to get an empty comb, place it in the center of your colony containing your imported or choice queen, and leave it there until you find eggs in it that are just hatching into larvæ; these larvæ will be scarcely visible to the naked eye when first hatched; but in place of the egg, you will see a tiny spot of the milky food that the nurse-bees place round the embryo bee. This is just the age you wish the larvæ for queen-rearing, and you may take the frame, bees and all, if you are sure—look sharp—you are not carrying your old queen along to your new hive. If you want as many queen-cells as you can get, it will be a good idea to cut an oblong piece out of the comb, just under the eggs and larvæ. If it is inconvenient to move your hive (as in the house-apiary) you can take only the combs with adhering bees to the new location, and in fact you need take only so many of the combs as are necessary to get all the brood and the queen.[318]

In 12 days after the eggs are given the bees, the queens may, some of them, hatch; therefore, if you design saving the extra queens, you will need to remove all the cells but one, or the first-hatched queen will destroy them all.[29] We have had a young queen destroy as many as twenty fine cells in a single day, when we were so careless as to delay attending to them just at the right time. About 10 days after the queen hatches, you may expect her to begin to lay, and then you are as far along as if you had purchased a laying queen to start with, except that your bees have been growing old all the time. See

Age of Bees. Unless these bees are supplied with fresh eggs or brood, they will be pretty weak before any young bees will be hatched to take their place. Now if you wish to have matters progress lively, you can give these bees a comb containing eggs every two or three days during the whole time they are waiting for the queen to be hatched and fertilized; they will do much better if they are thus employed, and they will be quite a prosperous colony by the time the queen is ready to lay. To get these eggs, you have only to insert an empty comb in the center of a populous colony until the queen has deposited as many eggs in the cells as are required.

So far, all is very simple. To swarm a large apiary, and at the same time Italianize all our new stocks, we would only have to repeat the process as many times as we have colonies. But how about the surplus queen-cells that we cut out? This is just where the complication comes in; yet if we look into the matter very carefully, I think it will be found quite simple. These queen-cells, if cut out shortly before hatching, and inserted into the combs of any queenless colony, will usually furnish them a queen as soon as the one left where it was built; and if an artificial colony was made at the time the cells were cut out, it is plain we should have them supplied about ten days earlier than the one that was obliged to start their cells from the egg. Bees usually seem to have a preference for building their own cells, instead of having them furnished; but as they can by no possibility get a queen hatched in less than ten days—perhaps nine in extreme cases—the queen from the inserted cell will be out and destroy the others almost as soon as they are started, and so we need be to no trouble to get all the undesirable brood out of the way, as in our first experiment. Unfortunately, there is an *if* in the matter, and it is, if the bees do not destroy this cell you have given them, and proceed to raise one of their own in the good old way. Many contrivances have been invented to prevent them, such as caging the cell, etc., but I think you will do well to waste no time in experimenting with such machinery. The lamp nursery enables us to hatch almost any number of queen-cells with safety, but occasionally the queens are lost in introducing even then; see Lamp Nursery.

The plan I would recommend for beginners, and perhaps for everybody else as well, is to procure as many combs of hatching brood from different hives as you have queen-cells and to insert a cell in each; the manner of inserting the cells will be found in Queen-Rearing. These combs are to be all put in the one hive in which the cells were built; and if you have more than ten cells, put on an upper story, or even a third. As there are no bees in the hive except those that built the cells and the young ones just hatching, we shall have no cells torn down, and in a few hours they will have waxed them all firmly in their places.

Now with these combs of hatching brood, every one containing a cell nearly ready to hatch, we are in excellent trim to go on with artificial swarming. We can not only remove hives and put empty ones in their places as in our first experiment, but we can take combs of bees and brood from any hive in the apiary, blacks, hybrids, or any thing and put them into a new hive located anywhere, put one of the frames with the queen-cell among them, and, presto! we have a good colony, requiring no more care whatever. Four combs of bees and brood will make a good colony at any time of the year, and they will be at work like an old colony in ten days. I have never known a cell destroyed when given to an artificial swarm in the manner I have stated. In substituting a new hive for an old one, we should, if possible, use a new hive precisely like the old one, or much trouble may be found in getting the bees to go into it. If we can not do this, make it look at least like the old one.

Since the increase of out-apiaries, advantage has been taken of the fact that, when a frame of brood and bees is taken a considerable distance, the bees will stay wherever they are put. Suppose you have a hive full of combs, each comb having a queen-cell, as explained already. If this hive be taken to an out-apiary, each comb with its queen-cell and adhering bees may be put into a separate hive, the hive then filled with frames of foundation; and, if done early enough in an extra good season, each nucleus thus formed will grow into a good colony during the course of the season, with no further care than to see that it has succeeded in getting a laying queen. It is better, however, to take along, at the time of hauling away, a second hive full of brood and bees, but with no queen or queen-cells, and give to each nucleus one of these combs with adhering bees. Then you have a fair chance of success in any ordinary season.

For those who use large hives, and work for extracted honey, there is a very simple way to double the number of colonies, which has worked well in the hands of some. When the time comes for surplus storing, put a queen-excluder on the hive, and on this put a second story filled with frames of foundation, or, better still, empty comb, then a third story also filled in the same way, except that you place in the third story one or two combs of brood taken from the lower story, together with the adhering bees. Some young brood and eggs should be in the comb or combs of brood placed above. Be sure that the queen is left in the lower story. Let there be an entrance in the upper story, not necessarily very large. In about three weeks a young queen will be laying above, and at the close of the harvest this upper story will contain a strong colony, which may be put into a separate hive, and a bottom-board may be put under it, so as to stop all communication with the lower story.

EMPTY COMBS FOR ARTIFICIAL SWARMING.

These will almost always be on hand in swarming time; but if not, a frame containing a sheet of fdn. may be put in place of any comb taken from a strong colony. The fdn. is fully as good as the natural comb, and, in some respects, even better. If you have no fdn., let the bees build combs, one at a time, in new frames, watching them to see that they do not build drone comb. If they will not build worker comb, contract the space with a division - board, and have the combs built in weaker colonies. Using frames of fdn. is, however, far the better way. During fruit-blossoms, and long before swarming time, an ample supply of beautiful combs may be secured, built out from foundation.

Caution:—The foregoing directions are given generally for making artificial swarms during the swarming season, or, at least, at a time when honey is coming in abundantly. It will require more skill and more care to make artificial swarms in the fall, or at any time when the bees are disposed to rob; and if a hive is moved away, as directed, the new one must always have a comb containing unsealed brood, as well as the empty combs, or the bees will not be certain to defend their hive against robbers. See QUEEN-REARING.

ASTERS. Under this head we have a large class of autumn flowers, most of which are honey - bearing; they may be distinguished from the helianthus, or artichoke and sunflower family, by the color of the ray flowers. The ray flowers are the outer colored leaves of the flower, which stand out like rays; in fact, the word aster means star, because these ray flowers stand out like the rays of a star. Many of the yellow autumn flowers are called asters, but this is an error; for the asters are never yellow, except in the center. The outside, or rays, are blue, purple, or white. You may frequently find half a dozen different varieties growing almost side by side. Where there are acres of them, so to speak, they sometimes yield considerable honey, but some seasons they seem to be unnoticed by the bees. I do not think it will pay to attempt to cultivate them for honey; better move your bees to where they grow naturally, when you have determined by moving a single hive first, as a test, whether they are yielding honey in paying quantities.

ASTER.

Where the asters and goldenrod abound largely, it may be best to defer feeding until these plants have ceased to yield honey, say the last of September.

B.

BARRELS. For liquid honey in quantity we shall probably never find a cheaper receptacle that will stand the rough usage of shipping honey, as well. We can put our honey in tin cans, but these are more expensive—the very cheapest costing over one-half cent for every pound of honey they will contain—and they can not be shipped *safely*, without first being crated. Besides all this, a barrel of honey will be received at a much lower rate of freight than any other kind of package it is possible to make. If we are then all decided as to the expediency of storing our honey in barrels, we wish to decide upon the most profitable size for these barrels. The regular size of about 31 or 32 gallons is probably the cheapest size, but it has been objected to on account of the difficulty of handling so great a weight as 350 to 400 lbs., which the barrel and all would weigh. This, however, is no great objection to one who knows how to "take the advantage" of a barrel, as my father used to express it to "us boys," when we were loading stone, and as economy of money as well as "traps" is quite an item where we have tons of honey, I think we had better have large barrels principally. The large extracted-honey men, as a rule, use second-hand alcohol-barrels having a capacity of about 500 lbs. of honey. They can usually be purchased of druggists anywhere from 75 cts. to $1.25. If thoroughly washed out they are perfectly good and wholesome for honey.

For smaller-sized packages, cypress kegs holding from 75 to 200 lbs. have the general preference. Neither these nor the alcohol-barrels need to be waxed inside; but it should be understood, that, the smaller the package, the more expensive it is per pound. Cypress kegs of 50 lbs. capacity cost about 40c each; 100 lbs. capacity, 60c; 175 lbs., 80c.

Kegs and barrels should not be used in localities where the atmosphere is very dry. In California, for instance, square tin cans have to be used exclusively. Any wooden receptacle would shrink so as to be utterly useless; but in most of the cities east of the Mississippi, barrels and kegs certainly have the preference on account of convenience in handling, their strength and consequent proof against breakage in shipment, and in general their cheapness. The honey-buyer prefers them to the square can for the trade. An objection to the square can is, that if a hole is punched in them with a nail, in boxing, or they happen to be racked, in trucking, so as to break the solder joint, in a large pile it is difficult to tell just where the leak is; but with kegs, as they are not boxed, it is perfectly easy to locate the trouble. When stored, kegs and barrels should, of course, be put in a moist place, a cellar for instance.

LEAKY BARRELS.

I hope you will feel as I do about it, that it is bad enough to talk about having honey leak all round, without having any practical experience in the matter; and I am very glad to be able to tell you how to entirely avoid it. It may be well to remark, that honey has a funny way of expanding during the candying process — it will generally candy as soon as the weather gets cold—and if your barrels or cans do not give it room to expand, it will be pretty sure to push out the corks or bungs. Some kinds of honey expand more than others; and under some circumstances, perfectly ripened honey will scarcely candy at all. If the barrels are left not quite full, and then filled up completely when ready to ship, there will be very little trouble.

We prefer barrels made of sound oak, but I presume those made of other strong wood will answer, if carefully waxed as we shall direct. The hoops should be of strong hoop iron, for honey is very heavy compared with most other liquids, and we wish them to stand safely the rough handling they are likely to receive on the cars, even if they should be sent back and forth several times. The hoops should be secured by large tacks, if they show any tendency to slip. If you have had the barrels made for your own use and intend them to be returned when you sell honey, it is a very good idea to have them neatly painted. This will keep the hoops in place, and will preserve the barrels very materially. There is one objection to this, however, and that is, you are many times under the necessity of waiting for your barrels to be emptied, and then they are likely to be forgotten. We once waited two years for some we had sent away with honey, and then succeeded in getting the pay for them instead of the barrels, after much importunity.

WAXING THE BARRELS TO PREVENT LEAKING.

A good barrel, carefully made of well-seasoned timber, *should not* leak, without any waxing; but as they often do, we think it safest to have them all waxed.[30] This is simply coating the entire inside with wax or paraffine. The latter we consider better, as well as cheaper. Wax is worth from 25 to 30c. per lb., but the paraffine can be had for 20c. As the latter melts at a lower temperature, and is more limpid when melted, a much less quantity is needed to coat the inside thoroughly and fill all cracks and interstices, and less skill and expedition is needed in its manipulation. You should have about a gallon of the melted liquid, for a small quantity will not keep hot until you can pour out the remainder after the waxing is done, and too much of it will adhere to the inside of the barrel. Ten or 12 lbs. will do very well. Have your bungs nicely fitted, and a good hammer in readiness to get the bung out quickly. With a large-mouthed tunnel, pour in the hot liquid, and bung it up at once. Now roll the barrel so as to have the wax go entirely round it, then twirl it on each head, and give it another spinning so as to cover perfectly all round the chime. This operation will have warmed the air inside to such an extent that the liquid will be forced into every crevice; and if there is a poor spot, you will hear the air hissing, as it forces the liquid through it. Just as quickly as you get the inside covered, loosen the bung with your hammer; and if your work is well done, the bung will be thrown into the air with a report. Pour out the remaining liquid, warm it up, and go on with the rest. If the weather is cool, you had better put your barrel in the sun, turning it frequently and driving down the hoops, before you pour in the wax. This is to save your material; for if the barrel is cold, it will take a much heavier coating: and the main thing is simply to close all crevices. See Extracted Honey.

HOW TO REMOVE CANDIED HONEY FROM BARRELS.

Good thick honey will usually become solid at the approach of frosty weather, and perhaps the readiest means of getting it out of the barrel in such cases is to remove one of the heads, and take it out with a scoop. If it is quite hard, you may at first think it quite difficult to get a scoop down into it; but if you press steadily, and keep moving the scoop slightly, you will soon get down its whole depth. If the barrel is kept for some time near the stove, or in a very warm room, the honey will become liquid enough to be drawn out through a large-sized honey-gate. After the head of a barrel has been taken out, the barrel should be waxed again before using, around the head that has been removed. Get out all the honey you can, by warming and allowing it to drain, and then with a tea-kettle of warm water, clean off every particle of honey. The rinsings may be saved and fed to the bees, or used for vinegar, that there be no waste. See Vinegar. As barrels are apt to get musty, or give the honey a taste, I would advise washing and lightly coating them every season, before being used again. After having been once coated, a very small quantity of paraffine will answer perfectly, the second time. I should have no hesitation in using any kind of a barrel for honey, if it were first scalded, allowed to dry thoroughly, and then perfectly coated with paraffine. If the barrel is dry and warm, or slightly hot, there will never be any danger of its cleaving from the wood, as wax sometimes does. Paraffine has neither taste nor smell, and does not decay as wax does, when exposed to dampness or the action of liquids.

Caution:—A mixture of wax and rosin was at one time used for coating barrels, and after giving it, as I thought, a thorough test, I used it for a whole crop of honey. The result was that the honey tasted of rosin after being in the barrels over winter, and it was sold at 10 c. when it would otherwise have brought 15c. This was quite a serious matter, as some of the journals used to recommend the rosin.

BASSWOOD. With perhaps the single exception of white clover, the basswood, or linden, as it is often called, furnishes more honey than any other one plant or tree known. It is true, that it does not yield honey every season, but what plant or tree does?[31] It occasionally gives us such an immense flood of honey that we can afford to wait a season or two, if need be, rather than depend on sources that yield more regularly, yet in much smaller amounts. If a bee-keeper is content to wait—say ten or fifteen years for the realization of his hopes, or if he has an interest in providing for the bee-keepers of a future generation, it will pay him to plant basswoods. A tree that was set out just about 10 years ago on one of our streets, now furnishes a profusion of blossoms, almost every year; and from the way the bees work on them, I should judge it furnished considerable honey. A hundred such trees in the vicinity of an apiary would be, without doubt, of great value. See Artificial Pasturage. Our 4000 trees were planted in the spring of 1872, and in 1877 many of them were bearing fair loads of blossoms. We made some experiments with basswood seeds, but they proved mostly failures, as have nearly all similar ones we have heard from. By far the better and cheaper way is to get small trees from the forest. These can be obtained in almost any quantity, from any piece of woodland from which stock have been excluded. Cattle feed upon the young basswoods with great avidity, and pasturing our woodlands is eventually going to cut short the young growth of these trees from our forests, as well as of many others that are valuable. We planted trees all the way from one to ten feet in height. The larger ones have, as a general rule, done best.

AMERICAN BASSWOOD, OR LINDEN. 32

The cut will enable any one to at once distinguish the basswood when seen. The clusters of little balls with their peculiar leaf attached to the seed-stems are to be seen hanging from the branches the greater part of of the summer. and the appearance, both before and after blossoming, is pretty much the same. The blossoms are small, of a light yellow color, and rather pretty; the honey is secreted in the inner side of the thick fleshy petals. When it is profuse it will sparkle like dewdrops if a cluster of blossoms is held up to the sunlight.

Climatic influences have their effect upon basswood. Among the hills of York State the leaves assume mammoth proportions. I measured one that was 14 inches long. While this leaf was among the largest. yet the leaves were. on the average. about twice the size of those in our own locality. In Illinois I noticed that the basswoods seemed to be less thrifty than in Ohio. The leaves seemed to be smaller. and the bark of the trees of a little different appearance. The preceding engraving represents quite accurately the typical forms. however. The European variety has smaller leaves. and differs from *Tilia Americana* in a few other minor respects.

It is rather to be regretted that this tree is not more plentiful than it is. It is one of the main stays, where it grows, of the honey-producer. and one of the most valuable woods in manufacture. It will hardly do for outside exposure to the weather; but it is admirably adapted for packing-boxes, and is used in *immense* quantities in the manufacture of furniture, forming the bottoms and sides of drawers, the backs of bureaus, dressing-cases. etc.. and it is also employed extensively in the manufacture of paper; in fact, the envelopes that are sent out from the Home of the Honey-bees are said to be made from basswood "pulp."

It has often been said that we are cutting off our own noses in using it for one-piece sections—that we are "killing the goose that lays the golden egg." Well. it is true that apiarian-supply dealers may use quite a little; but still. the amount that *they* use is very insignificant in comparison with that employed by furniture-makers. packing-box concerns, and paper-makers.

After all, there is one redeeming feature. The basswood is a very rapid grower. We thought at one time that we had used about all the basswood in this section, to say nothing of the enormous quantities shipped in from Michigan and other States. But somehow the farmers bring in beautiful nice white basswood lumber; and where they get it in our vicinity is a sort of puzzle. At least some of this lumber is from a second growth of trees that sprouted ten years ago from the stumps of old trees—said trees having been cut for us ten years ago. *If* basswood will replace itself in ten or even twenty years. so that it can be used again for lumber. there is yet hope that it may continue to bless the bee-keeper.

Basswood, and perhaps most other forest-trees. require shade. especially when young; and, much to our surprise. some that were planted directly under some large white-oak trees, have done better than any of the rest. Who has not noticed exceedingly thrifty basswoods growing in the midst of a clump of briers and bushes of all sorts? I would place the trees not more than 12 feet apart, for it is an easy matter to thin them out whenever they are found too close. A neighbor has planted basswoods entirely round his farm on the road-sides, and they add much to the comfort of travelers, are pretty to the sight. and, without doubt, will furnish honey enough, in time, to pay all expenses.

The best yield of honey we have ever had from a single hive, in one day, was from the basswood bloom; the amount was 43 lbs. in three days.[13] The best we ever recorded from clover was 10 lbs. in one day. The honey from the basswood has a strong, aromatic or mint flavor, and we can tell when the blossoms are out, by the perfume about the hives. The taste of the honey also indicates to the apiarist the very day the bees commence work on it. The honey, if extracted before it is sealed over, when it is coming in rapidly, has the distinctive flavor so strong as to be very disagreeable to some persons. My wife likens it to the smell and taste of turpentine or camphor, and very much dislikes it. when just gathered; but when sealed over and fully ripened in the hive, she thinks it delicious, as does almost every person.

BEARS. The bear has long been known as the proverbial enemy of the bee. He is very fond of honey. and seems to have little regard for stings. His great furry coat and thick skin seem to be almost proof against their little fiery darts. Our forefathers used to tell us a good deal about bears making raids upon bee-trees.

When I visited California, in 1888, I ran across an apiarist who discovered that somebody or something had been making nocturnal inroads upon his bees. An old bear came every night and clawed the honey out until only one out of 11 colonies was left, and Mr. R. wanted so bad to keep that one that he hung it up in a tree by a rope, so high the old bear could not reach it. He could not carry it away, for the bees that were gathering honey would be lost; but if it were hung up they could find it. That night the bear came after more honey; and as he could not reach that last hive, he clawed up the tree and commenced to slide down on the rope, to get the bees. Now, the rope held the hive very well, but it wouldn't hold a big bear too, and so it broke, and down came the bear, bees, and all. He must have been somewhat astonished; but he gathered himself up and ate all the honey, and then went off. As he had now got the last one, Mr. R. thought he wouldn't come any more; but back he came the next night. Well, the bees that had no hives wanted to work somewhere, and so they went into the bee-house near by, and built some combs under the clock-shelf, and, don't you believe that that old bear smelled the honey under the clock-shelf and want-

BEAR TAKING HONEY OUT OF A MUTH JAR.

ed that too? but as the honey-house was shut up and locked, he could not get in; but he made a hole in one corner with his teeth and claws until he could get one paw through, and then he reached in as far as he could and tried to claw down that last bit of honey the poor bees had made. I saw the place where he made the hole in the bee-house.

In 1889, while I was visiting at the Michigan Agricultural College, I was invited to see their pet bear. Being provided with a small camera I was told to watch his bearship manipulate a bottle of honey, and take a couple of views. After reaching all the honey he could out of the bottle in an upright position, he turned it up as in the engraving, and poured it down his throat. As he smacked his lips he tipped the bottle a little too fast, and a lot of it ran down over his mouth, and some of it ran over his eyes. That was of small consequence, however, for, after every drop had been taken from the outside, he kept on poking his tongue around the inside and then outside, along his furry cheeks, and as near his eyes as his tongue would reach. After giving a purr of satisfaction he was led back to his kennel, and chained. True to his natural instincts and appetite he showed he was fond of honey. Hundreds of instances might be given, but these will suffice.

BEE-BREAD. A term in common use, applied to pollen when stored in the combs. In olden times, when bees were killed with sulphur to get at the honey, more or less pollen was usually found mixed with the honey; it has something of a "bready" taste, and hence, probably, came its name. Since the advent of the extractor, and section boxes, it is very rare to find pollen in the honey designed for table use. See POLLEN.

BEE-DRESS. See VEILS.

BEE-ESCAPES. See COMB HONEY, also EXTRACTING.

BEE-HUNTING. I have warned you so often, my friends, against leaving sweets of any kind about the apiary, and about being careful not to let the bees get to robbing each other, that it may seem a little queer, to be directed how best to encourage and develop this very robbing propensity in these little friends of ours.

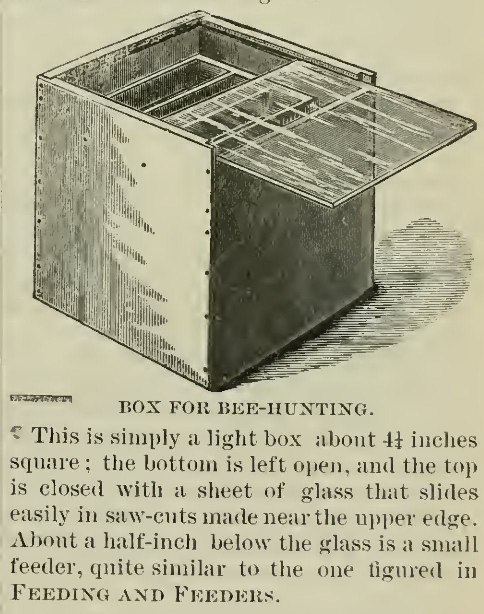
The only season in which we can trap bees is when they will rob briskly at home; for when honey is to be found in the flowers in plenty, they will hardly deign to notice our bait of even honey in the comb. Before starting out, it will be policy to inform yourself of all the bees kept in the vicinity, for you might otherwise waste much time in following lines that lead into the hives of your neighbors. You should be at least a mile from any one who has a hive of bees when you commence operations, and it were safer to be two miles. I do not mean by this to say that there are no bee-trees near large apiaries, for a number have been found within half a mile of our own, and an experienced hand would have but little trouble in finding more, in all probability; but those who are just learning, would be very likely to get very much perplexed and bothered by domesticated bees mixing with the wild ones.

Perhaps the readiest means of getting a line started is to catch the bees that will be found on the flowers, especially in the early part of the day. Get them to take a sip of the honey you have brought for the purpose, and they will, true to their instinctive love of gain, speed themselves home with their load, soon to return for another. To find the tree, you have only to watch and see where they go. Very simple, is it not? It certainly is on paper, but it usually involves a deal of hard work, when carried out in practice. You can get along with very simple implements; but if your time is valuable, it may pay to go out fully equipped. For instance, a small glass tumbler will answer to catch bees with; and after you have caught one, you can set the glass over a piece of honey-comb. Now cover it with your handkerchief to stop his buzzing against the glass, and he will soon discover the honey, and load up. Keep your eye on him, and as soon as he is really at work at the honey, gently raise the glass and creep away, where you may get a good view of proceedings. As soon as he takes wing, he will circle about the honey, as a young bee does in front of the hive, that he may know the spot when he comes back; for a whole "chunk" of honey, during the dry autumn days, is quite a little gold-mine in his estimation. There may be a thousand or more hungry mouths to feed, away out in the forest in his leafy home, for aught we know.

If you are quick enough to keep track of his eccentric circles and oscillations, you will see that his circles become larger and larger, and that each time he comes round, he sways to one side; that is, instead of making the honey the center of his circles, he makes it almost on one edge, so that the last few times he comes round he simply comes back after he has started home, and throws a loop, as it were, about the honey to make sure of it for the last time. Now you can be pretty sure which way his home lies almost the very first circuit he makes, for he has his home in mind all the time, and bears more and more toward it.

If you can keep your eye on him until he finally takes the "bee-line" for home, you do pretty well, for a new hand can seldom do this. After he is out of sight, you have only to wait until he comes back, which he surely will do, if honey is scarce. Of course, if his home is near by, he will get back soon; and to determine how far it is, by the length of time he is gone, brings in another very important point. The honey that the bees get from the flowers is very thin; in fact, it is nearer sweetened water than honey, and if we wish a bee to load up and fly at about a natural "gait," we should give him honey diluted with water to about this consistency. Unless you do, he will not only take a great deal more time in loading up, but the thick honey is so much heavier he will very likely stagger under the load, and make a very *crooked* bee-line of his homeward path. Besides, he will take much more time to unload. Sometimes, after circling about quite a time, he will stop to take breath before going home, which is apt to mislead the hunter, unless he is experienced; all this is avoided by filling your honey-comb with honey and water, instead of the honey alone.

Now, it takes quite a little time to get a bee caught and started in the work; and that we may be busy, we will have several bees started at the same time; and to do this expeditiously, we will use a bee-hunting box made as in the following cut.



BOX FOR BEE-HUNTING.

This is simply a light box about 4½ inches square; the bottom is left open, and the top is closed with a sheet of glass that slides easily in saw-cuts made near the upper edge. About a half-inch below the glass is a small feeder, quite similar to the one figured in FEEDING AND FEEDERS.

HOW TO USE THE HUNTING-BOX.

Take with your box about a pint of diluted honey in a bottle. If you fill the bottle half full of thick honey, and then fill it up with warm water, you will have it about right. In the fall of the year, you will be more likely to find bees on the flowers in the early part of the day. When you get on the ground, near some forest, where you suspect the presence of wild bees, pour a little of your honey into the feeder, and cautiously set the box over the first bee you find upon the flowers. As soon as the box is well over the flower, close the bottom with your hand, and he will soon buzz up against the glass. Catch as many as you wish, in the same way, and they will soon be sipping the honey. Before any have filled themselves, ready to fly, set your box on some elevated point, such as the top of a stump in an open space in the field, and draw back the glass slide. Stoop down now, and be ready to keep your eye on him, whichever way he may turn. If you keep your head low, you will be more likely to have the sky as a background. If you fail in following one, you must try the next, and as soon as you get a sure line on one, as he bears finally for home, be sure to mark it by some object that you can remember. If you are curious to know how long they are gone, you can, with some white paint in a little vial, and a pencil-brush, mark one of them on the back.* This is quite a help where you have two or more lines working from the same bait. When a bee comes back, you will recognize him by the peculiar inquiring hum, like robbers in front of a hive where they have once had a taste of spoils. If the tree is near by, each one will bring others along in his wake, and soon your box will be humming with a throng so eager that a further filling of the feeder from the bottle will be needed. As soon as you are pretty well satisfied in which direction they are located, you can close the glass slide and move along on the line, near to the woods. Open the box, and you will soon have them just as busy, again; mark the line and move again, and you will very soon follow them to their home. To aid you in deciding just where they are, you can move off to one side and start a cross-line.† Of course, the tree will be found just where these lines meet; when you get about where you think they should be, examine the trees carefully, especially all the knot-holes, or any place that might allow bees to enter and find a cavity. If you place yourself so that the bees will be between you and the sun, you can see them plainly, even if they are among the highest branches. Remember you are to make a careful and minute examination of every tree, little and big, body and limbs, even if it does make your neck ache. If you do not find them by carefully looking the trees over, go back and get your hunting-box, bring it up to the spot, and give them feed until you get a quart or more at work. You can then see pretty clearly where they go. If you do not find them the first day, you can readily start them again almost any time, for they are very quick to start, when they have once been at work, even though it is several days afterward.

Bees are sometimes started by burning what is called a "smudge." Get some old bits of comb containing bee-bread as well as honey, and burn them on a small tin plate, by setting it over a little fire. The bees will be attracted by the odor of the burning honey and comb, and, if near, will sometimes come in great numbers. Oil of anise is sometimes used, to attract them by its strong odor. We have had the best success in getting them from the flowers as we have directed.

A spy-glass is very convenient in finding where the bees go in, especially if the tree is very tall; even the toy spy-glasses sold for 50c. or a dollar, are sometimes quite a help. The most serviceable, however, are the achromatic opera-glasses that cost from $3.00 to $5.00. With these we can use both eyes, and the field is so broad that no time is lost in getting the glass instantly on the spot. We can, in fact, see bees with them in the tops of the tallest trees, almost as clearly as we can see them going into hives placed on the ground.

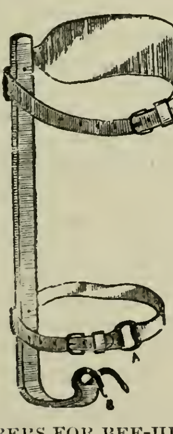
After you have found the tree, I presume you will be in a hurry to get the bees that you know are there, and the honey that *may* be there. Do not fix your expectations too high, for you may not get a single pound of the latter. Of two trees that we took a few years ago, one contained just about as much honey as we had fed them, and the other contained not one visible cell full! The former were fair hybrids, and the latter well-marked Italians. If the tree is not a valu-

*Since this was written, an A B C scholar says: "Bees vary in their flight. But I have found that on an average they will fly a mile in five minutes, and spend about two minutes in the hive or tree. Of course, they will spend more time in a tree when they have to crawl a long distance to get to the brood-nest, hence we may deduce the rule: Subtract two from the number of minutes absent, and divide by ten. The quotient is the number of miles from the stand to the tree. (See GLEANINGS, 1887, page 431.) This applies to a partially wooded country. Perhaps in a clearing they could make better time. On a very windy day it takes them longer to make trips."

†The same writer says further: "It is a waste of time to look for the bee-tree, or to make cross-lines, until you get beyond the tree. When the bees fly back on the line, you may rest assured that you are beyond the tree. Move your last two stands closer together (lining the bees carefully), so that they are only ten or fifteen rods apart. Now, as you have bees flying from two directions into the tree you will probably discover where they are immediately. But if you fail to find them easily, take a stand off to one side, eight or ten rods, and cross-line. This is the only place that I find a cross-line of any advantage."—*See Gleanings in Bee Culture, Vol. XV., page 771.*

able one, and stands where timber is cheap and plentiful, perhaps the easiest way may be to cut it down. This may result in a mashed-up heap of ruins, with combs, honey, and bees all mixed up with dirt and rubbish, or it may fall so as to strike on the limbs or small trees, and thus ease its fall in such a way as to do very little injury to the hive of the forest. The chances are rather in favor of the former, and on many accounts it is safer to climb the tree and let the bee-hive down with a rope. If the hollow is in the body of the tree, or so situated that it can not be cut off above and below, the combs may be taken out and let down in a pail or basket; for the brood-combs, and such as contain but little honey, the basket will be rather preferable. The first thing, however, will be to climb the tree: and as I should be very sorry to give any advice in my A B C book that might in any way lead to loss of life, I will, at the outset, ask you not to attempt climbing unless you are, or can be, a very careful person. An old gentleman who has been out with us remarked that he once knew a very expert climber who took all the bees out of the trees for miles around, but was finally killed instantly, by letting his hands slip, as he was getting above a large knot in the tree. We do not wish to run any risks, where human life is at stake.

For climbing large trees, a pair of climbers are used, such as is shown in the cut below.



CLIMBERS FOR BEE-HUNTERS.

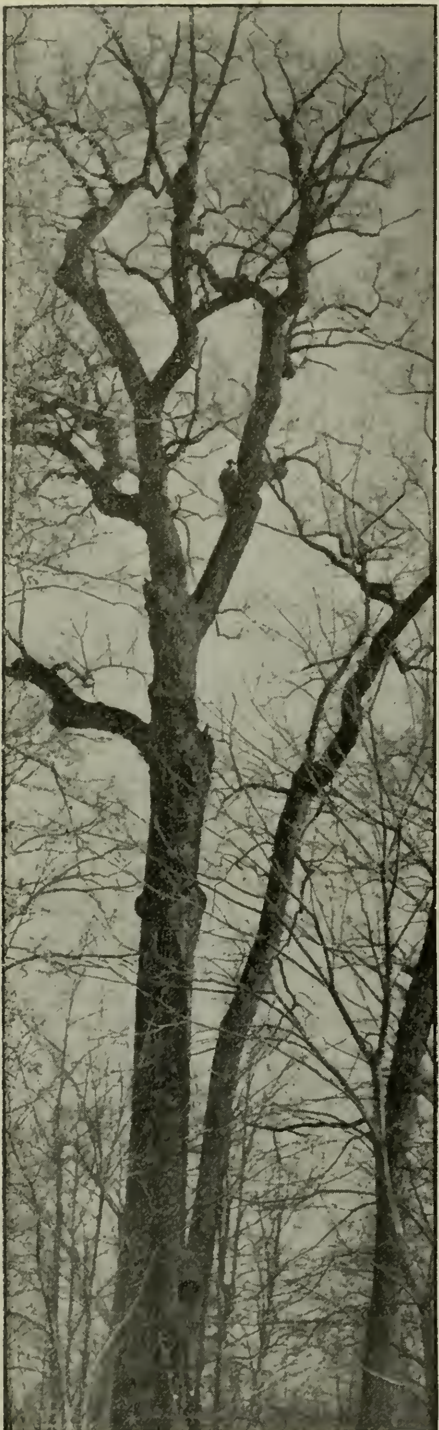
The iron part is made of a bar 18 inches long, ⅝ wide by ¼ thick. At the lower end it is bent to accommodate the foot as shown, and the spurs are made of the best steel, carefully and safely welded on. These points should be sharp, and somewhat chisel-shaped, that they may be struck safely into the wood of the tree; the straps will be readily understood by inspection. When in use, the ring A is slipped over the spur B, and the straps are both buckled up safely. If the tree is very large, the climber provides himself with a tough withe or whip, of some tough green bough, and bends this so it will go around the trunk, while an end is held in each hand. As he climbs upward, this is hitched up the trunk. If he keeps a sure and firm hold on this whip, and strikes his feet into the trunk firmly, he can go up the most forbidding trees, rapidly and safely. A light line, a clothes-line for instance, should be tied around his waist, that he may draw up such tools as he may need. The tools needed are a sharp ax, hatchet, saw, and an auger to bore in to see how far the hollow extends. If the bees are to be saved, the limb or tree should be cut off above the hollow, and allowed to fall. A stout rope may be then tied about the log hive, passed over some limb above, the end brought down and wrapped about a tree until the hive is cut off ready to lower. When it is down, let it stand an hour or two, or until sundown, when all the bees will have found and entered the hive. Cover the entrance with wire cloth, and take it home.

There are some trees, indeed, so large that it would be impossible to climb them with the implements already given. A very ingenious plan, however, has been put into execution by Mr. Green Derrington, of Poplar Bluff, Mo. I give his description in his own language, and together with it a reproduction from a photograph which he sent. He says:

I send you a photograph of a large poplar-tree, which I climbed by means of spikes and staples. To prevent the possibility of falling I put a belt under my arms. To this I attached two chains. At the end of each chain is a snap. My method of climbing is as follows: After ascending the ladder as far as I can go I drive into the side of the tree a large bridge spike, far enough into the wood to hold my weight. A little further up I drive another spike. In between the spikes I drive the first staple, and to this I attach the first chain by means of the snap, and ascend by the nails as far as the chain will allow me; I then drive another staple, and attach the other chain, and next loosen the lower snap. After driving in more spikes, I again ascend as high as the chain will allow me, and attach the other chain to another staple. In this manner I can make my ascent with perfect security.

The tree shown in the picture is 7 feet in diameter at the foot. If you will follow all along up the body of the tree, just above the crotch on the right limb you will see your humble servant, 88 feet from the ground. The tree stands close to the Black River, in a graveyard, and from it I obtained 59 lbs. of honey. Your climbers are excellent for small trees, say from two to three feet in diameter; but the tree illustrated has such a rough and uneven bark, and is so large, that it would be difficult to climb it without the aid of spikes and the staples I have mentioned. On account of the large knots it would be impossible to use a rope, or something similar, to hitch up by climbers, as described in the A B C book. Knots are not in my way when I use spikes and staples. GREEN DERRINGTON.

Poplar Bluff, Butler Co., Mo.



CLIMBING A BEE-TREE, 88 FEET FROM THE GROUND.

If you want only the honey, and do not care for the bees, you can slab off one side of the hollow, cut out the combs, and let them down in pails. The bees can very often be saved in this way, as well as the former. Fix the brood - combs about the right distance apart, in a pail or basket; the bees will in time collect about them, and may then, toward dark, be carried safely home. Many bee-hunters brimstone the bees; but I am so averse to any such method of killing bees, that I have not even the patience to describe it. Sometimes the hollow is below the limbs; in this case, the climber passes a surcingle about him, under his arms, around the tree, and in this position chops the bees out. I have said nothing about smoke or veils; for so far as my experience goes, none seem to be needed. The bees become so frightened by the chopping, that they are perfectly conquered, and cease entirely to act on the offensive. It may be well to have some smoking rotten wood near, and a bellows smoker would be very convenient to drive the bees out of the way, many times.

After you have got them down where the combs can be reached, the usual directions for transferring are to be followed. A bee-keeper who has a taste for rustic work, might set the log up in his apiary, just to show the contrast between the old style of bee-keeping and the new. Some very interesting facts are to be picked up in bee-hunting. One of the trees we once cut contained comb as much as a yard long, and not more than 8 inches wide in the widest part. It has been said, that bees in a state of nature select cavities best adapted to their needs. I am inclined to think this very poor reasoning. If a farmer allowed nature to take care of his corn-fields, he would get a very poor crop; and from what I have seen of bee-trees, I should judge the poor fellows need to be taken care of, almost as much as the corn. We often get 100 lbs. of comb honey from a hive, but I never knew a bee-tree to give any such amount, as the product of a single season. We sometimes find quite a quantity of honey in a tree, it is true; but it is usually old honey, and often the accumulation of several years.

There are more bees in the woods than we perhaps have any idea of, especially in the neighborhood of considerable apiaries. In one of my first trials at bee-hunting I started a fine line, directly toward the woods, but I looked in vain for bees, after going into them, and finally gave it up. A few days afterward I got an old hand at the business to hunt them up for me, and he almost at once pointed out a tree plainly visible from where they were baited, standing in the open lot. As the tree contained very thick old honey, it had probably stood there unnoticed for years, and yet it was in plain sight. The same hunter very soon found another, but a little distance from this one. And within a few days we had found two more in that same locality.[36]

DOES BEE-HUNTING PAY?

If you can earn a dollar per day at some steady employment, I do not think it would, as a rule; but there are doubtless localities where an expert would make it pay well, in the fall of the year. With the facilities we now have for rearing bees, a bee-keeper would stock an apiary much quicker by rearing the bees, than he would by bringing them home from the woods, and transferring. In the former case he would have nice straight combs, especially if he used foundation, but the combs from the woods would require a great amount of fussing with, and they would never be nearly as nice as those built on the foundation, even then. So much by way of discouragement. On the other hand, a ramble in the woods, such as bee-hunting furnishes, is one of the most healthful forms of recreation that I know of; and it gives one a chance to study, not only the habits of the bees, but the flowers as well; for in hunting for a bee to start with, we find many plants that are curious and many that we would not otherwise know they frequented. In some of our trips we were astonished to find the Simpson honey-plant, of which so much has been said in our back journals, growing in our own neighborhood, and we saw the bees drinking the sweet water out of the little hollow balls, or rather pitcher-shaped blossoms.

NEVER QUARREL ABOUT BEE-TREES.

When you have found your tree, go at once to the owner of the land, and get permission to take your bees. No matter what the law allows, do nothing in his absence you would not do if he were standing by, and do your work with as clear a conscience as you would work in your own bee-yard. Many quarrels and disagreements and much hard feeling have been engendered by cutting bee-trees. If I am correctly informed, bees are the property of whoever finds them first; and on this account it is customary to cut the initials of the finder, with the date, in the body of the tree; but you have no more right to cut the owner's timber without permission than you have to cut his corn. I have never found any one inclined to withhold consent, when they were politely *asked* for permission to get our bees out of the trees. I do not wonder that people feel cross when their timber is mutilated by roving idlers, and I can scarcely blame them for giving a wholesome lesson now and then just to remind us that we have laws in our country for their protection. I hope my readers will have no disposition to trespass on the premises or rights of any one, without permission. The most difficult and particular person in your neighborhood will, in all probability, be found pleasant and accommodating, if you go to him in a pleasant and neighborly way.

BEE-MOTH. It is very likely that the moth-worm is, as has been so often stated, the worst enemy the honey-bee has — if we except ignorant bee-keepers—but if such is the case, we can consider ourselves very fortunate, for the moth is almost no enemy at all, to one who is well posted and up with the times. When you hear a person complaining that the moth-worm killed his bees, you can set him down at once as knowing very little about bees; and if a hive is offered you that has an attachment or trap to catch or kill moths, you can set the vender down as a vagabond and swindler. You can scarcely plead ignorance for *him;* for a man who will take upon himself the responsibility of introducing hives, without knowing something of our modern books and bee-journals, should receive treatment sufficiently rough to send him home, or into some business he understands.

When a colony gets weakened so much that it can not cover and protect its combs, robbers and moth-worms help themselves as a natural consequence, but either rarely does any harm if there are plenty of bees, and a clean tight hive. If a hive is so made that there are crevices which will admit a worm, and not allow a bee to go after him, it may make some trouble in almost any colony; and I can not remember that I ever saw a patented moth-proof hive that was not much worse in this respect than a plain simple box hive. A plain simple box is, in fact, all we want for a hive; but as we must have the combs removable, we must have frames to hold them; and if these frames are made so that bees can get all round and about them, we have done all we can to make a moth-proof hive.

Of course, colonies will at times get weakened; and with the best of care, with the common bees especially, worms will sometimes be found in the combs. Now if you have the simple hive I shall recommend, you can very quickly take out the combs, and with the point of your knife remove every web and worm, scrape off the debris, and assist the bees very much. If there is an accumulation of filth on the bottom-board, lift out all the combs, and brush it all off, and be sure you crush all the worms in this filth, for they will crawl right back into the hive, if carelessly thrown on the ground.

If you keep only Italians, or even all hybrids, you may go over a hundred colonies and not find a single trace of a moth-worm. At the very low price at which Italian queens are now to be purchased, it would seem that we are very soon to forget that a bee-moth ever existed;[37] and the readiest way I know of to get combs that are badly infested, free from worms, is to hang them, one at a time, in the center of a full hive of Italians. You will find all the webs and worms strewed around the entrance of the hive, in a couple of hours, and the comb cleaned up nicer than you could do it, if you were to sit down all day to the task.

HOW TO KEEP EMPTY COMBS SECURE FROM THE MOTH WORMS.

If you have Italians only, you may have no trouble at all, without using any precaution; but if there are black bees around you, kept in the old-fashioned way, or in patent hives, you will be very apt to have trouble, unless you are careful. Suppose, for instance, you take a comb away from the bees during the summer months, and leave it in your honey-house several days; if the weather is warm, you may find it literally infested with small worms, and in a few days more the comb will be entirely destroyed. Combs partly filled with pollen seem to be the especial preference of these greedy, filthy-looking pests, and I have sometimes thought they would do but little harm, were it not for the pollen they find to feed on. A few years ago we used to have the same trouble with comb honey when taken from the hive during the early part of the season; but of late we have had less and less of it; and during late years I have scarcely seen a moth-worm in our comb honey at all, and we have not once fumigated our honey-house. I ascribe it to the increase of the Italians in our own apiary, and those all about us, for the greater part of the bees in the woods are now partly Italian. These have driven the moth before them to such an extent that they bid fair to soon become extinct. Perhaps much has been also done, by keeping all bits of comb out of their way; no rubbish that would harbor them has been allowed to accumulate about the apiary; and as soon as any filth has been found containing them, it has been promptly burned. Those who take comb honey from hives of common bees are almost sure to find live worms in them, sooner or later.

How do the worms get into a box of honey that is pasted up tightly, just as soon as the bees are driven out? I presume they get in just as they get into the comb taken from a hive during warm weather. The moth has doubtless been all through the hive, for she can go where a bee can, and has laid the eggs in every comb, trusting to the young worms to evade the bees by some means after they are hatched. This explanation, I am well aware, seems rather unreasonable, but it is the only one I can give. In looking over hives of common bees, I have often seen moths dart like lightning from crevices, and have sometimes seen them dart among the bees and out again; but whether they can deposit an egg so quickly as this, I am unable to say. In taking combs from the hive containing queen-cells to be used in the lamp nursery, I have always had more or less trouble with these moth-worms. The high temperature, and absence of bees, are very favorable to their hatching and growth, and after about three days the worms are invariably found spinning their webs. If they are promptly picked out, for about a week, no more make their appearance, showing clearly that the eggs were deposited in the combs, while in the hive.

When the queen-cells are nearly ready to hatch, I often hear the queens gnawing out, by holding the comb close to my ear. By the same means, I hear moth-worms eating out their galleries along the comb; and more than once I have mistaken them for queens. They are voracious eaters, and the "chanking" they make, when at full work, reminds one of a lot of hogs. As they are easily frightened, you must lift the combs with great care, to either see or hear them at their work.

Their silken galleries are often constructed right through a comb of sealed brood, and they then make murderous work with the unhatched bees. Perhaps a single worm will mutilate a score of bees before he is dislodged. These are generally found at the entrance of the hive in the morning, and numerous letters have been received from beginners, asking why their bees should tear the unhatched brood out of the combs, and carry it out of the hives. I presume the moth is at the bottom of all, or nearly all, of these complaints. If you examine the capped brood carefully, you will see light streaks across the combs where these silken galleries are; and a pin or a knife-point will quickly pry his wormship out of his retreat. As the young worms travel very rapidly, it is quite likely that the eggs may have been deposited on the frame or edges of the comb. It is a little more difficult to understand how they get into a honey-box with only a small opening, but I think it is done by the moth while on the hive.

You may, perhaps, have noticed that the moth-webs are usually seen from one comb to another, and they seldom do very much mischief unless there are two or more combs side by side. Well, if in putting away your surplus combs for winter you place them two inches or more apart, you will seldom have any trouble, even should you leave them undisturbed until the next July. There is no danger from worms, in any case, in the fall, winter, or spring, for the worms can not develop unless they have a summer temperature, although they will live a long time in a dormant state if not killed by severe freezing weather. I have kept combs in my barn two years or more; but they were not removed from the hives until fall, and were kept during the summer months in a close box, where no moth could possibly get at them. I have several times had worms get among them when I was so careless as to leave them exposed during warm weather, and one season I found nearly 1000 combs so badly infested that they would have been almost worthless in less than a week. The combs were all hung up in the honey-house, and then about a pound of brimstone was thrown on a shovel of coals in an old kettle. This was placed in the room, and all doors and windows carefully closed. Next morning I found most of the worms dead; but a few that were encased in heavy webs were still alive; after another and more severe fumigation, not a live one was to be found, and my combs were saved. I have several times since fumigated honey in boxes in the same way. The following extract from Burt's *Materia Medica* may contain some hints as valuable to apiarists as to doctors.

In the form of *sulphurous-acid fumes*, or gas, sulphur is the most powerful of all known agents as a disinfectant and deodorizer. To disinfect a room and clothing from infectious diseases, as smallpox, etc., first close up the chimney, and paste up all crevices of the windows and doors to prevent the escape of gas. Now raise up all carpets, and hang up the cloths, so that the fumes of gas may have complete access to them. When this is done, set a tub in the center of the room with six inches of water in it; in the center of this water place a stone that comes just above the water; on this stone set an iron vessel with two pounds of sulphur broken up into quite fine pieces or lumps; on this pour a few ounces of alcohol, to make the sulphur burn readily; set the alcohol on fire, and leave the room, closing the door behind you. It is well to repeat this fumigation three or four times.

After the bees have died in a hive, it should never be left exposed to robbers and moths, but should be carried indoors at once, or carefully closed up. If you have not bees either by artificial or natural swarming, to use the combs before warm weather you should keep a careful watch over them, for a great amount of mischief may be done in a very few days. I once removed some combs, heavy with honey, in August, and thinking no worms would get into them so late, I delayed looking at them. A month later, the honey began to run out on the floor; and upon attempting to lift out a comb, it was found impossible to do so. When all were lifted up at once, a mass of webs nearly as large as one's head was found, in place of the honey and combs. So much for not keeping a careful watch of such property.

HOW TO KEEP EMPTY COMBS.

When combs are left in spring, after the death of the bees in a hive, there is no safer place to put them than in the care of a good strong colony. Brush off the dead bees and put the combs in a clean hive on the stand of a strong colony, and then place the colony *over* this hive of empty combs, so that they will be obliged to pass through the hive of combs to go in or out. In other words, give the bees no entrance, except that of the lower hive, allowing free communication between the two. The combs will be kept free from worms and mold, with no care whatever on your part, except to keep the entrance so small for two or three days at first that robbers shall not trouble.

After the weather has become warm, three or four stories of empty combs may be piled on the top of a hive containing a colony, with a queen-excluder between, and a frame of brood in the upper story to make sure that the bees traverse all the combs.

By way of summing up, I would say: Use plain, simple, unpatented hives; get Italians as soon as you can; keep your colonies strong; be sure that none of them by any means become queenless, and you need have no solicitude in regard to the bee-moth among your bees. If you have spare combs, or comb honey that has been taken away from the bees in warm weather, keep an eye on it, and either destroy the worms as soon as they appear, or fumigate them as I have directed. When your eye has become trained, you will detect the very first appearance of a worm by its excrement, in the shape of a fine white powder. We sometimes hunt them out thus and destroy them, when they are so small as to be only just visible to the naked eye. Giving your combs a good freeze, say a temperature of 15 or 20°, will answer the same purpose as the fumigation.

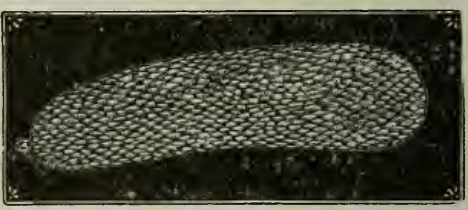
BEES. Everybody knows what bees are, I suppose, and therefore I need not attempt to give you a picture of them. If you contemplate becoming a bee-keeper, I would advise you to get a hive of them, and then to use your own eyes and ears, to see if what I tell you about them is true. There are several varieties of bees, the two most common being the black, or brown bees (indigenous to this country),[39] and the Italians, natives of Italy. The general characteristics of the blacks are described under HYBRIDS, which see. The Italians, combining as they do so many excellent traits with so few faults, have deservedly the pre-eminence over all other races, and this pre-eminence has been held ever since their introduction, early in the '60's. The Carniolans, evidently a variety of black bees, and which they very much resemble, were introduced into this country in 1884, or thereabouts. They are said to be very gentle; but the few colonies of them that we have tried are no more so than the average Italians, and in one case in particular they were more vindictive than the Cyprians. As stated, they resemble blacks, and might easily be mistaken for them; but there is a difference. They are larger, and their abdomens are more of a bluish cast, the fuzzy rings being very distinct. They are gentler, as a rule, and do not, like the blacks, boil over in confusion when the hive is opened, although one of our Carniolan colonies did this very thing. They have not the fixity of character of the Italians—colonies of the same race differing quite widely. The general verdict is, that they are excessive swarmers, and this trait alone makes them very undesirable. Their close resemblance to black bees makes it impossible to detect the crosses of the two races. This fact, coupled with their great swarming propensity, will largely prevent their meeting with general favor.[40]

The Egyptians have been tried in our country to some extent, but are, I believe, inferior to the Italians, besides being much more vindictive. Bees from the island of Cyprus and from the Holy Land are mentioned in connection with ITALIAN BEES, which see. Albino bees have also been talked about; but after testing them in my own apiary, I find them little different from the common Italians. The fringe, or down, that appears on the rings of the abdomen of young bees is a trifle whiter than usual, but no one would observe it unless his attention were called to it. The queens are very yellow, but the workers, as honey-gatherers, are decidedly inferior, even to the second generation; and when we select light-colored bees or queens for several successive generations, if we are not careful we shall have a worker progeny lacking as honey-gatherers, and in ability to endure. By selection, we can get almost any thing we want, and that quite speedily with bees, for we can produce several generations in a single season, if need be.

It is said in the South, that they have two varieties of the common or black bee, but it is quite likely they are one and the same thing, for bees in the same neighborhood vary much in color; the bees of one colony may be almost a brown, while in another they are almost black. I shall speak, in this book, of but two kinds in particular — the black, or common, and the Italian.

HOW BEES GROW.

During warm weather, while your bees are gathering honey, open your hive in the middle of the day, and put in the center a frame containing a sheet of fdn.; examine it every night, morning and noon, until you see eggs in the cells. If you put it between



A QUEEN'S EGG UNDER THE MICROSCOPE.

two combs containing brood, you will very likely find eggs in the cells the next day.

If you have never seen an egg that is to produce a bee, you may have to look very sharp the first time, for they are white like polished ivory, and scarcely larger than one of the periods in this print. They will be seen in the center of the cell attached to the comb by one end. The egg under the microscope has much the appearance of the cut. It is covered, as you notice, with a sort of lace-like penciling, or net-work, it might properly be called. As soon as you discover eggs, mark down the date. If the weather is favorable, these eggs will hatch out in about 3 days or a little more; and in place of the egg, you will, if you look sharp enough, see a tiny white worm or grub floating in a minute drop of milky fluid. If you watch the bees you will find them incessantly poking their heads into these cells, and it is likely that the milky fluid is placed on and about the egg, a little before the inmate breaks its way out of the shell. I infer this, because I have never been able to get the eggs to hatch when taken away from the bees,* although I have carefully kept the temperature at the same point as in the hive. The net-work shown in the cut above will allow the milky fluid to penetrate the shell of the egg so as to furnish nourishment for the young bee at just the time it requires it. These worms are really the young bee in its larval state, and we shall in future call them larvæ. They thrive and grow very rapidly on their bread-and-milk diet, as you will see if you look at them often. They will more than double in size in a single half-day, and in the short space of 12 days they will have grown from a mere speck (the larva just hatched) to the size of a full-grown bee, or so as to completely fill the cell. This seems almost incredible, but there they are, right before your eyes. I presume it is owing to the highly concentrated nature of this same "bread-and-milk" food that the workers are so constantly giving them, that they grow so rapidly. If you take the comb away from the bees for a little while you will see the larvæ opening their mouths to be fed, like a nest of young birds, for all the world.

The figures underneath represent the age in days from the laying of the egg. First is the larva just as it has broken the egg-shell on the third day; next, the larva on the fourth day. During the fifth and sixth days they grow very rapidly, but it is difficult to fix any precise mark in regard to the size. On the ninth day the larva has straightened himself out, and the worker-bees have capped him over. I have made a pretty accurate exper-

3 4 5 6 9 12 15

THE DAILY GROWTH OF LARVÆ.

iment on this point, and it was just six days and seven hours after the first egg hatched, when they got it completely capped over. Just when they begin to have legs and eyes, I have not discovered; but I have found that the wings are about the last of the work.

In regard to this point Frank Cheshire, in his work on "Bees and Bee-Keeping," says:

> The chorion of the egg breaks, usually after three days (the time varies according to temperature), and a footless larva, with thirteen segments, exclusive of the head, alternately straightens and bends its body to free itself of the envelope. It is extremely curious that, before hatching, the larva presents rudimentary legs, which disappear—a fact which some have supposed to indicate (atavism) a reference to an ancestral type in which the larva bore feet; but this does not seem to be valid, for reasons which would encroach too much on our space. Toward the end of the larval period, the three segments following the head have little scales beneath the skin on the ventral side, which are the beginnings of the legs, and which can not be seen until the creature has been immersed in alcohol; the budding wings outside these, on second and third segments, are, by the same treatment, brought under view, as are also the rudiments of the sting in queen or worker larvæ, the male organs appearing in that of the drone. After sealing, the fourth segment begins to contract, and the fifth becomes partly atrophied, so that, soon, the former constitutes only a partial cover for the base of the developing thorax, and the petiole between it and the abdomen, while the latter becomes the narrow, first abdominal segment. It has been explained that the last three segments disappear in forming the sting; and now we find the fourth forming the petiole, leaving nine of the thirteen original segments, of which three go to the thorax, and six to the abdomen.

After the larvæ are 6 days old, or between 9 and 10 days from the time when the egg was laid, you will find the bees sealing up some of the largest. This sealing is done with a sort of paper-like substance; and while it shuts the young bee up, it still allows him a chance to breathe through the pores of the capping. He is given his last feed, and the nurses seem to say, "There! you have been fed enough; spin your cocoon, and take care of yourself."

After this, as a general thing, the young bee is left covered up until he gnaws off the capping, and comes out a perfect bee. This will be in about 21 days from the day the egg was laid, or it may be 20, if the weather is very favorable; therefore he is shut up 11 or 12 days. Now, there is an exception to this last statement, and it has caused not a little

* Since this was written it has been proven that eggs, removed from the hive, when subjected to proper temperature will hatch if supplied artificially with the milky food; otherwise, not.

trouble and solicitude on the part of beginners. During very warm summer weather, the bees, for one reason or another, decide to let a part of their children go "bareheaded," and therefore we find, on opening a hive, whole patches of young bees looking like silent corpses with their white heads in tiers just about on a level with the comb. At this stage of growth they are motionless, of course, and so the young bee-keeper sends us a postal card, telling us the brood in his hives is all dead. Some have imagined that the extractor killed them, others that it was *foul brood;* and I often think, when reading these letters, of the family which moved from the city into the country; when their beans began to come up, they thought the poor things had made a mistake, by coming up wrong end first; so they pulled them all up, and replanted them with the bean part in the ground, leaving the proper roots sprawling up in the air. My friend, you can rest assured that the bees almost always know when it is safe to let the children's heads go uncovered.

As it is, many times, very important to know just when a queen was lost, or when a colony swarmed, you should learn these data thoroughly; for instance, it will be safe to say, 3 days in the egg, 6 in the larva, and 12 days sealed up.

The capping of the worker-brood is nearly flat; that of the drones, raised or convex; so much so that we can at a glance tell when drones are reared in worker-cells, as is sometimes the case.

The young bee, when he gnaws his way out of the cell, commences to rub his nose, straighten out his feathers, and then to push his way among the busy throng, doubtless rejoicing that he, too, is one of that vast commonwealth. Nobody says a word to him, or, apparently, takes any notice of him; but for all that, they, as a whole, I am well convinced, feel encouraged, and rejoice in their way, at a house full of young folks. Keep a colony without young bees for a time, and you will see a new energy infused into all hands, just as soon as young bees begin to gnaw out.

If you vary your experiment by putting a frame of Italian eggs into a colony of common bees, you will be better able to follow the young bee as it matures. The first day he does little but crawl round; but about the next day he will be found dipping greedily into the cells of unsealed honey, and so on for a week or more; after about the first day he will also begin to look after the wants of the unsealed larvæ, and will very soon assist in furnishing the milky food for them. While doing this, a large amount of pollen is used, and it is supposed that this larvæ food is pollen and honey, partially digested by the young or nursing bees. Bees of this age, or a little older, supply the royal jelly for the queen-cells, which is the same, I think, as the food given the very small larvæ.[42] Just before the larvæ for the worker-bees and drones are sealed up, they are fed on a coarser and less perfectly digested mixture of honey and pollen. The young bees will have a white downy look, until they are a full week old, and they have a peculiar look that shows them to be young until they are quite two weeks old. At about this latter age they are generally the active comb-builders of the hive. When they are a week or 10 days old, they will take their first flight out of doors, and I know of no prettier sight in the apiary than a host of young Italians taking their play-spell in the open air, in front of their hive; their antics and gambols remind one of a lot of young lambs at play.

It is also very interesting to see these little chaps when they bring their first load of pollen from the fields. If there are plenty of bees in the hive, of the proper age, they will not usually take up this work until about two weeks old. The first load of pollen is to a young bee just about what the first pair of pants is to a boy-baby. Instead of going straight into the hive with his load, as the veterans do, a vast amount of circling round the entrance must be done; and even after he has once alighted he takes wing again, rushes all through the hive, jostles the nurses, drones, and perhaps queen too, and says as plainly as could words, "Look here! This is I. I gathered this, all myself. Is it not nice?"[43]

We might imagine some old veteran who has brought thousands of such loads, answering gruffly, "Well, suppose you did; what of it? You had better put it in a cell, and start off after more, instead of making all this row and wasting time, when there are so many mouths to feed." I said we might imagine this, for I have never been able to find any indication of any unkindness inside of a bee-hive. No one scolds or finds fault, and the children are never driven off to work, unless they wish. If they are improvident, and starvation comes, they all starve alike, and, as I do believe, without a single hard feeling or bit of censure toward any one. They all work together, just as your right hand assists your left; and if we would understand the economy of the bee-hive, it were well to bear this point in mind.

Shortly after the impulse for pollen-gathering, comes that for honey-gathering; and the bee is probably in his prime, as a worker, when he is a month old. At this age he can, like a man of 40, "turn his hand" to almost any of the duties of the hive; but if the hive is well supplied with workers of all ages, he would probably do most effective service in the fields. See AGE OF BEES.

If a colony is formed of young bees entirely, they will sometimes go out into the fields for pollen when but 5 or 6 days old. Also when a colony is formed wholly of adult bees, they will build comb, feed the larvæ, construct queen-cells, and do the work generally that is usually done by the younger bees, but it is probably better economy to have bees of all ages in the hive.

BEES ON SHARES. There are cases, doubtless, where it is advantageous to both parties to let bees out on shares; but as a general thing I would advise owning your bees, even though it be but a single colony, before you commence to build up an apiary. It almost always happens that one of the parties is dissatisfied; and, as is frequently the case with such partnership arrangements, both the parties have been wronged, to hear their story for it.

KEEPING BEES ON SHARES.

I believe it is customary for one of the partners to furnish the bees, and the other to do the work; at the end of the season, every thing is divided equally. If new hives, Italian queens, etc., are to be used, the expense is equally divided. The division of stock is usually made as soon as the honey season is over, and each party takes his chances of wintering. To prevent any misunderstanding, I would advise that the whole agreement be put in writing, and that whenever something turns up for which no provision has been made, some agreement be made in regard to it, and that this be put in writing also. Instead of inquiring what other folks do, arrange the matter just as *you* can agree, and make up your minds in the outset that you are going to remain good friends, even if it costs all the bees and your whole summer's work. Don't let it turn out as shown in the cut.

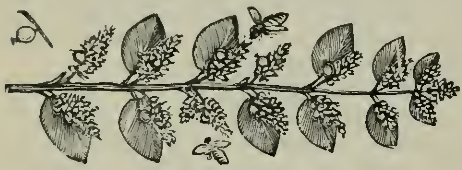
BLUE THISTLE (*Echium vulgare*). If I am correct, this plant is not a thistle at all, but more properly a near relative of the borage, which it closely resembles. It grows in great profusion in many of the Southern and Middle States, but the principal reports seem to come from Virginia, and the valley of the Shenandoah. As it blossoms fully four months in the year, and produces a beautiful white honey, it would seem that it might well deserve a place among the plants on a honey-farm. If we are correct, it needs but little coaxing to cover whole farms; and in Va., we are told there are hundreds of acres of it growing wild, as a weed. Over 200 lbs. of white box honey have been reported from it, from a single colony, in one summer. A field of blue is no doubt a very pretty sight to the bee-keeper; but to the farmers, who find it a great pest, it may not look so handsome. We have really no right to make our honey-farm a nuisance to the neighborhood, by bringing in foul weeds; so perhaps you had better take your bees down where it grows, instead of sending for seeds.

Later.—Recent reports indicate that it is no worse a weed than the borage. It dies root and branch every fall, and is therefore entirely unlike the dreaded Canada thistle.

BORAGE (*Borago Officinalis*). This has been at different times recommended for bees, but as those making the experiment of planting several acres of it did not repeat it in succeeding years, I think we are justified in concluding it did not pay. I have raised it in our garden, and some seasons the bees seem very busy on it. It has a small blue blossom, and grows so rapidly that a fine mass of bloom may be secured by simply planting the seeds on the ground where you dig your early potatoes. If it is to be raised by the acre, it should be sown at about the same time and much in the same manner as corn, in hills or broadcast.

In 1879 I had a half-acre of it. It was moderately covered with bees for many weeks, but was much inferior to the Simpson honey-plant.

BUCKBUSH (*Symphoricarpus vulgaris*). This bush is sent in every season as a wonderful honey-bearing plant, although on our hands it has not amounted, as yet, to very much. It is nearly allied to the snowdrop, which it resembles, only the berries are small and red, instead of white. It is sometimes called the "coral-berry," from its looks. Its



BUCKBUSH.

botanical name comes from the fact that *sym* means *together*, or crowded. *Pherein* means to *bear*, or carry, and *carpus* means *fruit;* so that the name means, we might say, "bearing fruits crowded together." I believe it is usually found in the woods, and in some localities is reported to furnish some very nice honey. I do not know that very much is done in the way of cultivating it for honey. The common snowdrop (*Symphoricarpus racemosus*) sometimes bears considerable honey, but probably not as much as buckbush.

BUCKWHEAT. In many localities buckwheat is the great staple for artificial pasturage; and I don't know but that it might be ranked next to the clovers in almost every locality, were it not for the fact that every now and then it fails to yield honey.[44] I believe, however, that a yield of grain is almost always accompanied by more or less honey. The fact that the grain usually pays a good profit, aside from the honey, makes it one of the most promising plants for artificial pasturage known. In our locality there can be no honey nor any crop of grain, without good soil; and if it is not so naturally, it must be made good by barnyard manure, or by the use of phosphates, bone-dust, guano, or similar fertilizers. Very likely the profits of the grain will seldom pay for such expensive manures as guano; but it is, I think, worth while to *test* phosphate, bone-dust, guano, and other similar fertilizers, in every one's locality.

In raising the grain for seed, as many bee-keepers do, it will, no doubt, pay to get the ground in excellent order. The best crop of grain we ever made was by plowing under a heavy growth of red clover; and I believe that such a course will give a crop of almost any thing. We also received considerable honey. The variety used is what is called the "gray" buckwheat. Under the influence of the clover and abundant rains, the crop was fairly ripened in just 65 days after sowing; and as it was not sown till the 15th day of August, our experiment shows that, under favorable circumstances, buckwheat is a very speedy crop. Buckwheat is largely used in most localities for enriching the soil. Several prominent writers recommend plowing in two or even three crops of buckwheat, one after another, when you are short of manure, and yet wish to get your ground into a high state of cultivation. Buckwheat does not do well during severe hot weather in the summer, therefore in our locality it does not pay to sow it before the middle of July. For the same reason it can not well be raised early in the spring. Unless we have unusually cool weather for the time of year, the hot weather during the blooming time will prevent it from filling out.

Buckwheat sometimes yields honey and grain when sown early in the spring; but these cases are exceptional. The seed remains in the ground all winter without injury, and comes up quite early in the spring, therefore it may be quite a troublesome weed if the seed is allowed to rattle off so as to seed the ground while harvesting.

As a rule, buckwheat furnishes honey only early in the morning; and bees seldom notice it at all after about eleven o'clock in the forenoon. I have, however, seen exceptions to this. A young friend, living about twenty miles distant, on sandy soil (ours being rather heavy clay), informed me that he had a field of buckwheat that yielded honey all day long. It was so contrary to my experience that I paid him a visit, and actually found the bees humming busily on the blossoms during the middle of the afternoon. An examination of his hives showed brood-raising and comb-building going on rapidly under the influence of the dark honey which sparkled from the cells all through the hives. In our locality, during buckwheat time we often have the bees so busily employed during the forenoon that there is as little danger of robbing, as during clover or basswood time, while in the afternoon they act crazy for any chance to push their way into the hives and steal. The quality of the honey from buckwheat is generally pronounced poor. It is dark in color and rank in taste, especially when first gathered. Some specimens, however, that are thoroughly ripened in a hive containing a large strong colony, become mellow and delicious to the taste: this, however, is rather an exception, although there are individuals in almost any community who prefer buckwheat honey to any other kind. As a rule, however, when clover and basswood honey is bringing from 15 to 20 cents, buckwheat sells from 12 to 14. A commission man in Albany, N.Y., said, in Jan., 1887, that he worked up an immense trade on buckwheat honey by having it stored in sections holding about three-fourths of a pound each. He got up a boom on them by selling them for an even dime. The

JAPANESE BUCKWHEAT.

sections were rather thin, so that each customer had a nice-looking cake of honey for his ten cents. This commission man said he would rather have buckwheat honey for his trade than any other; but he afterward admitted, that the principal reason was because he could give a bigger slice for a dime than he could of either clover or basswood.

DIFFERENT VARIETIES OF BUCKWHEAT.

When I first began learning my A B C in bee culture there was only one kind of buckwheat known. About the year 1877, however, the silverhull made quite a stir among bee-men. It was really somewhat superior, on account of the extra weight of the grain, as well as the larger yield per acre, and it was thought to furnish more honey than the common. At the same time, what is called the gray buckwheat made its appearance; but I soon became satisfied that there was no material difference between the gray and the silverhull.

In 1885, Peter Henderson and other seedsmen advertised a new variety which they called the European silverhull. This differed from our former grains by the small size of the kernel. The little seeds were very plump and heavy. Reports seemed to be rather conflicting as to its value, some thinking it greatly superior; others to the effect that, all things considered, it was of no particular advantage.

In the spring of 1887, Peter Henderson gave glowing accounts of a new variety called the "Japanese." This, while it was black in color, like the old common buckwheat, showed a marked superiority in the size of the grain, which at once attracted great attention. On preceding page we give our readers a cut of the plant as it appeared in Henderson's catalogue.

During the season of 1887 we sold something like forty bushels of this new variety of buckwheat, the greater part of it to be used in small quantities for testing the new grain. During the last three months of 1887 we received reports of this buckwheat from 40 individuals. Now, although we especially called for unfavorable as well as favorable tests, the report as a whole places it far ahead of any thing ever before known in the line of buckwheat. Different experimenters report receiving from 862 to 1275 kernels from a single stalk. Now, if it were possible to make each single stalk in a field give any thing like the yield mentioned above, the yield per acre would be enormous. In fact, we have had reports of its yielding at the rate of 80 bushels per acre. It is my impression, that, by studying the habits of the plant, and by properly preparing the ground, we may yet succeed in doubling even this yield; and I don't know of any more promising field for experiments for a bee-keeper than in developing buckwheat up to its best. My experience indicates that, while we do this, we shall secure wonderful results, also, in the yield of honey. With the experience I have had in cultivating the plant for honey, I think if I were going to start a honey-farm I would sow nearly or quite half of it in buckwheat, and alsike clover would certainly occupy a very great part of the other half. There is this in favor of buckwheat: We can easily get two crops of seed in a season; and where we wish to get blossoms for bees, it is not at all difficult to get even three crops of blossoms on the same ground. Very likely, however, the bees would not work on the first crop, for it would come out simultaneously with clover and basswood. Another thing greatly in its favor is, that if it is cut off in the fall by an untimely frost it is usually worth all the crop cost, for fertilizing the ground; but it should be plowed under promptly, just as soon as the frost nips it. Plow it under before the frost has wilted it, if you can.

About three pecks of seed, as a rule, are required per acre; and although the Japanese seed is much larger than the common seed, I would not give it any heavier seeding, for the reason this variety branches out more than the common, and I am not sure but that half a bushel per acre would give more grain than the larger amount. We sow it with a seed-drill having a phosphate-sower combined. We prefer to sow from 200 to 400 lbs. of phosphate per acre. Excellent crops are sometimes raised where the ground has been planted to corn that has been injured by floods, cut-worms, or something of that sort.

Dec. 1, 1889.—Another year's experience with Japanese buckwheat places it so much ahead of every thing else in the buckwheat line that other varieties will, without question, be dropped and set aside. During the past season we have sold for seed something like 500 bushels of the Japanese, at a price ranging from $1.50 to $2.00 per bushel, according to the quantity of the purchase. When the new crop came in, we thought it would be safe to offer a dollar a bushel. After we had bought over 100 bushels, however, the amount of seed offered was so great that we lowered our price to 90 cts., then to 75, then to 60, and just now we dare not offer over 50 cts. a bushel, the crop is so great. This all comes about from the introduction of the new variety. Not only bee-keepers, but farmers in general, can unite in giving a vote of thanks to our enterprising seedsman Peter Henderson for having given us this wonderful improvement over all the old kinds of buckwheat. The yield in some cases has run as high as 40 or 50 bushels per acre, in fields of 40 or 50 acres. It has been suggested, that farmers would cease trying to raise it if the price remains so low as only 50 cts. per bushel. To this I reply, "Not so, if it should continue to give the enormous yields per acre it has been giving for the last two years." Another thing to be considered, which is greatly in favor of Japanese buckwheat, is that it may be taken from the ground in so short a time that it frequently costs comparatively nothing. During the past season we have published a little pamphlet entitled "Buckwheat: All about It, and How to Grow It." In this pamphlet Mr. J. H. Kennedy, of Quenemo, Ottawa Co., Kansas, tells us of a crop of 116 bushels of

Japanese buckwheat that cost him next to nothing. After turning under his oat-stubble in July, as it was too early to put in wheat he sowed the ground with a drill, to buckwheat. The buckwheat came off so quick that the ground was apparently in almost as good a condition for sowing wheat as it was when first prepared. He therefore put the wheat-drill right on to the buckwheat-stubble, and he reports the next season, April 25, that the wheat put on the *buckwheat stubble* looks exactly as well as the rest of the 20 acres. He has not made us any report in regard to the yield of the wheat after it was harvested. Now, this is something wonderful. Some will urge that such a course—that is, such heavy and continual cropping—will soon exhaust the soil. I am inclined to think, however, that a plant so different in its habits from wheat would take little if any thing from the soil that the wheat needs; and it is a common remark, that nothing fits the ground so nicely for a succeeding crop as buckwheat.

Some years ago, we had quite a crop of buckwheat honey from a piece prepared for and planted with corn. The corn was so nearly killed by cut-worms that it was harrowed over nicely and sown to buckwheat in the latter part of June. This is almost a month earlier than buckwheat is usually sown here, but the yield was such that, from the two acres, we had at least 200 lbs. of comb honey, besides the large amount that must have gone into the brood-apartments.

The bees that gathered the largest part of this were dark hybrids; the pure Italians were at the same time storing white honey from red clover. It was amusing to see hives side by side both working in the section boxes, one of which made white combs and honey, like that in June, while the other built combs of a golden yellow, and stored it with the dark rich-looking buckwheat honey. As the hybrids gave quite a large crop of this dark honey, I began to be a little partial to them; but after the boxes were all removed, I found they had put it all above, and left their brood-apartment almost empty, while the more prudent Italians had filled the brood-combs until they were in excellent condition for winter. It has been several times advanced, that the blacks and hybrids are ahead, when nothing but buckwheat honey is to be found in the fields.

BUYING AND SELLING BEES. With every A B C scholar who wishes to commence, or at least make a trial, with bees, the question naturally arises, "How shall I proceed to get a start?" Before I can answer the question fully, I should want to know something about you personally. To one who has very little money to spare, and expects to keep bees for the money they will furnish, as well as for pleasure, I would give a little different advice from what I would to some professional man who wants them as an ornament to his grounds, and who has more money than time. The latter, I should probably advise to purchase a colony or two of pure Italians, in a chaff or lawn hive, with all the section boxes, etc., ready for the bees to go right to work. If, on the other hand, you want the bees principally to fill up your spare moments, and wish to commence with the least possible expense, I would advise you to purchase one or two hives of common bees in your own neighborhood, and do all the rest yourself. You can get them at almost any season of the year you choose, and, if you are in the mood, I should say the sooner you get them the better. If you can choose from a number of stocks, take those having the greatest amount of bees and stores, other things being equal 353 If you can turn the hive up so as to examine the combs, smoking the bees a little to make them get out of the way, choose one having straight, regular cards of comb, for it will be much easier to transfer. I would not purchase more than two or three colonies to commence with. When you have learned to handle these few to your satisfaction, it will be time enough to think of more; and two colonies can be made to build up a large apiary, of themselves, if you manage them according to the latest methods. For directions in regard to moving them home, see MOVING BEES. As to price to be paid, I would suggest that you should not pay for common bees in box hives more than about $2.00 or $3.00 in the fall or early winter, and perhaps $4.00 or $5.00 in the spring or summer. Do not pay one cent more for bees in any kind of patent hives. When you get them home, and they are settled nicely, and flying if it is warm weather, you are ready to transfer them as per instructions under TRANSFERRING. After they are well over the shock of being transferred, give them an Italian queen, as per instructions in INTRODUCING, and you are then fully started for business. I think it an advantage for you to perform all these operations yourself, even though you should make bad work of it the first time, because it gives you valuable experience.

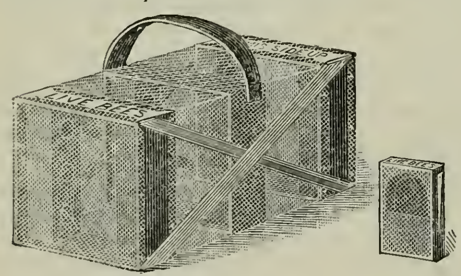
I would once more emphasize the importance of commencing with a very few stocks. A young man once came to me to know if he would not better buy 40 colonies to commence with, as they were offered him very low, and he was quite sanguine he could manage them. Although I advised him quite strongly not to take them, he decided to run the risk. In less than a year he had lost the greater part of them. Nevertheless he became an enthusiast, bought more, and increased until he had over a hundred; but when winter came, he lost heavily; and so on for several seasons, until his friends plead with him to give up bees. He finally came down to only a few colonies, which he kept strong and in good order, and he is now one of the most successful apiarists we have in our neighborhood, in wintering his bees.

A "CRUMB OF COMFORT" FOR THOSE WHO HAVE LOST IN WINTERING.

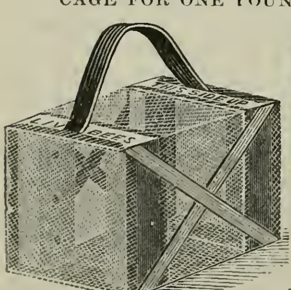
While the great losses have worked disaster to many, a great good has resulted in obliging us to improve our methods of shipping bees, as well as queens, to those who have quantities of empty hives and combs.

CAGES FOR SHIPPING BEES.

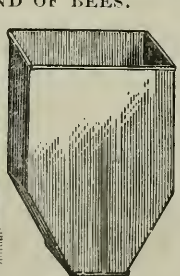
The trade now in bees in cages containing one pound each, and a queen, is almost a national industry. The bees are sent in wire cages made of bands of wire cloth, and our usual one-pound section boxes.



CAGE FOR ONE POUND OF BEES.



CAGE FOR ½ POUND OF BEES.



TIN TUNNEL FOR SHAKING THE BEES INTO THE CAGES.

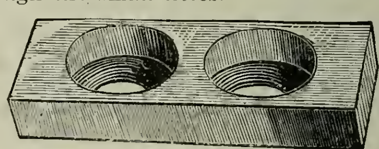
Bees must of necessity be sent by express; none are allowed by mail except the dozen or two that accompany the queen, and freight is altogether too slow.

With the above tunnel, an expert will put up a pound of bees ready for shipment, in five minutes, after finding the queen. After using the tunnel a dozen times or so, the honey that shakes against the inside should be washed off, and also the brush that is used to brush them down with. When the tunnel is dropped, it should be set with its mouth on the ground, and the small end covered with the small cap, to keep robber-bees from sucking up the new honey.

The cages may hold more bees than the weight named, especially in cool weather; in fact, we often put 1½ lbs. in a 1-lb. cage; but if the weather is hot, it is not safe to put in more than 1 lb. For *very long* distances we use a 1-lb. cage for only half a pound of bees.

CANDY-BLOCKS FOR BEE-CAGES.

After several experiments we have decided in favor of the little block shown below. It is just 4 inches long, and made to crowd in close in a Simplicity section. The block is 1½ inches wide by ¾ deep. Two holes, 1¼ inches or a little larger, are bored in it nearly through the block. Two smaller holes, in the center of the large ones, are then bored through. The small holes are ⅝. After the block is filled with the Good candy (see CANDY FOR BEES), it is fastened with wire nails in the section box—a block of candy on each side. Bees then have access to it through the small holes.



BLOCK TO HOLD THE CANDY.

You will observe the block is made of such dimensions that the wire caps when squeezed down will not injure a bee. As there are two blocks in a section, the quantity of food is proportioned to the size of the cage. The cage for two sections will hold enough for one-half pound of bees, while the cage for three sections will hold enough for a whole pound. When the candy is made of the powdered sugar, such as we have advised, there will be no trouble from the grains rattling out. In fact, it stays in the box in a pasty mass until the whole is consumed. For trips longer than a week, perhaps it would be well to use water-bottles; or the block could be made to hold more candy by putting the two holes a little further apart, and make a third hole between these two. Two openings for bees will be sufficient.

SELLING BEES BY THE POUND.

Sending bees and queens by the pound has grown to be quite a little industry. A neighbor of ours, to see what could be done with a good queen and a pound of bees, on June 16, 1882, put them into a hive, with a single comb of brood, all the rest being dry empty combs. He increased them to five fair colonies during the season, and wintered them all. Of course, they were fed, and supplied with empty combs, but had no help in the way of bees or queens. When a buyer gets a cage of bees and queen, if he has old combs or even hives where bees have died, all he has to do is to let the bees run out of the cage on to the combs, just as if they were a new swarm. As there is some danger of decamping, by far the better way is to give them a comb containing some unsealed brood. It will be noticed, that in purchasing in this way one can put his bees and queen on such combs as he is using in his own hives, and it does not matter whether his frames and hives are like those that other people use or not, for a pound of bees will "fit" any hive or any kind of comb.

The question is frequently asked, if one of these cages of bees with a queen may be turned loose on frames of foundation. It can be done, but you will have to watch them a little until they get the foundation drawn out, and the queen to laying in it. When they have done this they are all right. If you should attempt it at a time when honey is not rapidly coming in from the fields you will have to put on a feeder and feed them. One great advantage in purchasing bees in this way, is that the express charges are but a trifle compared with what they would be on a whole swarm.

It has also been asked, How late in the season will it do to attempt to build up a pound of bees, with queen, into a swarm that will winter? An expert ought to be able to do it without any trouble, if he commences the first of August—feeding, of course, liberally at any time when honey is not coming in. If he has a good comb of brood to give them by way of encouragement, he might commence even a month later. Novices had better not undertake it later than June or July; and if they could start them in May they ought to get a good strong colony, and something of a crop of honey, if they do not attempt to increase them. Unless one can have a brood-comb to give the little colony, I would advise purchasing not less than a pound of bees with queen; but if a comb of brood can be given, and they be started early in the season, ½ lb. of young Italians with queen will make a good full colony long before winter. See Moving Bees.

SELLING BEES BY THE NUCLEUS, AND HOW TO SEND BEES LONG DISTANCES.

The foregoing plan of selling bees by the pound answers very well where they are not to be sent long distances. After long experience and careful experimenting, we have come to the conclusion that a pound package will not answer where bees are obliged to take a journey of a week or more, and we have therefore resorted to the two or three frame nucleus. This is simply a small colony of bees having two or three frames of brood, and from a half to a pound of bees. See Nucleus. They are put into a light shipping-box made of ⅜ stuff, and then covered with a wire-cloth screen top. Such a package will go almost any distance. We have sent them even as far as Australia, and repeatedly to California and other distant points. In almost every instance the bees arrive in excellent condition. Nothing else seems to answer as well as combs all wired, from which the bees get their stores, and on which they may cluster. The nucleus form weighs three or four times as much as the pound package, and, of course, the express charges are higher, and hence customers should be notified that they will have to pay heavier charges.

SUGGESTIONS ON BUYING BEES.

During the year 1884 we bought about 150 colonies. As we had plenty of new hives, and plenty of new combs, we purchased only the bees and brood; that is, taking enough of the combs to get all the brood and the principal part of the new honey and new pollen. As we greatly prefer combs that are built on foundation in wired frames, we preferred not to take the old hives nor the old combs. We paid for these bees from five to six dollars per colony, on an average; but we found a vast difference in them. While some colonies would perhaps be worth ten dollars, others would hardly be worth three; so where you are buying bees, and have a chance to take your pick, it will make quite a difference, especially if bought in the spring. Find a colony first that is full of bees—the more the better. I never saw a hive with too many bees in it to suit my taste. Next look out for the brood. If there are many combs full of brood, even though the quantity of bees is moderate, the hatching brood will soon make the hive populous. The amount of stores when you are buying in the spring is of but little moment, as bees can easily be supplied if they do not supply themselves.

The next important item is the queen. A good queen is ordinarily worth as much as both bees and brood. She should be bright and sprightly looking, active, and large. A very old queen can usually be detected by her looks: for one who is accustomed to handling queens can tell a young queen from an old one almost as easily as you can tell a young person from an old one. A hive of bees having an old queen, little brood, and few bees, may not be as well worth $2.50 as one having a young vigorous queen, combs of solid sealed brood, and a hive boiling over with bees, would be worth $10.00. I hardly believe it will pay you to send off for bees and queens by express when you can get them at the above prices from an experienced apiarist living near you. The beginner, in purchasing bees, will also get much valuable knowledge from visiting a successful bee-keeper. Perhaps the knowledge gained from a single trip may be worth much more than the colony of bees he purchases.

J. A. GREEN'S APIARY IN WINTER, SHOWING OUTSIDE PACKING-CASES.

C.

CAGES FOR QUEENS. See INTRODUCING.

CANDY FOR BEES. There is just one candy that is used universally by bee-keepers. Though used particularly as a food in queen-cages and pound cages, it is also used for feeding during winter or early spring. It is none other than what is popularly termed the "Good" candy, after I. R. Good, of Nappanee, Ind., who introduced it in this country. It was, however, first invented by a German by the name of Scholz many years before Mr. Good introduced it. See "Langstroth on the Honey-Bee," p. 274, of 1875. By Europeans it is therefore called the Scholz candy.

HOW TO MAKE IT.

Make a stiff dough out of a first quality of extracted honey and powdered sugar. These are all the directions that were given at first, but it would seem that, from the difference in results, more specific directions are necessary. Mr. J. D. Fooshe (or, rather, his wife, who makes it for him) has been very successful in making candy. Their method is as follows: Take good thick honey and heat (not boil) it until it becomes very thin, and then stir in pulverized sugar. After stirring in all the sugar the honey will absorb, take it out of the utensil in which it is mixed, and thoroughly knead it with the hands. The kneading makes it more pliable and soft, so it will absorb, or, rather, take up, more sugar. For summer use it should be worked, mixing in a little more sugar until the dough is so stiff as not to work readily, and it should then be allowed to stand for a day or two; and if then so soft as to run, a little more sugar should be kneaded in. A good deal will depend upon the season of the year. There should be more sugar in proportion to the honey in warm or hot weather, than for cool or cold weather. It should not be so hard in winter so but that the bees can easily eat it, nor should it be so soft in summer as to run and daub the bees.[18] For this reason the honey, before mixing, should be heated so as to be reduced to a thin liquid. For shipping bees, the main thing to look out for is to see that the candy does not run nor yet get hard. It is one of the nice points in making this candy to make it just right. Don't delude yourself by the idea that a second quality of honey will do. Always use the nicest you have. We have had the best results with first quality of clover extracted. Sage honey, for some reason or other, has the property of rendering the candy in time as hard as a brick, and, of course, should not be used.

With the Good candy we have been enabled, with the Benton cage, to send queens not only across the continent and to the islands of the sea, but even to Australia, on a journey of 37 days. There is not very much trouble in mailing queens to Australia, if the candy can be made just right so as not to become too hard nor too soft on the journey. If it retains a mealy, moist condition, the bees will be pretty sure to go through all right. See Benton cage, under INTRODUCING.

HARD CANDY FOR FEEDING.

There are some, perhaps, who would like to make the hard candy. The following are the directions we have used in the older editions of this work. The candy answers a very good purpose, but it is a good deal more trouble to make it, and it can be used only for winter and spring feeding.

HOW TO MAKE HARD CANDY.

Into a tin sauce-pan put some granulated sugar with a little water—a very little water will do. Make it boil, and stir it; and when it is done enough to "grain" when stirred in a saucer, take it quickly from the stove. While it is "cooking," do not let the fire touch the pan, but place the pan on the stove, and there will be no danger of its burning. Cover the dining-table with some newspapers, that you may have no troublesome daubs to clean up.

To see when it is just right you can try dropping some on a saucer; and while you are at work, be sure to remember the little folks, who will doubtless take quite an interest in the proceedings, especially the baby. You can stir some until it is very white indeed for her; this will do very well for cream candy. We have formerly made our bee-candy hard and clear; but in this shape it is very apt to be sticky, unless we endanger having it burned, whereas if it is stirred we can have dry hard candy, of what would be only wax if cooled suddenly without the stirring. Besides we have much more moisture in the stirred sugar candy, and we want all the moisture we can possibly have, consistent with ease in handling.

If your candy is burned, no amount of boiling will make it hard, and your best way is to use it for cooking, or feeding the bees in summer weather. Burnt sugar is death to them, if fed in cold weather. You can tell when it is burned, by the smell, color, and taste. If you do not boil it enough, it will be soft and sticky in warm weather, and will be liable to drip when stored away. Perhaps you had better try a pound or two at first, while you "get your hand in." Our first experiment was with 50 lbs.; it all got "scorched" "somehow."

As the most convenient way of feeding candy that will probably be devised is to put it into your regular brood - frames, I shall give directions for making it in that form. If you do not like it so, you can break it out, or cut it in smaller pieces with a knife, when nearly cold.

Lay your frame on a level table, or flat board; perhaps you had better use the flat board, for you need some nails or wires driven into it, to hold your frame down close, that the candy may not run out under it. Before you fasten the frame down, you will need to put a sheet of thin paper on your board, to prevent the candy's sticking. Fix the board exactly level, and you are all ready to make your candy. If you have many stocks that need feeding, you can get along faster by having several boards with frames fastened on them. You will need some sort of a sauce-pan (any kind of a tin pan with a handle attached will do) that will hold about 10 lbs. of sugar. Put in a little water —no vinegar, cream of tartar, or any thing of the sort is needed, whatever others may tell you—and boil it until it is ready to sugar off. You can determine when this point is reached, by stirring some in a saucer, or you can learn to test it as confectioners do, by dipping your finger in a cup of cold water, then in the kettle of candy, and back into the water again. When it breaks like egg-shells from the end of your finger, the candy is just right. Take it off the stove at once; and as soon as it begins to harden around the sides, give it a good stirring, and keep it up until it gets so thick that you can just pour it. Pour it into your frame, and get in just as much as you can without running it over. If it is done nicely, the slabs should look like marble when cold, and should be almost as clean and dry to handle. If you omit the stirring, your candy will be clear like glass, but it will be sticky to handle and will be very apt to drip. The stirring causes all the water to be taken up in the crystallization, or graining process, and will make hard dry sugar of what would have otherwise been damp or waxy candy. If you wish to see how nicely it works for feeding bees, just hang out a slab and let the bees try it. They will carry it all away as peaceably as they would so much meal in the spring.

You can feed bees with this any day in the winter, by hanging a frame of it close up to the cluster of bees. If you put it into the hive in very cold weather, it would be well to keep it in a warm room until well warmed through. Now remove one of the outside combs containing no bees, if you can find such a one, spread the cluster, and hang the frame in the center. Cover the bees at the sides and above, with cushions, and they will be all safe. If a colony needs only a little food, you can let them lick off what they like, and set the rest away until another time, or until another season.*

CANDIED HONEY. All honey, as a general thing, candies at the approach of cold weather. It has been suggested that thin honey candies quicker than thick, and such may be the case; for honey that has been perfectly ripened in the hive, that is, has been allowed to remain in the hive several weeks after being sealed over, will sometimes not candy at all, even if exposed to zero temperature. As some honey candies at the very first approach of cold weather, and other samples not until we have severe freezing weather, we can not always be sure that perfect ripening will prove a preventive. It is very seldom indeed that we find sealed comb honey in a candied state,[46] and we therefore infer that the bees know how they can preserve it best for their use; for although they can use candied honey when obliged to do so, it is very certain that they dislike to bother with it, for they often

---

* Maple sugar, poured into wired frames while hot, makes excellent bee-candy. Cakes of maple sugar laid over the frames answer equally well.

carry it out to the entrance of their hives when new honey is coming in, rather than take the trouble of bringing water with which to dissolve it.

HOW TO PREVENT HONEY FROM CANDYING.

By following out the plan of the bees, we can keep honey in a clear, limpid, liquid state, the year round. The readiest means of doing this is to seal it up in ordinary self-sealing fruit-jars, precisely as we do fruit. Maple molasses, syrups, and preserves of all kinds, may be kept in the same way if we do our work well, almost as fresh, and with the same flavor, as the day they were put up. We should fill the jar full, and have the contents heated to about 130° F., when the cover is screwed on. The bees understood this idea perfectly, before fruit-jars were ever invented, for they put their fresh pollen in the cells, cover it perfectly with honey, and then seal it up with an air-tight wax cover. To avoid heating the honey too hot, it may be best to set the fruit-jars in a pan of hot water, raising them up a little from the bottom, by a thin board. If the honey is over-heated, just the least trifle, it injures its transparency, and also injures its color; in fact, it seems almost impossible to heat some kinds of honey at all, without giving it a darker shade.

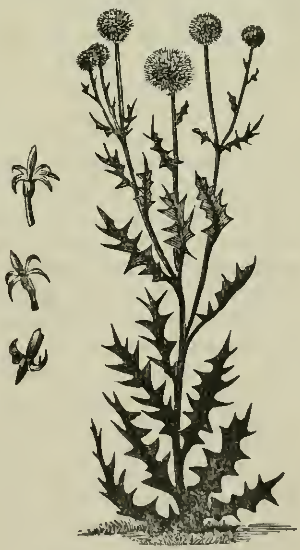
CANDIED-HONEY CONFECTIONERY.

If you allow a barrel of linden or clover honey to become candied solid, and then scoop out the center after one of the heads is removed, you will find, after several weeks, that the honey around the sides has drained much after the manner of loaf sugar, leaving the solid portion, sometimes, nearly as white as snow, and so dry that it may be done up in a paper like sugar. If you now take this dry candied honey and warm it in an oven until it is soft, it can be worked like "taffy," and in this state you will pronounce it, perhaps, the most delicious confectionery you ever tasted. You can also make candy of honey by boiling, the same as molasses, but as it is little if any better, and much more expensive, it is seldom used. See EXTRACTED HONEY.

CARNIOLANS—see BEES.

CATNIP. (*Nepeta Cataria*). This is a near relative of GILL-OVER-THE-GROUND, which see. Quinby has said, that if he were to grow any plant exclusively for the honey it produced, that plant would be catnip; and very likely he was not far from right. But as we have never yet had any definite report from a sufficient field of it to test it alone, either in quality or quantity of the honey, we remain almost as much in the dark in regard to it as we were at the time he made the statement, several years ago. Several have cultivated it in small patches, and have reported that in a state of cultivation it apparently yielded more honey than in its wild state, for bees are found on it almost constantly, for several months in the year; yet no one, I believe, is prepared to say positively that it would pay to cultivate it for this purpose.

CHAPMAN HONEY-PLANT (*Echinops sphærocephalus*). This honey-plant was introduced in 1886 by H. Chapman, of Versailles, N. Y., from whom it derives its name. The plant is quite thistle-like, about two feet in height, and is surmounted on one or more of its stalks by balls, or what botanists term "heads." These are from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in diameter, and vary in number on each plant from 6 to 10 heads. The heads, when in bloom, are covered with small star-like white flowers, in the center of which the anthers, blue in color, surround the pistil. The engraving below will give you a good idea of the plant as a whole, and also of the star-like flowers, detached from the heads, shown at the left.



CHAPMAN HONEY-PLANT.

We had a small patch of these plants upon our honey-farm, and we were surprised to see how the bees worked upon them in fours and fives at a time, and after greedily taking a "big drink" of the nectar they give that happy hum of rejoicing, such as we see upon clover-fields. The number of bees that will visit one of these heads in a single day is enormous—as many as 2135 having been counted. As regards the quantity of honey produced, Mr. Chapman says that two acres of these plants started his 175 colonies to storing honey. This seems almost incredible; but I have found that, if several of the heads be covered with a paper sack, they will, in 48 hours thereafter, after taking the sacks off, look as if they had been dipped in honey. The flavor of the honey is a very pure sweet — much like simple syrup, only it has a slight flavor which is pronounced very pleasant. Mr. Chapman has tested the plant for several seasons, and has now ten acres under cultivation. For fuller particulars, see Gleanings in Bee Culture for Aug. 15, 1886.*

CIDER AND CIDER-MILLS. Not only are many of our bees drowned in the cider, in the vicinity of cider-mills, but the cider, if gathered late in the season, is quite apt to prove very unwholesome as a diet for our little friends. Probably much of the dysentery that causes such havoc is the result of this unsealed cider stored in the cells when winter comes on. If the colony is very strong, and well supplied with winter stores, the cider may do but little harm; but where they are weak, and obliged to use the cider largely, they sometimes die even in the fall. We at one time fed a colony about a gallon of sweet cider, and they were dead before Christmas. At another time a barrel of sweet cider was found to be leaking; but as the bees took it up greedily as fast as it ran out, their owner kindly allowed them to work away. They all died quite promptly, after the experiment.

The bees of a large apiary will take sweet cider from the mill nearly as fast as it can be made, and we at one time had quite a serious time with the owner of such a mill, because the Italians insisted on "going shares," whenever he made sweet cider. After paying quite a little sum in the way of damages, and losing our bees every season there was a large apple-crop, besides buying sugar in the vain attempt to call them away by counter-inducements, we, at the suggestion of one of the other sex, hung white cloth curtains over all the openings to the mill. Some strips of pine, $2.50 worth of sheeting 2½ yards wide, and a couple of hours' time, fixed the mill so that scarcely a bee was to be seen inside. In a very short time they gave up flying around the mill, and apparently forgot all about it.

*Up to April 1, 1891, there are no reports to justify the high expectations that had been raised as to the value of this plant. Some report that the bees act as if sitting drunk on the flowers.

CLOVER (*Trifolium*). While most persons seem to tire, in time, of almost any one kind of honey, that from the clovers seems to "wear" like bread, butter, and potatoes; for it is the great staple in the markets; and where one can recommend his honey as being pure white clover, he has said about all he can for it.

WHITE CLOVER.

The most important is the common white clover (*Trifolium repens*), which everybody knows is perhaps at the head of the entire list of honey-producing plants. We could better spare any of the rest, and I might almost say all the rest, than our white clover that grows so plentifully as to be almost unnoticed almost everywhere. But little effort has been made to raise it from the seed, because of the difficulty of collecting and saving it.

There is a large variety known as white Dutch clover, that is sold by our seedsmen, to some extent. I have not been able to gather whether it is superior to the common. The common red clover — *T. pratense* — yields honey largely some seasons, but not as generally as does the white, nor do the bees work on it for as long a period.[49] While working on red clover, the bees bring in small loads of a peculiar dark-green pollen; and by observing this we can usually tell when they are bringing in red-clover honey. The Italians will often do finely on red clover, while the common black bees will not even so much as notice it. The general cultivation is much like that of Alsike Clover, which see; but the safest way for a beginner is to consult some good farmer in his own neighborhood, as different localities require slightly different treatment. The same will apply to saving the seed, which can hardly be saved profitably without the use of a clover-huller, made especially for the purpose.

PEAVINE, OR MAMMOTH RED CLOVER.

This is the largest kind of red clover known, as its name indicates; and it does, many seasons, furnish a very large amount of honey. As a rule, however, like the red clover mentioned above, it is seldom worked on by the common bees; but nearly every season it is visited more or less by Italians; and some seasons, where large fields are near by, the bees store very large amounts of very fine honey from this source alone. As it is in bloom principally during the months of August and September, it is a very important honey-plant.[50] Although the hay is hardly equal to that from the common red clover, it is perhaps the best forage plant to plow under, known. When well started it will grow on almost any soil; and once a good stand is secured and plowed under, the ground will be in condition to furnish a fair crop of almost any thing.

SWEET CLOVER.

As friend J. C. Swaner, of Utah, upon whom I once called, has had considerable experience with this plant I asked him to prepare an article, which he has done. The same appeared in Gleanings for Jan. 1, 1889, and is here reproduced.

Sweet clover grows here along the water-courses, moist waste places, along the roadsides, and in neglected fields. It grows from six inches to as many feet in height, according to the location, and it is covered with an abundance of bloom from top to bottom, yielding in most seasons an abundance of nectar, which, after being gathered and stored, produces honey of the very best quality and color. It does not generally bloom in the first year; but in the second it commences about the first of July, and keeps up a continual bloom until killed by frost, furnishing bees with pasturage, generally from the middle of July until the latter part of August.

Sweet clover is sometimes used for pasturage, and also for making hay, if cut when young, though it is a long way behind alfalfa for that purpose. Though it is sometimes relished by stock, very few would sow it for feeding. If eaten while green it is in a measure a cause of hoven, or bloat, in cows. If you wish good milk or butter you had better not feed it to milch cows, as it imparts a very disagreeable taste to it. If eaten off by stock it will soon recover, and produce an abundance of bloom for the bees.

As sweet clover is a biennial it is not a very hard weed to eradicate, and very seldom troubles cultivated fields, though it will sometimes seed a field; and if such field is planted to grain the following season, it will come up, and is cut off only with the reaper. Next season, if the same field be neglected, it will quite likely be covered with sweet clover, and that, too, sometimes as high as your head. If a field is cultivated as it should be for two seasons, the clover will entirely disappear. The plant requires a little moisture in the soil the first year; but after that it will grow without. I consider it, for my part, a great deal better to see a roadside lined with it than the sunflowers, etc., that generally grow in such places.

Now, to sum up, sweet clover is our main honey crop in this locality. It is our best honey; and said honey, I may say without boasting, compares favorably with the best grades known.

I do not think it will pay to sow it for honey alone, unless on such land as is considered worthless; but I think it would be a benefit to *such* land.

As to the amount of nectar it will produce per acre, I am unable to say; but I think it will compare favorably with white clover; in fact, I think that it produces fully two-thirds of our honey crop in this locality, and I should consider this a poor country for honey, if it were destroyed; but as it is, we generally get a crop; that is, the bees generally have some honey to spare. J. C. Swaner.

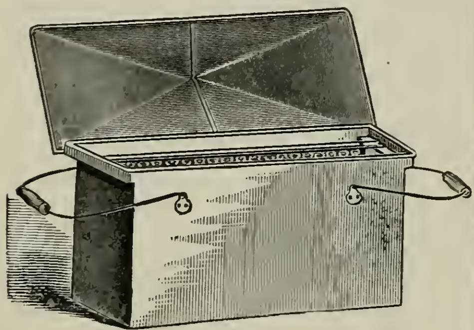
Salt Lake City, Utah, Dec. 22, 1888.

Sweet-clover honey tastes very much as sweet clover smells when its green leaves are bruised slightly. The flavor is not rank enough to be at all disagreeable, but the quality compares well with the best. The extracted honey is very thick, and has the same beautiful flavor as the comb honey. It seems to me that these facts give us a wonderful opening for starting a honey-farm where land is cheap, and nothing else will grow on account of severe drouths.

It is now well established, that cattle do *sometimes* eat sweet clover green, although some say it is objectionable as pasturage. Prof. Tracy, of the Mississippi Agricultural College, speaks highly of it as a hay plant, but says, as do others, that stock must *learn* to eat it. Livingston's catalogue says it is "quite valuable for soiling." Its general character as a good honey-plant is well established, and it may be well worth while to give it a thorough test as a forage-plant.

There is still another very important clover; viz., alfalfa, or, as it is sometimes called, lucerne. See ALFALFA.

COMB-BUCKET. When the bees are gathering no honey, especially during the lull that usually intervenes between spring and fall pasturage, it is many times quite difficult to remove combs of brood, or open hives at all, without getting robbers at work. Any one who has had quite a time with robbing - bees, will remember for some days that it makes trouble to leave a comb outside the hive while we are handling others inside. Robbing - bees will get at them, and soon they will learn to follow us about, and finally " dive " right into the unsealed honey the minute a comb is exposed. Suppose we do not have robbers; still, when we take a frame out of a hive it is very convenient to have some place where we can set it down safely, while we look at the rest. If



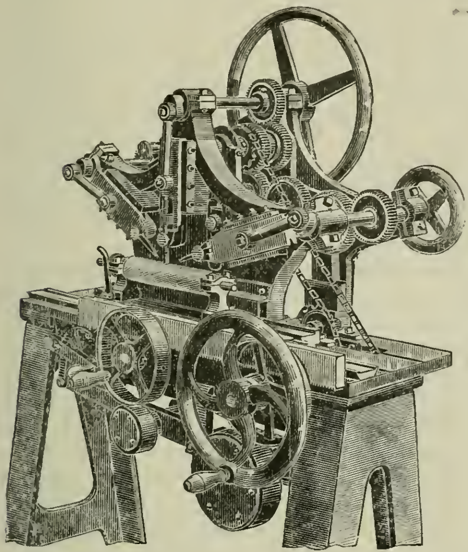
COMB-BUCKET.

we stand them up against the hive, or one of the posts of the grapevine trellis, unless we are very careful, bees are killed; and if the day is a windy one, the comb is quite apt to be blown down in the dirt. To avoid all these mishaps, we have sometimes carried about an empty hive; but this is unwieldy, and does not keep away robbers either, unless a cover is carried with it. Comb-buckets have been made of wood, but these are unsightly unless kept painted; and if any honey drips from the combs, it soaks into the wood in a way that is far from being tidy. The one shown in the engraving is made of light tin, and I believe meets all requirements.

It can be readily carried from hive to hive, and the light cover is very quickly closed bee-tight, whenever occasion may require. Where extracting is done indoors, the bucket can be used to very good advantage, for five heavy combs are about as many as one cares to carry at once.

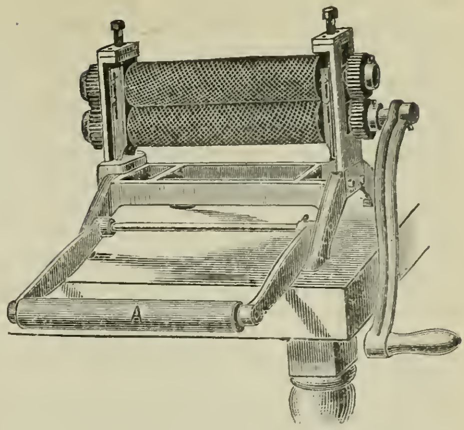
COMB FOUNDATION. Since the introduction of foundation, within the past few years, many difficult points have been solved completely; such as, how to insure straight combs, how to insure all worker-comb or all drone-comb, as the case may be, and how to furnish the bees with the wax they need without being obliged to secrete it by the consumption of honey. It is so simple a matter to make a practical test of it by hanging a piece in a hive when honey is coming in, that I think I may be excused from describing the way in which the bees use it, at any great length. Neither will it be needful to dwell on the successive steps by which it was discovered, and brought to its present state of perfection. The first mention we have of wax foundations that were accepted by the bees, was published in a German bee-journal as far back as 1857. Mr. J. Mehring, of Frankinthal, Germany, if I am correct, seems to have been the original inventor. For nearly 20 years the matter seems to have slumbered, although different ones at different times, among whom was our friend Wagner, took it up, made some improvements, and dropped it again. The sheets made in both England and Germany had no side-walls, but simply indentations. Mr. Wagner added shallow side-walls, making it much more like natural comb. Until recently it was all made with a pair of plates; even yet the Given press is preferred by some (see elsewhere); but it did not require much wisdom to decide that such an article, if wanted in large quantities, should be rolled out by machinery. In the latter part of 1875 I talked with a friend of mine who is quite an artist in the way of fine mechanical work and machinery, and told him what I thought was wanted. The result was that he made a machine that would roll out a continuous sheet, with very fair side-walls of wax, and superior to any thing ever made. Indeed, so perfect was the workmanship of the rolls, that, even though fifteen years have passed, nothing yet has been constructed which fully equals the foundation from them. Mr. A. Washburn, the mechanic who did the work, made the rolls by stamping—an operation slow, laborious, and consequently expensive. This made the price of these machines from $100 to $125 apiece — a figure beyond the reach of the average bee-keeper, and even of most supply-dealers. In consequence of the call for mills for less money, Mr. Chas. Olm, of Fond du Lac, Wis., invented an automatic machine which cut with a set of knives the embossed surfaces of the rolls. It was thus made possible for us to manufacture foundation-mills at a price from one-fourth to one-fifth of those first made.

As the space here is limited, I can hardly go into minute details showing you how these rolls are made. The following is an engraving of a machine embodying the principles of the original one made by Mr. Olm, but with the added improvements of the foreman of our machine shop, Mr. Washburn.



A MACHINE FOR ENGRAVING FOUNDATION ROLLS.

There are two gravers, as you will notice, held at the proper angles, set in slides operated by a crank and pitman. One of the keen chisels first comes down and makes a cut in the surface of the roll. This first cut raises the edge of the chip, but does not take it out. The other chisel cuts this chip entirely loose, and throws it out. As these knives work back and forth, the carriage holding the roll is spaced automatically until the end of the roll is reached. Here it is again carried back automatically, and, after a "click, click," the knives, or gravers, resume their work. This is repeated until the surface of the roll has been indented with the lozenge faces. The side wall is then stamped by a perpendicular punch, likewise fastened into a slide, and operated by a crank and pitman. The machine is run by power, and is almost entirely automatic. The machinist simply operates a set of levers, while the machine responds to his bidding. It can likewise be operated by hand-power whenever occasion demands.



10-INCH FOUNDATION-MILL.

The cut represents one of the latest improved mills. The wooden-roller attachment will be explained further on. The price of these machines ranges all the way from $15.00 to $40.00. The regular size of a ten-inch machine for the Langstroth frame costs $20.00.

HOW TO REFINE WAX.

Under WAX, in the latter part of the work, this subject will be partially treated ; but in this place, in order to make a first-class article of foundation, some specific directions will be necessary. Wax cakes are usually of all grades and colors, particularly if your trade is such that you are obliged to make use of the commercial article. The difference in color is due largely to the amount of impurities the wax contains. To cleanse this wax and also reduce it to a uniform color, proceed as follows: Into a receptacle of the proper size (say a wash-boiler, one that your wife will let you have), pour four or five inches of water. Put it on the stove and heat the water, after which put in the wax. When the latter is melted, dip it out and pour into receptacles with sloping sides. The deeper the receptacle the better it will be. The Dadants, who have the reputation of making the finest foundation in the world, use tin cans 10 inches in diameter at the bottom, 12 inches at the top, and 20 inches deep.* If you can not afford these deep cans, utilize whatever receptacles you can get hold of. Sap-pails or ordinary pails would answer your purpose sufficiently well, perhaps. Having dipped out all the wax from the boiler into the cans, put them in a close room, or, better still, in a cupboard, so that the cooling process may be delayed as long

* Use no receptacles made of galvanized iron—see WAX.

as possible. The longer the cooling the better opportunity is afforded for the impurities to settle to the bottom. When the wax is hard, remove and scrape off the bottom of the cakes, which will be largely foreign settlings and other impurities. If these wax cakes have not, in your judgment, attained the proper color, that is, a bright yellow, repeat the operation once or twice until you are satisfied.

The method already given is essentially the one employed by the Dadants, and I give it here because it is one of the secrets of their success in turning out yellow foundation. If you are making foundation for your own use, it is not necessary to have the wax so thoroughly refined; but as the trade demands yellow foundation you will have to supply what it calls for. We have found, however, that the darker grades of foundation are as readily accepted by the bees as the lighter. As it costs some more to make the yellower foundation, if your customer prefers, let him have the darker for one or two cents per pound less. I might state right here that the wax for thin or surplus foundation should be brighter in color than that intended for the brood-chamber. We make it a practice to save out our yellowest wax for thin foundation.

HOW TO MAKE WAX SHEETS.

To be able to do this work successfully, requires not a little skill. Neatness is another important essential. A little carelessness in spilling and dripping wax upon the floor means a great deal of trouble in scrubbing it up afterward. Indeed, it is well nigh impossible to get a floor clean after particles of wax have become pressed and rubbed into it by great big clumsy feet.

The operation of making wax sheets, in a word, is dipping a thin sheet of wood into a deep vessel of melted wax. A film will cling to the board, which is afterward peeled off. Very simple, isn't it? But I am afraid, my friend, that, before you get through it, you will find it more difficult than you at first imagine. One of the prime essentials for making wax sheets successfully is experience. But with the assistance of a few suggestions, I can save you a great deal of trouble.

To melt wax for dipping, you must be sure not to burn it, otherwise it will be totally spoiled. To insure against this, the receptacle for melting should be inclosed by another larger receptacle containing hot water. This is to be placed upon the stove, and the wax cakes are to be deposited in the inner tank. As the wax can not get hotter than the boiling-point, there is no danger of burning. But desiring to work as economically as possible, you will feel, perhaps, that you are not able to purchase any more implements than are absolutely necessary. An old wash-boiler, or one that your wife thinks she can spare, can be made to answer nearly as good a purpose. Place it upon the stove and pour in four or five inches of water. Into the water, put the wax cakes. As the latter have a specific gravity lighter than the former, they will float on the water either before or after being melted, and consequently there will be no danger of burning. After putting in a sufficient amount it can be dipped out into the dipping-tank. This is a deep vessel for holding the wax after it is melted. A sufficient quantity should be dipped into this tank so that the dipping-board may be immersed within an inch or so of the upper end.

The dipping-tank should be placed close by the stove, so that the hot wax can be dipped or drawn off readily through a suitable faucet from the melting-tank on the stove. You are now ready for your dipping-boards, which I will presume you have already made. There should be at least two, and more would be an advantage. These boards should be made of the very best straight-grained pine lumber which you can obtain. There are generally only one or two boards in a log which are fit for the purpose, and they are the "heart" boards. These will warp neither one way nor the other, and the grain is not as liable to shale up and catch the wax sheets when being peeled off. They are to be made of a size to suit the frame you are using. If you are using the Langstroth frame, the dipping-boards should be 9 inches wide and about two feet long, or long enough to leave about two inches projecting out of the melted wax for finger room. Before using they should be soaked in brine water for a few hours, the proportion of salt in the water being about a teacupful to two or three pails of water. We have found that the salt serves a double purpose: It acts somewhat as a lubricant in facilitating the removal of the sheets, and as a preventive against the grain rising in the board, and consequently roughening. Before we used the salt, we used to have to sandpaper the boards quite frequently; but we rarely have occasion to do it now.

Besides the melting-tank, dipping-tank, and the dipping-boards, you need a cooling-vat of water, for cooling the wax film adhering to the dipping-boards. An ordinary tub of cold water may answer; but if you propose making very much foundation, you had better make an oblong shallow wooden box, capable of holding water. This cooling-vat should be close at hand.

Two can work to the best advantage — one to dip, and the other to peel off the sheets. In order to make the dipping a success, the wax must be neither too hot nor too cold. We find that we get the best results when it is at about the temperature of 165 or 170° F. It is too cold if there is a small film, or little spots of cooling wax on top of the melted liquid from which you are dipping. If too cold, it will leave little ripples on the sheets, and the surface of the sheets will be wavy and the thickness irregular. If the wax is too hot, the sheets will crack in peeling off. It is very important, as you will find by experience, to do the dipping when the wax is at the right temperature. Properly made sheets will work much better in the rolls than when they have been subjected to either extreme of temperature. If they begin at any time to stick to the plate, rub a rag, moistened in a weak solution of lye, such as is made from an ash-leach, on both surfaces of the board, and you will probably have no more trouble. If this fails, then the sides of the boards have become roughened, and, of course, nothing will do then but to sandpaper them down again after they are dry.

We make five kinds of foundation; viz., heavy brood, from 4 to 5 ft. per lb.; medium brood, 5 to 6 ft. per lb.; light brood, 7 to 8 ft.; thin surplus, about 10 ft. to the lb.; and extra thin surplus, from 11 to 12 ft. To make sheets for the first named, five dippings will be required; for the second, three; for the third, two; and for the last, one short quick dip.

After each successive dip into the tank, before immersing again allow all the ripples to run off till the board is smooth. Immerse quickly, and draw out as quickly. The number of dippings will have to be varied, however, according to circumstances. The adjustment of the mill, the temperature of the wax, and the quickness of the plunge of the dipping-board, all have their influence. It may be an advantage to reverse the dipping-board, i. e., dipping the other end. After the boards are dipped they should be placed immediately into the vat of cool water, which we before described. After the boards are cold, scrape the edges with a knife. Peel up a corner of the sheet, and pull it off. As you proceed in your work, the wax in the dipping-tank will become cool, and the water* in the cooling-vat will become warm. Of course, both must be restored to their proper temperature. To bring the wax in the dipping-tank to the right point, pour in a dipperful from the melting-tank on the stove. Add another dipperful, if necessary. To cool the water in the cooling-vat, draw off a portion of it and add cold water.

I have thus given minute details in regard to making wax sheets, because beginners usually fail on this feature of the work more than in any other.

ROLLING THE WAX SHEETS.

I will presume that you have carried out faithfully the foregoing instructions, and that you have already purchased a foundation-machine. Procure a box or small table about three feet high, and upon this screw down the machine. You will also need two other small tables, one in the rear of the machine and the other in front. The latter is to hold the piles of sheets after they have been embossed on the rolls. The former is to hold a shallow vat for holding the sheets— the latter immersed in three or four inches of water. This vat should be made of tin, long enough to accommodate the length of the sheets, and of suitable width. We find that, when the sheets are taken from lukewarm briny water (110°), they work much better; indeed, we now regard this tempering of the sheets quite a necessity. In order that you may get a proper idea of the arrangement as above given, I submit the engraving on next page, taken from a photograph, as the two helpers were making foundation.

At the left of lady No. 1 is the oblong shallow vat containing the sheets immersed in tepid water. For the sake of economy of space, and general convenience, we have a couple of tables made exactly right for the purpose. The engraving will make their manner of construction self-evident. We use a similar table for holding the piles of wax sheets after being run through the rolls.

Before proceeding with the operation of rolling, see that the room is properly warmed, say about 80°. It has been found by experience that this temperature is best. This is rather too warm to work with comfort; but in making fine quality of foundation, comfort is not to be looked after. Next, you need some sort of lubricant. Various mixtures have been advocated, such as soap made into a lather; a weak solution of lye, obtained from an ordinary ash-leach; a sat-

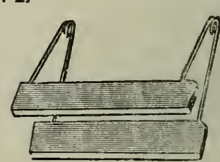
*Use soft water whenever you can in foundation making.

urated solution of salt and water; a solution of slippery-elm bark; and ordinary starch paste, such as women use for wall-paper. After testing most thoroughly all of the different ones mentioned, we have decided in favor of the paste, with the addition of a tablespoonful of salt to the pint, as being by far the best. I believe the Dadants use the soap lather; but for some reason or other we have not been able to make it answer as well as the starch paste.

Your enthusiasm may prompt you to run a dry sheet through the rolls, just to "see how it will work." Just as sure as you do, you will find your ardor greatly diminished, for the wax will cling to both rolls, and can be removed only by a method to be described further on. Having prepared your starch paste (and we suppose every woman knows how that is made), add about a tablespoonful of salt to a pint of paste. This should, of course, be added in the preparation of the paste, in order to be quite thoroughly mixed throughout. When cold, fill the tin tray under the roll. Dip your hand into the paste, and rub it over the rolls until they are thoroughly lubricated. If possible they should be warmed to about 95° in order to work best. Place the mill near the stove for a little while before you expect to use it.

ROLLING OUT FOUNDATION.

Referring to the engraving again, No. 1 is to feed the sheets and turn the crank. We will suppose that you assume the position of No. 1 while an assistant acts as No. 2. If the end of the sheet is too thick, cut it off with a knife.* Feed the sheet into the mill and turn the crank about half a revolution. Now raise the wooden roller until it is level with the upper metallic roll. The office of this wooden roller is to keep the sheet, after it has passed through the mill, from coming in contact with the lower roll *before* it should. It also causes the sheet to be fed evenly. As soon as the sheet is run through an inch or so, the end will stick on one of the rolls and must be picked out with a blunt hickory bodkin. A shawl-pin made blunt would be better, but you must be careful not to let it scratch the surface of the rolls. You will find that the first three or four sheets will give you more trouble than those succeeding; and, likewise, that a new mill will give more trouble at first than after you have used it some. After you have loosened the end of the sheet in the manner indicated, No. 2 is to grasp it with the grippers, made as shown in the accompanying engraving. The manner of using them is shown above in the right hand of No. 2.



GRIPPERS.

Referring to the large engraving again, No. 1 rolls out the sheet, and watches carefully to see that no foreign particles adhere, either to the upper or under side of the sheet,

*The sheets as they leave the dipping-boards are, as a general thing, a little ragged, and sometimes a little thickened at the ends. Instead of trimming each sheet individually before passing it through the mill, take a pile of them and trim all at once, evenly and squarely, with a large butcher-knife, as will be explained presently. Put this pile into the vat of water, and you are ready to roll.

such as would damage the surface of the rolls. No. 1 receives the sheet and deposits it on the table at her right.

HOW TO ADJUST THE MILL FOR LIGHT AND HEAVY FOUNDATION.

In adjusting the mill from thin to thick foundation, give the adjusting top bolts each an equal turn—somewhere about one quarter of a turn *up*. If the sheets roll bowing on one edge, the rolls are screwed down too much on one side. If you are running on heavy foundation, and desire to turn the mill down to medium, an eighth of a turn will probably be entirely sufficient. Be careful not to screw down the mill too much, or you will bruise the surface of the lozenge faces. If the bottom of the cell is thick on one side, with a screw-driver loosen the screw in the cam one-eighth of a turn, and follow up with the one on the opposite side of the cam which you will find on one end of the *top* roll. Be sure to oil often.

CAUTION.

I have already incidentally remarked in one or two places in regard to the danger of running pieces of metal through the mills. To prevent the occurrence of such accidents, be sure that all nails and pins are kept out of the room. We used to box our wax in the same room where we rolled out the wax sheets. By some means, the nails would get on to the tables by the piles of wax sheets, and we had trouble later. A nail is an innocent-looking thing when lying on a table, to be sure; but let some one heedlessly lay a pile of wax sheets on top, and that nail will be sure to imbed itself in the sheet above it. As it will be pretty apt to elude scrutiny, it will be passed through the mill, clinging to the sheet, and the consequence is a big nail-mark on the surface of each roll. After having invested twenty-five or thirty dollars in a foundation-mill, and damaging it, you will find, as Josh Billings says, that "egsperiens keeps a gude skule, but the tuishen is ruther hi." Only one little nail, that's all! We have also had the rolls injured by the bodkin, or little implement used for lifting up the sheets from the rolls. It would be laid carelessly in front of the mill, and, in some strange way, would get imbedded into the sheet, only to repeat the mischief. We now have them suspended by a rubber cord from the ceiling, in such a way as to hang four or five inches above the rolls. When it is necessary to use it, the bodkin can be drawn down. After usage it is let go, when it will draw up out of the way, where it can not get entangled in the sheets.

HOW TO CLEAN THE FOUNDATION-ROLLS.

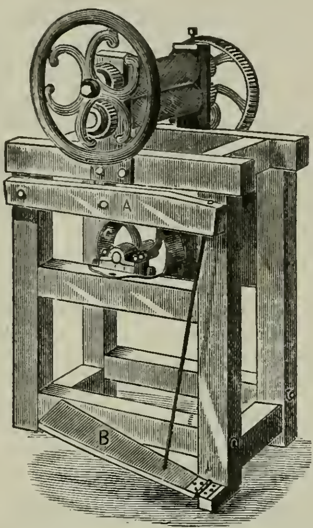
Now, after you have been using your comb-mill for a day or so, the rolls will become clogged, or dirty, from small particles of wax collecting in the interstices. The most expeditious way we have found for removing all such particles is to turn a jet of steam upon the rolls for five or ten minutes, or until the rolls feel hot to the hand. While the steam is blowing, the rolls should be turned backward and forward. The action of the steam is to melt the particles of wax, and then blow them off. Next scour with a brush and boiling soapsuds. Where it is not convenient to use steam, a stream of boiling water from a tea-kettle will answer nearly as well as the steam, though it does not do its work as rapidly.

If you do not succeed in making *nice* foundation, clean the rolls as I have just directed, and you will be surprised at the difference in results. Unless you do keep your rolls clean you will probably become disgusted with the whole business.

MAKING FOUNDATION IN LARGE QUANTITIES.

The foregoing directions in regard to making the wax sheets, and passing them through the mill, apply to those who either desire to make foundation for their own use, or to supply a moderate trade which they may have. Where the article is to be made by the ton, the wax should be melted by steam, by means of a series of coiled pipes, or by heating water surrounding the vat of wax. Either plan is very simple; and where large quantities are to be melted, it is by far the best. Steam is not only a great convenience in melting the wax and cleaning the foundation-rolls, but it may be made a very useful servant in turning the rolls themselves. Very recently, comb-foundation machines have been built, to be operated by steam-power. The following engraving illustrates one of these machines.

For some time it was a problem as to how these mills could be operated by power so they could be started instantly and stopped instantly, and yet in no way inconvenience or endanger the operator while manipulating the wax sheets. The problem was successfully solved by means of friction-rollers. The treadle B communicates, as you will notice, with a light iron rod. This operates another lever, A, which in turn operates a friction-pulley. Pressure upon the treadle brings the friction-pulley in contact with the lower pulley, C. The mill can be instantly started or stopped. Before we adopted power attachment, our employees complained a good deal in consequence of the tiresome work of turning the crank on the hand-mills, and we found it necessary to employ a good strong man. Since the adoption of these power-mills, the services of the latter have been entirely dispensed with; and only one woman (rarely two) oper-



A POWER FOUNDATION-MILL.

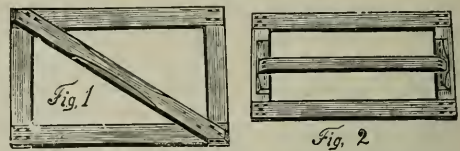
ates the machine easily alone. Reversal of motion is accomplished, what little there is of it, by hand. The large balance-wheel can be turned backward or forward. When ready to roll, power is applied. The general directions which have been given for the hand-mills will apply to the power-mills.

TRIMMING AND SQUARING THE SHEETS.

As the sheets are taken from the rolls, lay them squarely upon each other until you have a pile 2 or 3 inches high. Now lay on them a board cut the exact size you wish the fdn. to be, and with a sharp, thin-bladed butcher or other knife, cut through the whole, all around the board. To prevent the knife from sticking, dip it occasionally in the starch, such as is used in rolling the sheets. To have the knife work nicely, you should have a coarse whetstone near by, with which to keep the edge keen. As the board is liable to shrink, warp, and get the edges whittled off, where a great number of sheets of a particular size is wanted, we have frames, made sharp on their edges and lined with tin. The tin is folded, and put on so that the knife-edge does not strike it, if the blade is held in the proper position.

To cut the sheets we have frames made as follows:

The diagonal piece in figure 1 serves as a brace to keep it true and square, and also for a handle to lift it by. The frame is placed over the sheet so as to cut to the best advantage, and the knife is run around it.



FRAMES FOR CUTTING SHEETS FOR BROOD-FRAMES.

Figure 1 is for cutting sheets 12 by 18, and figure 2 for the L. frame, 8 by $16\frac{1}{2}$ in. For the wired frames shown on page 65, the sheets are to be cut $8\frac{5}{8}$x$17\frac{1}{8}$.

For cutting a great number of small pieces, such as starters for sections, a pair of frames like those shown in the engravings below are very convenient.

Fig. 3.

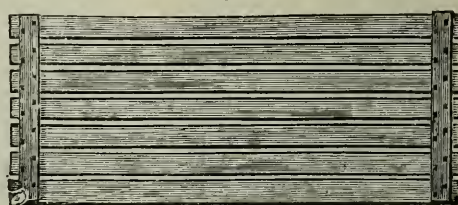
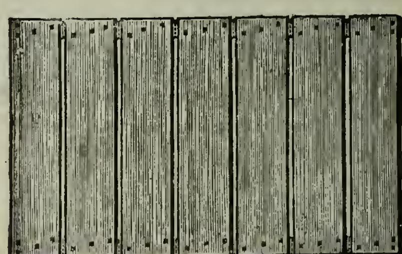


Fig. 4.



MACHINE FOR CUTTING STARTERS.

Fig. 3 is composed of seven $\frac{1}{4}$-inch strips, $1\frac{3}{4}$ inches wide, by about 20 inches long. The spaces are just wide enough to allow the knife to run between them. Fig. 4 is composed of the same number of boards, but they are $3\frac{5}{8}$ wide, by about 16 long. You will observe that this allows one frame to be placed over the other, each fitting in between the cleats of the other. To use the machine, place a sheet (or sheets) of fdn., say 12 by 18, on Fig. 3, and lay Fig. 4 over it. Run the knife through all the spaces, and then turn the whole machine over. Now run it through as before, and your sheet is cut into oblong pieces, just such as we put in the 4¼ section boxes when we ship them in hives complete. We should, perhaps, use pieces somewhat larger, were it not that there would be greater danger of their breaking out with the rough handling they get when the hives are sent by freight. The pieces, as made with the above frames, are 1⅝ by 3⅝ inches.* If much work is to be done with these frames, they had better be covered with tin, like the frames before mentioned.

FOUNDATION FOR COMB HONEY.

The only trouble with it for comb honey is that, under some circumstances occurring very rarely I believe, the bees will build on to the foundation, without thinning the center at all, as they usually do. I believe this is more apt to occur when a good yield of honey comes during rather cool weather, the bees being unable to get the wax warm enough to work readily.[51] The remedy for this will be in making the base of the cells of the fdn. exceedingly thin, and the small 6-inch machines seem best for this purpose. We have made machines for making the foundation four, four and a half, and five cells to the inch. The latter is intended to be used in brood-rearing, unless, perchance one may desire to rear drones. In that case, four cells to the inch should be used. As the queens are not as apt to deposit eggs in drone-cells, it was once thought that drone foundation would be more desirable in the surplus-apartment. But notwithstanding this, more recently a decided preference has been shown for thin *worker* foundation (five cells to the inch).

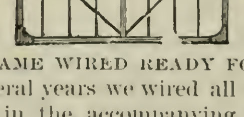
In order to get nice thin foundation, the rolls should be screwed down as closely as they may be (according to directions already given), so as to get the base of the cells nearly if not quite as thin as the natural base. If it is made a little too thick, the base is very easily detected in the comb honey, and has been called, not inappropriately, "fishbone."

Flat-bottom foundation has been made, which some think is the best surplus foundation. It is nothing but a sheet of wax, embossed with hexagonal cells inclosing a flat base. While it makes very nice comb honey, yet the testimony of many of those who have tried it is to the effect that it is not readily accepted by the bees, and consequently valuable time is lost. We do know this much, that they remodel and rebuild the cells before drawing them out. Notwithstanding this, there are two or three large honey-producers in the State of New York who consider it the best surplus foundation—Mr. P. H. Elwood, of Starkville, N. Y., an extensive bee-keeper of large experience, among the number. There are other New York bee-keepers who think as he does.

SAGGING OF THE FOUNDATION, AND HOW TO PREVENT IT.

Many devices have been tried to prevent the sagging of the fdn., and consequently slight elongation of the cells, in the upper part of the comb. With the L. frames, this is so slight that it occasions no serious trouble with the greater part of the wax of commerce; but with deeper frames, or with some specimens of natural wax, the sagging is sufficient to allow the bees to raise drones in the upper cells. Paper has been tried, and succeeds beautifully, while the bees are getting honey; but during a dearth, when they have nothing to do, they are liable at any time to tear the nice combs all to bits, to get out the paper, which I have supposed they imagine to be the web of the moth-worm. In our apiary I have beautiful combs built on thin wood; but as the bottom of the cell is flat, they are compelled to use wax to fill out the interstices, and the value of this surplus wax, it seems to me, throws the wood base entirely out of the question. I do not like the fdn. with wire rolled in it, on account of the greater expense, and because we cannot fasten it in the frames as securely as we can where the wires are first sewed through the frames.

Aside from the avoidance of drone-cells, we want combs that will not break out of the frames in shipping, handling, or extracting, in either hot or cold weather; we also want *frames* that will not sag in the middle, no matter how heavily they may be filled with honey.

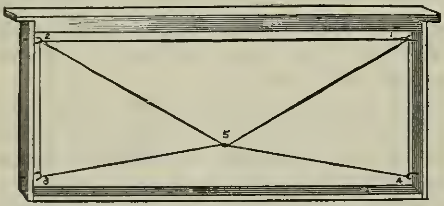


L. FRAME WIRED READY FOR USE.

For several years we wired all our combs as shown in the accompanying engraving. The top and bottom bars were pierced at regular distances, through which the wire was threaded back and forth. If a thin top-bar—that is, one not more than ¼ inch—is used, a folded tin bar will be necessary.

* Nearly all our prominent honey-producers, however, are strongly in favor of having the thin foundation entirely fill the sections; and for the one-pound sections, they are cut 3¾x3¼, made of foundation with the *base* about as thin as natural comb. To make starters this size the slots in both Fig. 3 and Fig. 4 should be 3¾ in. wide.

Latterly we have employed the method shown below, and it is what we call the Keeney plan. Perpendicular wiring is apt to bow up the bottom-bar if the wires are drawn tight, and to pull the top-bar down if it is not thicker than ⅞. True, we can avoid that by the use of folded tin bars, but bees seldom build over them nicely. The Keeney method of wiring takes less wire and less time, and it brings the entire strain upon the four corners of the frame—the point where there is the greatest strength. No piercing of top-bars or bottom-bars is necessary. A 1¼-inch wire nail is driven through the end-bars ⅜ of an inch from the top and bottom bars. They are then bent into the form of a hook by means of round-nosed pliers. To do this rapidly, string a lot of frames over a narrow board, so that the end-bars will lie in contact side by side, and then support the two projecting ends of the boards. With a straight-edge and pencil draw a line ⅜ inch from the top-bars, and then a line ⅜ inch from the bottom-bars. This gives you the location for each wire nail as regards the top and bottom bars. Before taking the frames off the board, drive the nails in. Then slide them off *en masse*, and afterward bend the points, as shown in the accompanying engraving. Cut your wire 69 inches long. Twist a loop in one end; catch the wire over hook No. 1, and pass successively to hooks 2, 3, 4, and back to 1; then draw. Next pass the wire under the wire at 5, catch over the hook at 2, draw the wire taut, and fasten by twisting.



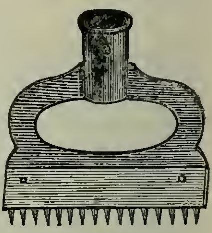
KEENEY'S METHOD OF WIRING, IMPROVED.

To get your wire the right length, wind it over a long board 5 or 6 inches wide, and rounded at the end to a feather edge. The length of this board should be just half the length of the wire you use; namely, for the L. frame, 34½ inches. After you have wound the whole coil of wire on this board from end to end, take an old pair of shears and cut all the strands in two, right where they bend over the end; and to keep them from flying all over when cut, slip a couple of rubber bands over each end of the board. Now, when you are ready to wire, just simply pull the wire out from one end.

This method of wiring is very expeditious and satisfactory for the ordinary bee-keeper. It is not as substantial as the perpendicular-wiring plan, but enough so for practical purposes. The two perpendicular wires, 2 and 3, 1 and 4, hold the ends of the foundation from flopping out of position. The horizontal wires, 1 and 2, hold the top, also, permanent.

The wire used is No. 30, tinned iron wire. After the wires are in and drawn up tight, the foundation is cut so as to fill the frame, and the wires are then imbedded into the wax by means of one of the various devices for that purpose. During this operation the foundation is supported on a level board cut so as to just slip inside the frame, and come up against the wires. The board is to be kept wet with a damp cloth, to prevent the wax sticking to it.

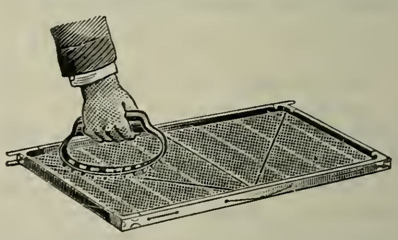
A common carpet - stretcher, like the cut below, is fitted with a short handle, and then the wax is warmed up so as to be quite soft. The wires are imbedded by laying the points along the wire, and pressing down while the foundation is supported by a board in the manner already given. By the use of the carpet-stretcher, the bees finish out the cells as perfectly as if nothing of the kind had ever touched them.



CARPET-STRETCHER.

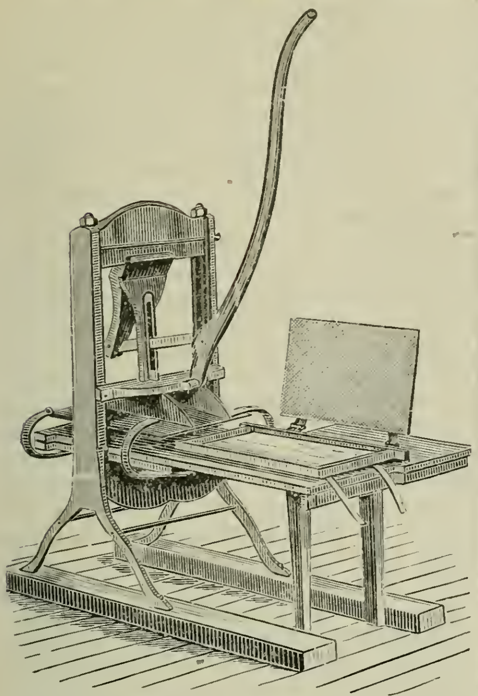
In putting in foundation on the Keeney plan, slip the top edge up in the groove where the comb-guide would go if the frame were not wired. Then imbed the wires in the foundation.

Still later, the implement figured in the cut below has found favor, and our girls now consider it quicker and easier to use than any other thing heretofore tried. You see, the points strike one at a time, therefore no very great pressure is needed; and yet by rocking the implement the work is done very rapidly.



EASTERDAY'S FOUNDATION-FASTENER.

This press has found considerable favor with a few. With a pair of dies just the size of the inside of the frame, plain sheets of wax are made into foundation, and the wires imbedded into it at one and the same operation. The objections to it are, the price is much more than the price of rolls; that it makes sheets of only one size; that the wire used for it must be considerably finer than No. 30. No. 36, I believe, is generally used, and this we find too frail for our use, shipping bees, etc. As yet, I believe it does not put foundation into wired frames so that they will bear shipment, while that put in by hand can be shipped safely anywhere during warm weather. Neither is it adapted to making sheets of foundation that entirely fill the frames; and I should always want the sheets to come clear up to the wood on all sides.[52]



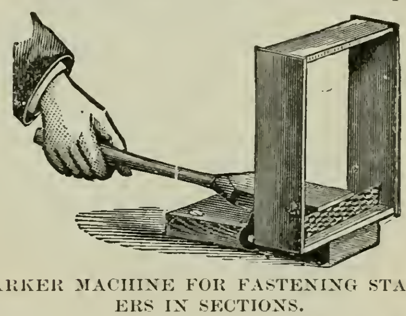
GIVEN FOUNDATION-PRESS.

FASTENING STARTERS IN SECTION BOXES.

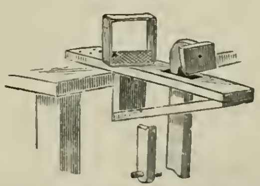
For this purpose the foundation is made in narrow strips, as has been before explained. For the one-pound section we have dipping-boards $3\frac{5}{8}$ inches wide; and after being rolled, they are then cut up into pieces that nearly fill the sections, or as much less as the taste or purse of the bee-keeper demands. The pieces are fastened only to the top-bar of the section, and this is done by either of the accompanying machines shown.

STARTERS FOR SECTION BOXES.

Many bee-keepers want the starter to fill the section as nearly as possible, leaving a space of only $\frac{1}{4}$ or $\frac{3}{8}$ inch at the sides and bottom. Even with so large a starter as this, the bees sometimes fail to fasten the comb at the sides and bottom. It is especially desirable to have it fastened at the bottom, to prevent breaking out in shipping; but even if long enough to touch the bottom, the bees do not always finish it down. Perhaps a safer way is to fasten a starter at the bottom, $\frac{3}{4}$ inch wide or deep; then fasten at the top a starter $3\frac{1}{4}$ inches deep. This makes a sure thing of having the comb fastened to the bottom-bar. Such starters properly fastened with a Clark fastener have been safely hauled on the trot to an out-apiary. If cut $3\frac{7}{8}$ instead of $3\frac{1}{4}$, the swing, and the consequent liability to fall out, would be much greater. The idea is, to rub or press a thin edge of the wax into the dry wood of the section. The motion of the machine spreads the wax down, and mashes it into the wood, as it were. Below is the Parker machine, which is used quite largely; in fact, many thousands of them have been sold. It does very nice work; but where thousands of starters are to be put in, it becomes a little tiresome on the hands.



PARKER MACHINE FOR FASTENING STARTERS IN SECTIONS.



CLARK'S STARTER MACHINE.

The one next illustrated is what is called Clark's starter machine. Instead of rubbing the foundation it presses it into the wood. Pressure is exerted entirely by the foot. This not only gives more power, but it leaves both hands free to pick up the sections, adjust the foundation, and, after fastening, remove them.

To operate, screw it down to a bench or table, so that the treadle just clears the floor. Make a little paddle, say 8 or 10 inches long, ¼ inch thick, and 1 to 1½ inches wide. Nail upon one side of it a piece of felt, or two or three thicknesses of old soft cloth, equal to the length of the presser-tongue, then whittle off the handle end, saturate the cushioned part well with salt water, renewing it if it should get dry. To moisten the tongue, lay your paddle under it, press with the feet just as when fastening in a starter, and then throw the paddle in your lap till needed again. This takes less time, and is more thorough, than to use the brush. You may need to moisten the tongue for each starter, or you may need it only after fastening several starters. It is a good plan to have a little tin dish of salt water in which the tongue may be so set as to keep in soak over night, so as to be in good trim for next day's work. With one hand pick up a section, and with the other put the foundation in position, directly under the tongue. Bring the latter down with the feet, and let the feet come back with a rebound, and the whole performance is quickly and easily done. If the presser-tongue is so sharp at the edge that it cuts off the foundation, round it off a little with sand-paper. For the first few trials, the wax may stick to the tongue rather than to the section. Scrape the former off smooth with a knife; wet it thoroughly with water or paste. The foundation, before insertion, should be warmed up to a temperature of about 110°. If the sheets are put in the direct rays of the sun, shining through a window, they will be soft enough. Some prefer to put the foundation in piles of perhaps 50, and then heat only one edge by means of hot a brick or a body of water in some kind of vessel kept heated by a lamp. Foundation must be tolerably soft or it will not stick firmly to the sections. This is the machine that is recommended and used by Dr. Miller, referred to elsewhere in this work.

COMB HONEY. I believe no other subject (unless it be that of wintering) has been so much discussed and so much improved upon as the one now before us. Our forefathers, with their old straw skeps and box hives, thought they had done well when they had secured the paltry amount of ten or twenty pounds of box honey. With the modern appliances it is possible to secure an average of forty or sixty pounds of section-honey; and occasional reports have shown that from 300 to 400 pounds have been obtained.

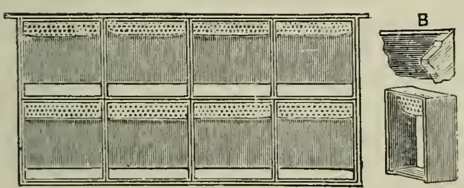
By the masses, a good article of comb honey is more highly prized than an equally good article of extracted honey (see EXTRACTED HONEY). While the latter can be, and, in the hands of the expert producer, is, equal in body, color, and flavor to the best comb honey; yet, as extracted ordinarily runs, the comb is a little superior in the qualities we have mentioned.

Comb honey can not be counterfeited, and, consequently, consumers are less suspicious of it. For these and other reasons, nature's sweet, in its original form, is in greater demand, and hence commands a higher price. To offset this, it also costs more to produce it, and requires, likewise, more skill and more complicated surplus arrangements to get a gilt-edged article. Years ago, all comb honey was produced in glass boxes. These were about five inches square, fifteen or sixteen inches long, glassed on both ends. They were not altogether an attractive package, and were never put upon the market without being more or less soiled with burr-combs and propolis. As they held from ten to fifteen pounds of honey each, they contained a larger quantity than most families cared to purchase at once. To obviate these and other difficulties, what is popularly known as the "section honey-box" was invented.

I was not long in adopting the new "section." My original box was made of six pieces—two on each side, and one for top and bottom. Each piece was the same size, and dovetailed at both ends. This section held about one pound and a half. For obvious reasons I thought it best that the section should hold just an even pound of honey; and to secure this, I found that a section 4¼ inches square would just permit eight to go inside a Langstroth frame, as shown on p. 73. These sections were first made of four pieces, to be put together with nails; but very shortly after, I constructed a section box of four pieces, dovetailed at the four corners. Two of the pieces (the top and bottom) were narrower, to allow of a passageway for the bees. Although my section box was at first ridiculed, it gradually grew in favor. It was just what was wanted—a small package for comb honey. Thus was accomplished, not only the introduction of a smaller package for comb honey, but one attractive and readily marketable. The retailer was at once able to supply his customer with a small quantity of comb honey without daubing, or fussing with plates. The good housewife, in turn, has only to lay the package upon a plate, pass a common case knife around the comb, to separate the honey from the section proper, and the honey is ready for the table, without drip. The wood cut away is then dropped into the fire. For "How to Make," see SECTIONS, under HIVE-MAKING.

SURPLUS ARRANGEMENTS FOR PRODUCING COMB HONEY IN SECTIONS.

It is the aim of every comb-honey producer to put his sections of honey upon the market in as clean and attractive a shape as possible; that is, free from propolis, burr combs, and stains, left by the bees. It is not possible to accomplish this perfectly by any present surplus arrangements, but it can be done to a very great extent, saving a great deal of after-labor. For the purposes set forth, two surplus arrangements are in vogue among bee-keepers; namely, the wide-frame system, and the crate, or case system. In the former, a frame of the size of the brood-frames is employed. This, instead of being only ⅞ of an inch thick, is 1⅞ in., or of a width

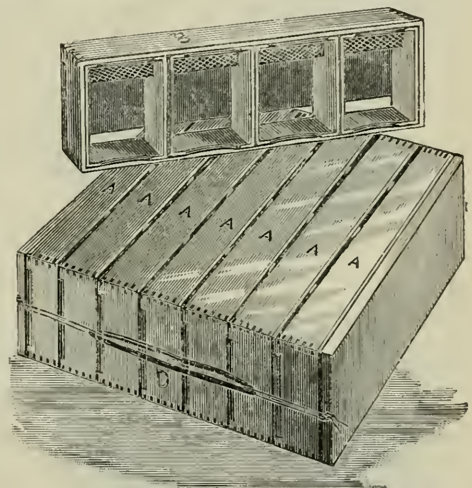


LANGSTROTH WIDE FRAME.

equal to the width of the section used. When one of these frames is filled with sections ready for the hive, the appearance is like the above cut, which represents a Langstroth wide frame filled with one-pound sections ready to be set into the hive. You observe, that all outside surfaces of the sections are protected, leaving only the edges of the sections subject to the propolizing of the bees. In the interstices formed by the contact of the sections, the bees will also crowd some of their bee-glue, particularly if the wide frames be a trifle too large for the sections.*

Wide frames are used with one, two, and, in rare cases, with three tiers of sections. The one figured above holds two tiers, and this is the one which has had a very large sale, and, consequently, is in use by a large number of bee-keepers. Since, however, it is not well adapted for tiering up (a term which will be explained further on), the single-tier wide frame is preferred. Notwithstanding this preference on the grounds of tiering up, of some of our best bee-keepers—notably, G. M. Doolittle, Borodino, N. Y.; James Heddon, Dowagiac, Mich.; Paul L. Viallon, Bayou Goula, La., large crops of comb honey have been secured in the double-tier wide frame. H. R. Boardman, of East Townsend, O., uses wide frames with three tiers of sections, and he gets a good crop of honey every year. But it is an open question in my mind, whether he could not secure as much or more honey by using one tier of sections at a time, on the plan of tiering up with less labor.

The single-tier wide frame used by Mr. G. M. Doolittle, and recommended by Mr. Viallon, is shown below.



DOOLITTLE'S SURPLUS ARRANGEMENT.

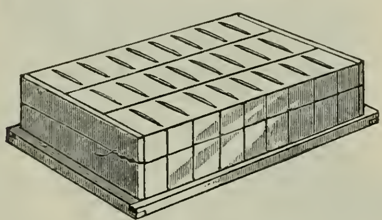
The several wide frames are clamped together by strong rubber loops, one at each end, attached to the side boards. Instead of the rubber, some use a wire loop, tension being produced by a little stick stretched across the middle. You will notice, also, that the wide frames have no projecting ends, and, indeed, are not necessary as they are used. The advantages of such an arrangement are, 1. It protects the outside surfaces of the sections; 2. It permits the ready shifting of sections in the outside row to the center, and *vice versa*. This feature is quite valuable, oftentimes, if it does not take too much time to do it. It not unfrequently happens that the sections in the outside wide frame are neglected by the bees, and it becomes desirable to have them filled out before the close of the honey-flow. All you have to do is, to lift the wide frame in question and in-

* Perhaps it should be remarked right here, that, as Nature "abhors a vacuum," so bees abhor any crack or crevice. It is highly important, therefore, that the wide frames should be close-fitting (see HIVE MAKING, elsewhere).

 COMB HONEY.

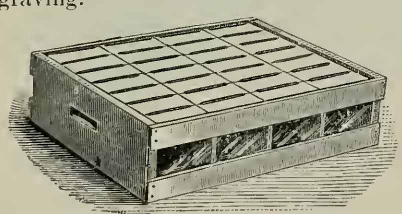
sert it in the center, where, if not too late, it will be filled out; 3. If the honey-flow is very light, one, two, or three of these wide frames, as the circumstances may demand, may be put on the hive at a time. The bees have only such space as they can occupy, and the storage room may be increased gradually as the needs of the colony call for; 4. Inversion can be practiced with this wide-frame arrangement when thought desirable.

Surplus arrangements of the latter type are quite varied in design. The first which I will mention, though but little used is hardly more than a honey board, or rack, with low projecting sides. It simply supports the sections, and protects their bottom sides from becoming soiled with bits of comb. A string holds the sections together compactly. The following engraving shows what it is.



A HONEY-RACK.

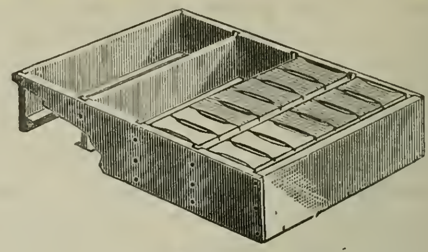
Another kind, which has obtained favor with some, is something after the following engraving.



COMBINED CRATE WITH SLATTED BOTTOM.

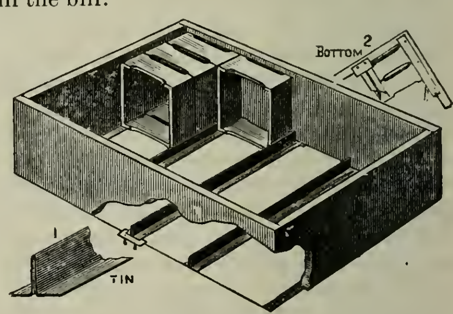
As you notice, it is simply a shallow box a little deeper than the sections. For a bottom it has a series of slats with indentations corresponding to the openings in the bottoms of the sections. The purpose of the slats is to protect the lower sides from bits of comb and propolis. It is something after the pattern of the one first described, only it has sides. This is called the combined crate, because it may be used for a retail as well as storage crate while on the hive. I don't recommend this crate, however, for sections ought always to be removed and cleaned.

The next engraving shows a crate after the Moore pattern; and as it differs so little from the one bearing the name of Mr. Heddon, I will describe the Moore only. You observe, that it is simply a shallow box, deeper by a bee-space than a section. Across it are transverse partitions. To the bottom



THE MOORE CRATE.

edge of each of these, as well as to the bottom of the two ends, are nailed strips of tin to form projections to support the sections. These transverse partitions serve both to strengthen the crates and hold the sections square—particularly the one-piece, which, if not properly made, are a little out of square. Of course, separators can not be used in such a crate, but some claim that more and just as cratable comb honey can be secured without. To them a non-separator crate is not objectionable. When the Moore and Heddon crate had its "boom" it was thought that separators could be dispensed with to advantage. A few think so yet; but the great majority, after carefully testing the matter, give their testimony decidedly in favor of separators. Principally for this non-separator feature in the Moore and Heddon crates, something had to be devised which would contain all their advantages and still permit the use of separators. The one figured below seems to fill the bill.



THE T SUPER.

For some years it was used by only a few bee-keepers, and practically it was unknown to the fraternity. It was not until C. C. Miller, of Marengo, Ill., recognizing some of its merits, described it in his book, "A Year Among the Bees" (see mention of this work in the back of this volume), that the attention of practical honey-producers at large was called to it.

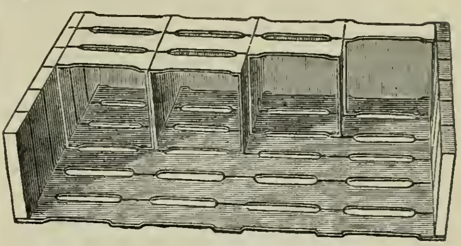
The following engraving shows a T tin itself.

T TIN.

As you will notice, it is simply a strip of tin folded in the form of an inverted T, combining simplicity with great strength. It can not be easily folded with ordinary tinners' tools, but requires to be made by special machinery. By referring to the engraving of the T super, you will see that three of these T tins, spaced equally distant, are used in each super to support the sections, as shown. A strip of tin is nailed to the bottom edges of each end, projecting far enough inside to support the ends of the sections. In the engraving, the T tins are repres ented as being supported by little pieces of strap iron (see bottom view); but more recently a double-pointed tack of the proper size, bent at right angles, is not only cheaper but neater. The two prongs of the staple are driven into the bottom edge of the sides, so that the horizontal portion projects far enough to support the T tin. This, as you will observe, brings them flush with the bottom, leaving the bee-space above the sections, as seen in the cut.

But the T super, for all its desirable features, has some disadvantages. 1. Open-side sections, which are preferred by some bee-keepers, can not be used in it. 2. As the upright of the T takes about $\frac{1}{16}$ of an inch, it leaves a space between two rows of sections, which the bees are inclined to fill with propolis. One-piece sections have a tendency to be diamond-shaped; and the T super, on account of the spaces between the rows, leaves them to lean against each other and from each other, in such a way as to leave ¼ inch, and in other cases almost no spaces at all. When these sections are filled with honey they come out of the super a little bit out of square, and this makes it somewhat difficult, sometimes, to crate.* 3. Bees will always fill the sections directly over the brood—that is, the central ones—before they will the outside rows. In order to make them fill out alike it is not an easy matter to change places with the central and outside rows.

Quite recently an effort has been made to combine the advantages of the wide frame with the advantages of the T super; and I believe it has been most successfully accomplished in what is now known as the section-holder.



THE SECTION-HOLDER.*

These are simply wide frames having no top-bars; thick end-bars and bottom-bars, with insets corresponding to the opening in the sections. Such a holder, on account of its accessibility from the top, unlike ordinary wide frames, can be filled and emptied easily, and, like wide frames, can be shifted from center to outside and *vice versa*. The end-bars are so thick, when nailed with wire nails to the bottom-bar, as to stand rigid. Sections 4¼ can be fitted into them, and they will be held, as a general thing, square. For ordinary wide frames, sections are liable to drop down from the top-bar, leaving a little space for the insertion of propolis. With the section-holders, gravity holds the sections close to the bottom-bar.

I said the outside rows can easily be shifted from outside to center, and this is no slight advantage during seasons when the honey-flow is slow, or rather meager at best. In the Dovetailed hive the section-holders are used in connection with a follower and wedge. To alternate sections, simply remove the wedge and follower. The section-holders may then be loosened by prying them apart. Having been wedged together in the first place, they will not stick very hard. Our preference, for these and other reasons, is for the section-holder arrangement. It is used largely in the east.

HOW TO SECURE COMB HONEY.

I have now described the different types of surplus arrangements in use for comb honey. Having selected the one best adapted for your purpose, you next desire to know how to secure comb honey. The first essential is to get a good STRONG WORKING FORCE OF BEES in readiness just before the expected honey-flow. To do this, brood-rearing in the spring should not be hindered or stopped for want of stores. If necessary, stimulative feeding should be practiced. In the mean

*This can be obviated by an extra set of T tins on top; or better, separator stuff ¼ inch wide.

*Engraving rather conveys the impression that the ends are solid. There are, in reality, six section-holders placed side by side. The separators are left off all except the last one.

time, if you have not already done so, you should see to getting your surplus cases ready—that is, filled with sections, and the sections with foundation, as given under COMB FOUNDATION. It is a great mistake to leave this to the last thing. A still greater mistake is to delay getting your supplies early. I hope my A B C scholars will bear this in mind. Many a fine crop of honey has fallen far short of what it might have been but for negligence in this important particular. I have talked—yes, scolded—through *Gleanings in Bee Culture* because bee-men persist in putting this matter off. When the bees are well started gathering honey, and the brood-combs begin to bulge, and the edges of the cells to whiten, you are then ready to contract, as given under CONTRACTION, further on, ready for the reception of surplus cases. Be careful about contracting too much, otherwise you may injure the fine quality of your comb honey by the admission of pollen. I think, therefore, I would not reduce the brood-nest to less than two-thirds of its former capacity.

TIERING UP.

If honey is coming in at a good rate, you may expect (if the bees have got started above) that the super, or case of sections, will soon be filled about half full of honey—the sections being in different stages of completion. When the super is about half filled with honey, raise it up and place another empty super under it. About the time this reaches the condition of about half completion, raise both supers and put under another empty one. This process of "tiering up," or "storifying," as it is called by the English, may be continued until three or four high, depending upon the length of the honey-flow and the amount of nectar coming daily. In the mean time the ripening process of the honey in the first supers continues. Usually it is not practicable to tier up more than three high.

CAUTION.

Care must be exercised in tiering up, or a lot of unfinished sections will be the result. When the honey-flow is drawing to a close, and you discover that there is an evident decrease in the amount of nectar coming in, give no more empty supers. Make the bees complete what they have on hand, which they will do if you are fortunate enough in your calculations as to when the flow of nectar will end. If uncertain whether another super is needed or not toward the close of the harvest, it is often advisable to put another super *on top*.[57] The bees are not likely to commence on this till they really need it. It is impossible to give general rules on tiering up; but with the assistance of the foregoing you are to exercise your own discretion.

WHAT TO DO WHEN BEES REFUSE TO ENTER THE SECTIONS.

At times bees will show a disposition to loaf, and consequently a disinclination to go into the sections. They will hang out in great bunches around the entrance, while the surplus-apartment is left almost entirely vacant, to say nothing of foundation being drawn out. This condition may be wholly due to the backwardness of the season. During those years (which are not frequent) when the bees have not yet filled their brood-combs after the honey season is nearly over, and, as the days progress, make little if any increase in the quantity of honey, we can not expect the bees to go above until all the available cell room below has been filled, as a rule. When this is crammed full, and there is a rush of nectar, they will commence work in the sections. Contraction (see that head elsewhere) is usually sufficient to start the bees. We will suppose you have a fair average season, and some colonies are storing honey in the supers, and others are not. With the latter, the trouble is clearly with the hive or with the bees. Some bees are much slower in going above than others. If honey is coming in freely, they can be baited, usually, by placing a partly filled section or two, of the year previous, in the center of the super. Sometimes a little bit of drone brood similarly placed may be used to advantage, but I should hardly recommend it, because it is liable to result in the discoloration of the sections next to it.[58] If the use of partly drawn-out sections, as explained, does not succeed in baiting the bees, go to a hive where the bees are already working in sections, if you can have access to such a one, and remove sections, bees and all, that are actually at work drawing out the comb. This will start any hive at work in the sections that contain bees enough to go to work. The sections should contain full sheets of foundation, because it has been shown, over and over again, that bees are much more ready to accept full sheets than starters. If you have complied with this, perhaps the hive is not properly shaded, and, as a consequence, the surplus-apartment is overheated by the direct rays of the sun. In this event, if you can not extemporize some kind of shade, use a shade-board, and smoke the bees above.

If the methods given still fail to force your bees to occupy the sections, and you have followed faithfully the instructions, the trouble is probably either because honey is not coming in sufficiently rapid, or because the brood-nest is not yet filled.

WHEN AND HOW TO TAKE OFF SECTIONS.

Usually it is not practicable to wait till every section in a super is complete; that is, until every cell is capped over. Those sections most liable to be unfinished will be in the two outside rows, and these the bees will be long in completing. If the honey-flow is over I would not wait for them to be completed, but would take the whole super off at once. The longer it remains on the hive, the more travel-stained the honey will become, and the more it will be soiled with propolis. Bees have a fashion of running through their apartments with muddy feet, and in this particular are not so very much unlike their owners. However, if you desire a really fine, delicious article of comb honey, one pleasing to the tongue and not so much to the eye, and are not particular about the white marketable appearance of the cappings, leave the super on the hive for two or three months. Most bee-keepers agree that comb honey left on the hive acquires a certain richness of flavor not found in honey just capped over. Although such honey is really better, it is not quite so marketable.

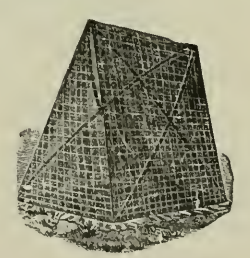
HOW TO GET BEES OUT OF THE SECTIONS.

There is one danger in leaving honey on till after the honey-flow. As soon as you open the hive, the bees, especially hybrids, are apt to uncap and carry some of the honey down. Whether you leave it on the hive or whether you remove it as soon as capped, the methods of taking off and getting the bees out will be much the same. In the former case, some supers may not be filled with honey, although a glance at the top may show nice white capped combs. Satisfy yourself by lifting one up and looking under. If capped below, it may be removed. To take off*, blow smoke into the top of the super for a little while, to drive most of the bees down; lift off the super, and set it on end near the entrance (not as it sits on the hive, or you will kill bees). If honey is coming in freely, robbers will not molest, and in two or three hours the bees will have left the super and gone into the hive.

Until you have had some experience, perhaps your safest plan is, never to set a super of honey by the hive. Sometimes it may be safe to let it stand there all day when the bees have more than they can do on the flowers; but, again, all at once it may start the bees to robbing, and demoralize them generally. A Davis brush (illustrated under EXTRACTED HONEY) can be used to very good advantage while smoking, as the bees pass out the opposite side. If robbers are bad, the supers containing the few bees that will stick and hang, can be carried to a darkened room designed for the purpose. Light should be admitted through an opening about one foot square. To each side of this hole, on the outside, should be nailed a piece of lath long enough to project six inches above the hole. To each lath is tacked wire cloth as long as the lath. This will leave $\frac{3}{8}$ of an inch passageway between the wire cloth and the side of the building. The adjoining diagram will make it plain. After a time the bees will leave their supers and fly to the opening. Here, as is the tendency of bees, they will crawl upward through the $\frac{3}{8}$ passageway, and escape. Robbers, instead of entering by the same way, will alight on the wire cloth, opposite the opening. Sometimes they will enter the passage—but rarely, I believe.

MILLER'S BEE-ESCAPE.

Another device for removing bees from sections is a bee-tent.

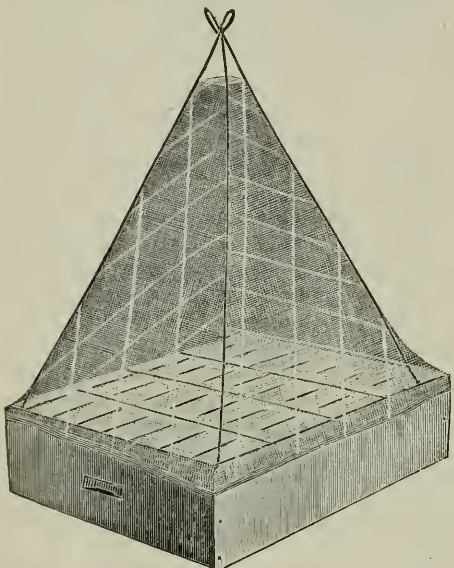


FOLDING BEE-TENT.

After removing as many bees from the sections as possible, take the crate[330] or crates, with the bees adhering and set them upon end on the ground. If many, pile them one upon another, alternately crossing. Now take the folding tent and place it over the crates. Before doing so, however, you should make an oblong hole (if there is not one there already) through the mosquito bar near the peak of the tent. The bees, on leaving the crates, will fly bumping their heads against the sides of the tent, until they arrive at the peak, where they will make their escape through the hole referred to above; but not one will have sense

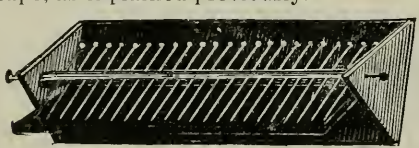
* The plan here given is the one recommended by Dr. C. C. Miller, Marengo, Ill.

enough to come back by the way he came. In this way, the crates of sections will soon be freed from the bees; and, as no bee will enter by the hole from the top, there will be no danger from robbing. When the bees are all out, another set of crates could be freed from bees in like manner. I need hardly add that the bee-tent and the section-crates should be placed in some shady place.



MILLER'S TENT ESCAPE.

C. C. Miller, carrying out the idea of the bee-tent, went a little further and constructed a miniature bee-tent to set directly over the pile of filled supers. It is simply a piece of mosquito-netting made into a sort of cone-shaped hood. Two V-shaped wires, with a loop in the apex, are leaned against each other in such a way as to hold the netting in the shape of a pyramid. The opening is about 1½ inches wide, and is made in the netting at the apex, where the bees will escape, as explained previously.



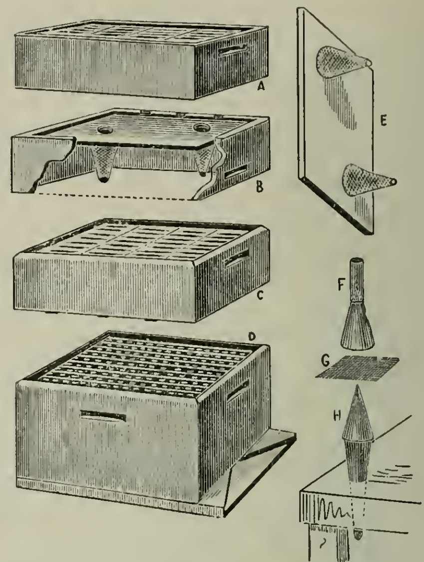
POUDER'S BEE-ESCAPE.

My plan is to prepare a close-fitting box with an entrance (or, rather, place of exit) similar to that of the chaff hive; over this entrance I have arranged a sort of trap so that the bees can pass one way only. Take a wooden bar about the size of a lead-pencil, and put through it a row of common pins, about 7 to the inch; this must be swung on pivots, so that the pin-points may rest on the "jumping-off board."

WALTER S. POUDER.

Groesbeck, O., March 24, 1884.

Another bee-escape which seems worthy of mention was described and illustrated in 1888 in our journal, *Gleanings in Bee Culture*, page 15. The engraving below shows almost at a glance how the implement works.



REESE'S CONE-CASE BEE-ESCAPE.

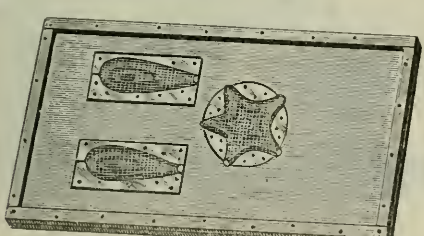
The device itself is shown at B, and is the invention of J. S. Reese, Winchester, Ky. It consists simply of a board of just such a size as to fit into the surplus arrangement. This board has two pairs of wire-cloth cones (a small one inside of a larger one), placed directly over holes in the board, as at E. This board is then dropped into an ordinary T-super shell, cones upward. The little pieces of strap iron serve as stops. The board is then nailed. For use, the whole is inverted as at B, in the engraving, and the apexes of the cones are now downward, ready for use. The figure at the right explains how the wire cones are made. G is a square of wire cloth. The funnel-shaped implement, F, crowds G over the solid cone H. F is removed, and G is now converted into a perfect cone. A sharpened stick (the size and shape of a leadpencil) enlarges the central mesh of the apex to the proper size of hole. The construction of the rest of the cone-case is self-evident from the engraving.

The principle upon which this cone-case bee-escape operates is, that bees will pass through the large end of a cone when they would never think of crawling up to the apex and entering through the small hole. In the engraving, A is a super filled with comb honey, from which we desire to remove all the bees. C is a super with empty sections ready to put on the hive. The cone-case bee-escape is put between the two, and the cover placed on A. The bees will pass down through the two holes opposite the cones, but none will pass back again by the way they came. The inventor informs us that, in two or three hours, every bee is out of the super into the hive and lower section-case. He takes advantage of the fact that bees have a tendency to go toward the brood-nest; and just as soon as they have done so they can not get back again—at least, they are not sharp enough to tell how they got there.

This and the horizontal escapes can be used in another way: Remove a number of filled supers; stack them up in a convenient place, say eight or ten high, and then set the cone-case on top. Instead of the cones being downward, as in the former instance, when on the hive, they are above the board E. After a few hours the bees will have passed upward through each successive super, until they reach the bee-escape, when they will pass out and return home.

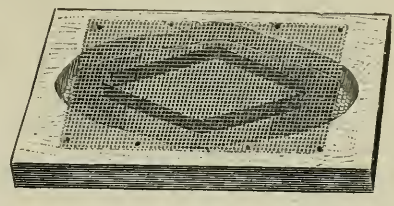
HORIZONTAL BEE-ESCAPES.

During the year 1890, Mr. Charles H. Dibbern, of Milan, Ill., conceived the idea of turning Mr. Reese's cones upon their sides, as it were, thus getting rid of their perpendicular projecting points. This makes what is called the horizontal bee-escape. The thickness is reduced to about ¼ inch, and is flat. The same can be fitted onto any ordinary honey-board without slats.



DIBBERN'S HORIZONTAL BEE-ESCAPE.*

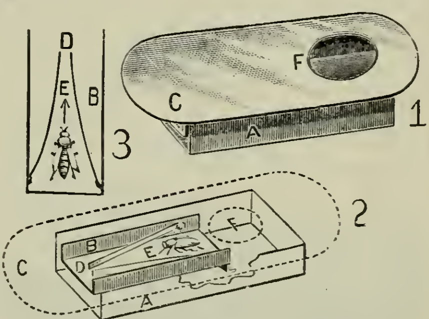
The engraving represents one that Mr. Dibbern first introduced, and is one of his best. Instead of taking a whole super, as at B, as shown in Mr. Reese's cone-case bee-escape, an ordinary honey-board with the ordinary bee-escape under it answers the entire purpose. The bees pass out of the super at A, through the honey-board, into the next super or brood-nest. As it is difficult to get back, there are very few indeed that do.



REESE'S HORIZONTAL BEE-ESCAPE.

After Mr. Dibbern had introduced his, Mr. Reese made a model like that shown in the engraving, and which he says works very satisfactorily. This is "let in" the board so that both surfaces are flat, and the thickness of the escape is regulated by the thickness of the board.

While either of these bee-escapes will generally empty bees out of an ordinary super over night, there are occasionally three or four bees, possibly more, that find their way back.



PORTER'S HORIZONTAL BEE-ESCAPE.

Mr. E. C. Porter, of Lewiston, Ill., introduced in 1891 one devised by his father, a cut of which appears above. This is somewhat on the principle of the Pouder escape. The bees, instead of passing under pin-points, pass through a couple of sensitive springs, that converge at D, in Figs. 2 and 3. The bees pass down the hole at F, Fig. 1, enter the passageway at E, and pass through D by spreading the springs. These springs come together close enough so that the bees are unable to return again. This escape in our apiary rid *every bee* out of the supers. But it has two objections—expense of manufacture, and sometimes a bee will get caught at the apex of the springs, and die there, and thus the object of the escape is thwarted. But I believe these cases of clogging are rare.[59]

THE ADVANTAGES OF THE LAST FOUR ESCAPES.

In smoking out most of the bees and then letting the remnant of them escape through

*The star-shaped pattern shown with its five points of exit did not work; i. e., the bees found their way back too readily. The pear-shaped form worked satisfactorily in our bee-yard.

the tops of bee-tents and fly home (if they can), there are the young bees that can not fly home, and these are quite apt to become lost. The smoking is also liable, at times, to cause the bees to uncap the honey. With any of the last four escapes, both of these difficulties are nicely avoided. The young bees go down into the hive, and every thing is done so quietly that there is no uncapping, no interruption of the work of the bees to and from the entrance, and the labor of the apiarist is also saved.

Any of the last four named can be used for EXTRACTING, which see.

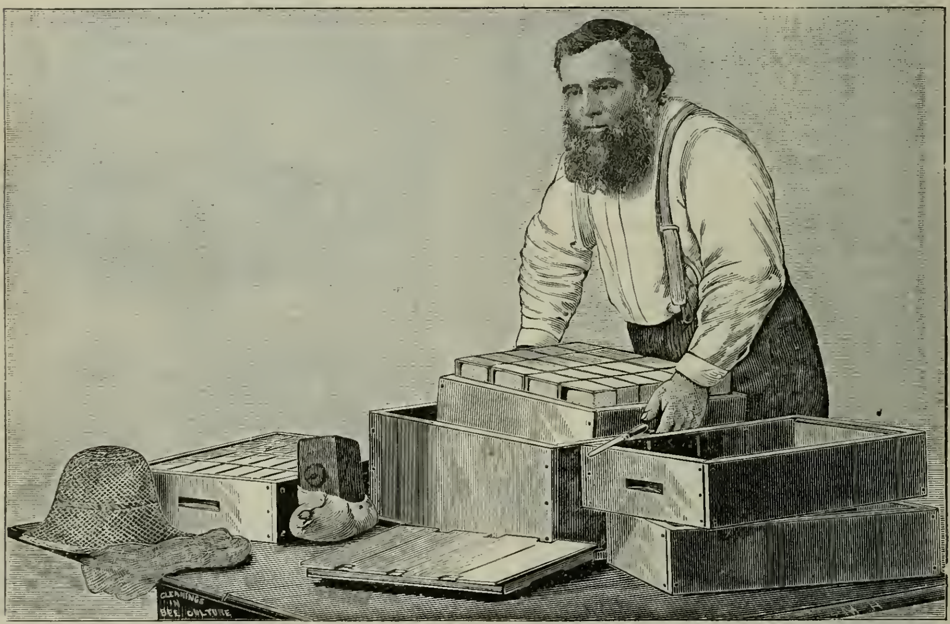
HOW TO REMOVE FILLED SECTIONS FROM WIDE FRAMES OR CRATES.

My friend, Dr. C. C. Miller, has adopted a very ingenious plan of emptying the sections from the T super, *en masse*. To accomplish this, all that is necessary is to construct a suitable follower, or a bearing-board. This, pushed from below, will crowd the sections out at once, together with the T tins, which are not made stationary, pressure being exerted upon the ends of the super. The manner of accomplishing the operation will be seen by the engraving above.

The bearing-board is shown in front of the table. You will notice that the two sides are notched out, in order to avoid, in the passage upward, the little pieces of strap iron, or bent wire staples, as the case may be. For the sake of strength it is cleated on the under side with ⅜ pieces. Its dimensions should be a trifle smaller than the inside dimensions of the super, so that it may not bind when crowding out the sections. A suitable frame supports the bearing-board to the proper height. In order to place the super squarely over this bearing-board, without looking under to see whether it is in the right place, Dr. Miller has arranged a box around the bearing-board, at such a distance from it that, when the super is fitted up in one corner of said box, a downward pressure on the super will crowd it down on the bearing-board squarely. One of his methods of emptying his super is illustrated below.

A SIMPLER METHOD OF EMPTYING T SUPERS.

The machine for taking sections out of T supers as shown above, although its use is easily understood, is somewhat difficult to make. It requires nice adjustment to make it so that the super may instantly be placed exactly right over the bearing-board. The sections can be taken out with no other apparatus than the bearing-board, and, indeed, at times this is perhaps the better way. The operation is as follows: Place over the super a board about the size of the super—a flat hive-cover will do. Now turn upside down both super and board held



HOW DR. C. C. MILLER REMOVES FILLED SECTIONS FROM THE T SUPER.*

* The likeness of the doctor above is excellent.

together, making the super now rest on the board. Place this on a hive or box so as to raise it a foot or less from the ground. Place the bearing-board on the sections; press your weight on the center of the bearing-board, and then pound gently about the edges of the bearing-board until the sections settle down the quarter inch or so; then, placing the right knee on the middle of the bearing-board, lift the super rim off the sections. If this is done in warm weather when propolis is soft, it will not be as easy as it reads to start the sections out of the super. Propolis, when warm, has that aggravating quality that it will not be hurried, and you may pound hard enough to break the sections without starting them; but if you let them stand *long enough* they will fall by their own weight. So take it easy; turn around and sit down on the bearing board, and meditate on the blessings you enjoy; and when you have sat and rested about as long as would be necessary to pound the sections loose with cold propolis, you will find that your sections have dropped without your noticing it.

HOW TO EMPTY THE SECTION-HOLDER SURPLUS ARRANGEMENT.

As explained under SECTION-HOLDERS, a little further back, there is a great advantage in *wedging* up surplus arrangements. The object of this is twofold: 1. To reduce cracks and crevices between the sections where they come in contact, and so reduce the amount of propolis that would ordinarily be secreted in these places; 2. To facilitate the removal of the sections, or to permit of alternating the outside rows of sections from outside to center, as already explained. With a follower and wedge, no bearing-board nor any special machinery is necessary to remove the sections. Remove the wedge and the follower-board, and, with the wedge, pry loose the section-holders by inserting one end into the rabbet of the super. A little prying against the ends will loosen each section-holder. You can then lift them out. To remove the sections from the section-holder, invert it, spread the end-bars a little apart, and, at the same time, with the thumbs press on the bottom-bars. This will loosen the propolis connections, and the sections will drop out readily.

HOW TO EMPTY THE MOORE CRATE.

If you use the Moore crate, the method of removing the sections will be very similar to the T super plan. By referring to the subject of HIVE-MAKING, you will see there are three divisions, or partitions, and consequently the follower should be made so as to pass up between these partitions, and raise the sections. To make this follower, take four pieces of wood, in length a little less than the inside width of the super, and about 3¾ inches square, or of such a size as will slip between the partitions easily. Space these so the partitions will pass between them readily. The operation of removing sections from the Moore crate is more difficult than from the T super. Some have not been successful in doing it without breaking the sections. In the T super there is very little opportunity for the bees to make propolis attachments. In the Moore crate, the propolis attachments are made not only around the sides but against the partitions, thus making the removal more difficult.

HOW TO REMOVE SECTIONS FROM WIDE FRAMES.

A great many of my readers are doubtless still using double-tier wide frames. As with the crate and supers, it will hardly pay to pick them out individually, after they have been filled. Before C. C. Miller adopted the T super, he employed the following method:

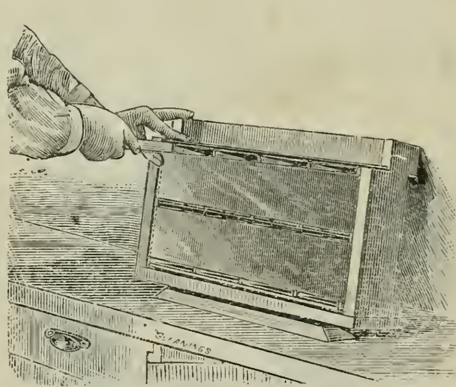


FIG. 1 — PUSHING OUT THE SECTIONS.

Fig. 1 shows a sort of frame for holding a wide frame containing sections. This frame is so constructed as to hold the wide frame securely while the sections are pushed out from between the separators with the push-stick shown. Insert a wide frame in the rack. With a common jack-knife, sever the propolis connections between the top and bottom bar. You are next to grasp the large end of the push-stick shown in Fig. 2. Beginning with the upper right-hand corner, push that section until the shoulder on the tenon end strikes against the separator. Do likewise with the other three corners. This tenon end with a shoulder prevents jamming into the honey, and the small projection is just long enough to break the connection and partly start the section. Next change ends with the stick, and push carefully around it in the same order as before, at the same time crowding out the middle. Be careful not to push one section very much in

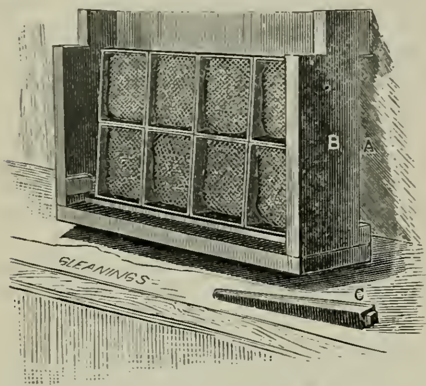
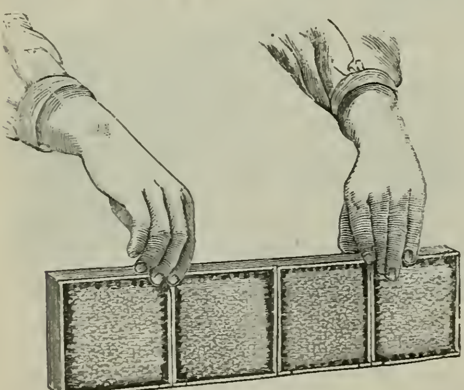


FIG. 2 — SECTIONS REMOVED.

advance of the others, but give each a gentle punch, just enough to crowd them all about equally. When they are pushed out they fall back against a cloth backing which stretches across the back of the two ends, as shown at A, Fig. 2. You are now ready to remove the wide frames, when the sections appear as shown in Fig. 2. Grasp them with the two hands, as shown below, four at a



METHOD OF HANDLING SECTIONS.

time. Lift them out, and repeat the operation. Dr. Miller's son, by his method has removed as many as 950 in an hour at his best—not a bad record for a boy. For details in regard to constructing this apparatus, you are referred to Dr. Miller's work, "A Year Among the Bees."

SCRAPING SECTIONS.

In order to make sections present a clean marketable appearance, all propolis should be scraped off. Some prefer, for this purpose, a case-knife; others, an ordinary dull jack-knife. But whatever implement you use, scrape the sections nice and clean. Be careful not to gash into the honey. Before you commence the operation you had better put on some old clothes, because the particles of propolis will be almost sure to ruin good clothes.

WHAT TO DO WITH UNFINISHED SECTIONS.

This is one of the serious questions among comb-honey producers, and a great deal has been written on the subject. The more carefully the apiary is manipulated in the matter of tiering up (which see), the fewer will be the number of unfinished sections, but they are not, however, always the result of improper manipulation. With the best of care, a sudden stoppage of the honey-flow will put upon the bee-keeper a lot of these sections. But perhaps you inquire why they are so undesirable. In the first place, on the market they sell very slowly; and if at all, for several cents less per pound. Second, they are liable to leak and drip during shipment, and, worse than all, daub the nicely finished sections which may be next to them. Third, they must be stowed away somewhere inaccessible to robber-bees till they can be disposed of.[60] In the meantime, what shall be done with them? It is desirable to convert them into cash in some way with as little expense as possible. Various bee-keepers have advocated various ways of making use of them.

USING THEM FOR BAITS.

Some say, keep them over till the following season and use them for "baits" in the sections as previously explained. It is generally agreed, that, for baits, they subserve a very useful purpose; but where one has a good many there will still be a large number to be disposed of in some way.

Serious objection has been made to using as in this way, or in putting back on the hive a section containing the least bit of honey left over from the previous year. The old honey is said to affect the new, and the empty comb is just as good for bait as if it contained some honey. In fact, the bees often, if not generally, remove the old honey before putting in new. Either let the bees empty the sections in the fall, if you want them for bait, or extract them and then let them be thoroughly cleaned *by the bees*. Better use up, as under the head of SELLING FOR LESS MONEY, all sections that have enough honey in them, and let the bees clean out in the fall those having less honey, and you will probably have enough for bait.

THE FEEDING-BACK METHOD.

Another plan is as follows: After sorting out the unfinished sections, put them into the regular hive-crates and set them over strong colonies when the honey-flow has stopped. In order to have these sections built out it will be necessary to feed extracted honey. Dilute with water to about the consistency of raw nectar, in the proportion of one pound of water to 10 lbs. of honey. The water should be heated, as the bees will take the mixture much more readily. Feed in large feeders toward night. As the bees will be greatly excited when fed, they will be apt to rush out of the hive pellmell, and at that time there is less liability of trouble from robbers. Give them all the feed they will take, and as fast as they will take it.

While some have been successful in thus finishing out and making salable unfinished sections, the majority have not been so successful. Some of the objections to feeding back are, first, that it has to be done at that time of year when robbers are worst, and that, unless the sections are carefully put in the crates preparatory to putting on the hive, they will have a botched appearance. The combs, likewise, are apt to be travel-stained. In localities where foul brood has existed, or does exist, it is dangerous to the welfare of the apiary. Last of all, the honey in such sections is more liable to candy. Unless you have a great many unfinished sections you had better not attempt feeding back. It can be made to pay only under the most favorable circumstances and the best management. Even then, only about three pounds out of five of the honey fed is obtained in comb honey. Sometimes, however, there is no appreciable loss. See Feeding Back, under Feeding.

FOR WINTER FEED.

Some bee-keepers reserve these unfinished sections, and place them on those hives that are likely to need a little more stores for winter. The bees will empty them and carry the honey below.

EXTRACT THE HONEY FROM THEM.

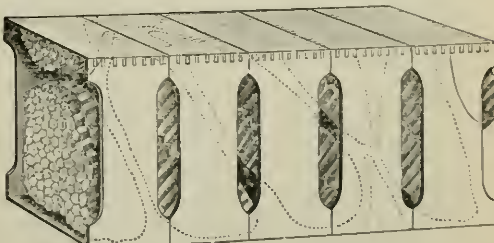
Another method is to extract the honey and place the sections on the hive, to be cleaned up by the bees. Put the sections into wide frames. After being uncapped they are extracted in the usual manner. But as this involves a good deal of labor, I believe the plan is not very largely practiced.

SELLING FOR LESS MONEY.

Still another method, and I believe it is the best where it can be done, is to sell such honey for two or three cents less per pound. You can state to the buyer that the honey is just as good, only it does not present quite so nice and marketable appearance. If you have only a small number of such sections you can use them up in your own family.

SHALL WE USE SEPARATORS?

A few years ago there was considerable discussion among prominent bee-keepers, as to whether separators could or could not be dispensed with profitably in the production of comb honey. Some stoutly maintained that they could, and others just as strenuously asserted that they could not. The former class urged that they could secure more honey without separators, and consequently that they could put up with the inconvenience of some few sections bulged out beyond the sides. While the latter class were ready to admit that *perhaps* a little more honey could be secured by the non-use of separators, they asserted that they obtained so much uncratable honey, and were put to so much inconvenience in trying to so arrange the sections as to have them built out evenly, that they never wanted to dispense with separators. It should be remarked right here, that, with the narrow sections, as, for instance, $1\frac{3}{4}$, $1\frac{1}{2}$, or $1\frac{3}{8}$, the separators are not so necessary as with the wide ones, such as $1\frac{7}{8}$ or $1\frac{15}{16}$. Full sheets of foundation in either case greatly lessen the need of their use. At the present time, however, by far the greater majority of the producers of comb honey advocate and use separators; and as our experience in former years was so unsatisfactory without separators, we are compelled to agree with the majority.



NON-SEPARATOR COMB HONEY.

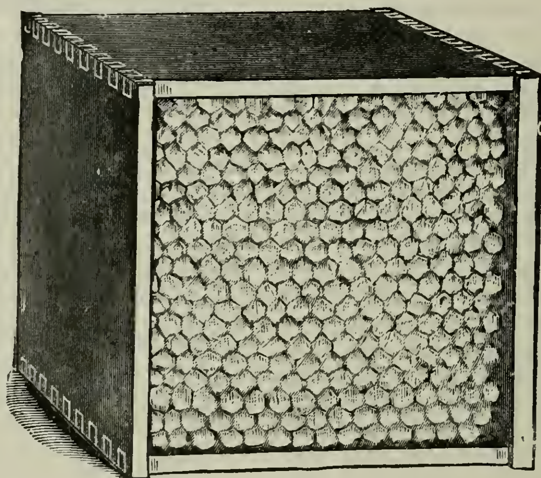
The accompanying engraving is reproduced direct from a drawing made of a series of sections of comb honey that were built without separators. The dotted lines show the direction the comb honey takes in passing back and forth from the sections. While this is an exaggerated case, it shows the tendency to which combs are liable to bulge without the use of separators. This row of sections was taken from several thousand pounds of honey which we purchased, over half of which was bulged, and a large percentage was almost uneratable.

WOOD OR TIN SEPARATORS.

Objection has been made to the tin separators, because of their metallic coldness. It is urged, that the smooth sides of the tin are not congenial to the bees, and that, furthermore, the expense of separators made of tin is greater than most bee-keepers can afford, in consideration of the low price of their product. Partly for these reasons, and partly for others, wood separators costing an almost insignificant sum have been made. They are cut out on a slicing-machine, and are really thin veneer wood, cut to the size of the separator. The thickness varies all the way from 28 to the inch up to about 16. The preference seems to be in favor of the thicker ones, for reasons presently to be given. Wood separators are now made so cheaply, that, after one season's use, rather than to fuss cleaning them of their propolis, they can be thrown away and new ones purchased. Another advantage, and an important one too, is this: The sides of the wood being rough, the bees are able to walk over the separators, while they could with difficulty cling to the tin ones.[61] The consequence is, instead of crawling over the nice clean surface of capped honey, they will just as readily select the wood, and so save just so much foot-stained honey. As I have already remarked elsewhere, bees, like their owners, have a fashion of going into their apartments sometimes with muddy feet.

There is one serious objection to wood separators, and that is, that they will warp and curl up. This difficulty is greatly lessened if, instead of 28 to the inch, they are cut 15 or 16 to the inch.

Experience says, "Never use tin separators loose, as in T supers; and never use wood separators where they are to be nailed on, as on a wide frame." The objectionable curling of wood separators occurs only where they are nailed on, when shrinking and swelling makes them curl. Where placed loose between sections, as in the T super, the tin separator troubles by bending endwise, while the stiff grain of the wood prevents this, and, not being nailed, the wood separator can shrink and swell without curling, even if very thin. Wooden separators are so cheap that you may find it better to throw them away after using once, rather than to clean the bee-glue off them.



A SECTION BOX FILLED WITH HONEY.

WHAT SIZE OF SECTION TO USE.

To answer this question intelligently for yourself, it will be well to consult the honey-market reports. As a general rule, sections holding an even pound of honey are preferred by consumers, and, of course, they bring a higher price. Notwithstanding this, few bee-keepers think that more honey can be secured in two-pound sections than in the smaller sizes. Most bee-keepers, however, are not so sure that it makes any difference to the bees: and while the fact remains that, in most markets, they sell for from one to two cents less per pound than the one-pound, it behooves every bee-keeper to think carefully before he decides on adopting two-pound sections. The size of section which seems to have the general preference is 4¼ inches square and 1⅞ inches wide. Aside from its being more marketable, it fits most of the surplus arrangements in use, while very few if any two-pound sections can be similarly adapted. The engraving gives a very good representation of a one-pound dovetailed section nicely filled with honey.

NARROWER SECTIONS.

Some markets demand a smaller package. Instead of going to the expense of making smaller sections, supply-dealers have been in the habit of making the regular 4¼ sections narrower—1¼, 1⅜, 7 to the foot, 1½, 1⅝. The seven to the foot hold about three-quarters of a pound, while the 1¼ and 1⅜ hold about half a pound.

There is a very great advantage in diminishing the *thickness* of a section instead of the *size*, for this reason: They will fit most of the surplus arrangements in use, and can be shipped readily in ordinary shipping-cases, with but little trouble. In 1884, '85, and '86, there was a great rage for the narrower sections, but most bee-keepers, if not all, have gone back to the regular one-pound section—4¼ inches square and 1⅞ or 1$\frac{15}{16}$ in. wide, as most suitable for the bulk of their honey. A small part of their crop they may have stored in the narrower sections to supply a local demand. If you feel moved to try variety of size in sections, do it on a very small scale or you will be sure to rue it.

OPEN-SIDE SECTIONS.

Within the last two or three years, the open-side (or, as our English friends term it, the four bee-way) sections have been brought before the bee-keeping public. These sections, as their name indicates, not only afford a passage to the bees from the top and bottom, but afford equal access from the sides. The advocates of such sections claim that the bees are much more ready to enter them, and that, as a rule, they are better filled out. It is argued, also, that the bees are loath to enter surplus arrangements divided up into several long canals, as it were, where the ordinary closed-side sections are placed side to side; that, in consequence of this, the open sides, for the reason that they afford passageway from all directions, are preferred by the bees. Theoretically they possess points of superiority over the closed sides. As yet very few are willing to admit that this is so in practice.

Notwithstanding the advantages above named, they have two or three quite serious drawbacks. (1) In consequence of their being made open all around, the corners project so as to make it difficult to insert and remove them from ordinary surplus arrangements. (2) In order to work them to the best advantage, a surplus arrangement especially adapted for them should be used. (3) Separators can not be used with them readily. At the present time they have not had a very thorough test, and it is not known definitely whether they will ever come into general use or not.

MARKETING COMB HONEY.

There is nothing that can make a bee-keeper feel better than clean cash for his surplus honey at the end of the season.—*Adam Grimm, page 86, Vol. I.*, —GLEANINGS.

Every thing, nowadays, depends on having goods neat, clean, and in an attractive shape, to have them "go off" readily; even our hoes have to be gilt-edged, for I noticed some at a hardware store a few days ago, and it seemed that those that were gilt, or bronzed, perhaps, were selling far in advance of the plain steel ones. We have been told of gilt-edged butter that sold for fabulous prices, but I hardly think it will be advisable to have our honey put up in that way, although we do wish it to look as well as any other of the products of the farm.

In order to get a fair price for your honey, you should watch the markets. To obtain this information, you should take one or more bee-journals. Through the medium of these you will learn whether the honey crop is going to be small or large. This you can not tell definitely from your own locality. If you have secured a good crop of honey, and you learn that the crop throughout the country is small, you must not be in haste to dispose of yours to the first buyer. In any case you must exercise your judgment.

SENDING HONEY TO COMMISSION HOUSES.

I believe the commission houses throughout our cities are great aids to bee keepers in disposing of their honey; notwithstanding, I want to enter a word of caution right here against being in too great haste to lump off your honey to these places. You may argue that you have not time to dispose of your product in small amounts; but many a bee-keeper has found to his sorrow the mistake he made in contributing to the flood of honey at a certain commission house. The consequence is, that at that place honey is "a glut on the market," and must be sold at a very low price. As a general rule, I believe I would sell elsewhere bef re shipping it off to the city.

As Dr. Miller has had a large experience in marketing and shipping comb honey to commission houses, I will here quote from his "Year Among the Bees," page 97:

I have had no uniform way of marketing honey. I should prefer in all cases to sell the crop outright for cash, if I could get a satisfactory price; but many, if not most years, I can do better to sell on commission. Judgment must be used as to limiting commission-men to a certain price. Some commission-men will sell off promptly at any price offered, and when sending to such men it is best to name a certain figure, below which the honey must not be sold. I have sold in my home market, as well as in towns near by, and have shipped to nine of the principal cities, and it would be an impossibility for me to say what would be my best market next year. Prices vary according to the yield in different parts of the country. If shipping to a distant point in cold weather, I keep up a hot fire to warm the honey 24 hours before shipping. If very cold I wait for a warm spell. On a wagon, the length of a section should run across the wagon—on a car lengthwise of the car. I always prefer, if possible, to load the honey directly into the car myself. Then I know that it will carry well, unless the engine does an unreasonable amount of bumping. * * In deciding between a home and a distant market, there are more things to be taken into consideration than are always thought of. There is breakage in transportation, and the greater the distance the greater the risk. If I can load my honey into a car myself, and it goes to its destination without change of cars, I do not feel very anxious about it. On this account a car-load is safer than a small quantity, for a full car-load may be sent almost any distance without re-shipping. If re-shipped, it is not at all certain how it will be packed in a car. * * * There is less danger of breakage by freight than by express. Besides danger of breakage, there is risk of losing in various ways. You may not be able to collect pay for your honey. If sent on commission, the price obtained may be less than the published market report. You have no means generally to know how correct the claims for breakage may be. In fact, unless you know your consignee to be a thoroughly honest man, you are almost entirely at his mercy. A quarter or half a pound may be taken off each case by the claim that it is custom to reject fractions. Taking all these things into consideration, together with the cost of freight and shipping-cases, it must be a good price that will justify a man to ship off honey to the neglect of his home market.

Mr. and Mrs. Axtell, of Roseville, Ill., are extensive bee-keepers, and their annual product goes up into the tons. As they also have had a large experience in selling honey on commission, we have thought best to give an article from *Gleanings in Bee Culture*, page 803, Vol. XVIII., written by Mrs. L. C. Axtell, on the subject. She covers every point; and any one contemplating selling honey on commission will do well to read it carefully. It may save loss, trouble, and vexation all around.

SELLING HONEY ON COMMISSION.

In the first place, I think people do not understand how to deal with commission men, as was the case when we began selling honey. The man who has honey or other farm produce for sale, more than he can well dispose of at home, should go to one or more of the grocers in his nearest large town, and get the names and address of several commission men, and ask this grocer whether his dealings with such and such a man have been fair and honorable, and note it down; then select the man he thinks he can trust, and send to him for his circular giving daily prices of farm produce.

Possibly the producer has friends living in the city who could make inquiries for him, for a trusty commission merchant. That business is like all others—some very honorable men are engaged in it, and some very dishonorable ones as well. Then write to the man, telling him that you have honey to sell, and that, if he wishes to handle it for you, you will send him some. Send as soon as possible after his reply, *but not before*. Yet, one need not be in too big a rush, as we have found by much experience that the apiarist has plenty of time to sell his honey during fall and winter, and we always get just as good prices during the early winter months as in the fall months; yet I would sell as fast as I could conveniently get at it after the first of September, as honey sells most rapidly in October and November.

We always try to ship the first of the week, not later than the middle, that the honey may arrive at its destination the same week. The apiarist should accompany the honey to the cars if possible, and help load it on, spreading out paper to set it on, and see that it is piled in with the ends of the section to the end of the car, the piles of cases not too high. The pile against the end of the car may be higher than the outside, and glass always inward, to avoid breakage.

Sometimes we can get a through car, so that it will not have to be changed from one car to another, which is often the cause of broken honey. Sometimes we can send it in a refrigerator car, which is a through car, and we could never see that the cold injured the honey. Send the bill of lading in the letter to the commission merchant, telling him how much per pound you ask for the honey. Sometimes we may name the price too high, and he can not sell; in that case he may hold yours and sell for others who have not named so high a price; but generally he will not hold it long, as he wishes his goods to move off, and he will either sell or notify you the price is too high, so you can write him again, lowering it. Of course, you keep yourself posted on the honey market. He has no right to sell at a lower price until you give directions. If the apiarist names no price, the commission man, if he is honest, and wishes your patronage, will do just as well by you as if you named your own price; but if he is not honest, it gives him a chance to cheat you if you leave the price with him, as I know they do sometimes sell at a better price than they report to the apiarist. If he is slow in writing you, write him again, and ask him how soon he will be sold out, and can handle more. Insist on having pay for as many pounds as are sent, fractions included, except, if the fractions result in less than 5 cts., it is usual to throw that in. Yet if the returns fall short 5 or 10 lbs. on several hundred, I should say nothing about it; but if it fell short much more I would instruct the commission man not to do so again, as it is not rulable—at least, this is what our most honest commission merchant wrote us when we asked him why it was his returns were so accurate, seldom falling short any in the least. The just weights, with fractions thereof, should be plainly marked on one end of the box of honey, and the commission merchant's address stenciled or plainly written on *top*, not on the side, so that the case need not be turned over to hunt the name.

Do not send very large shipments at first until you can trust your man, and then it is better to have less at a time, and quick returns, if one wishes the money to use; and the apiarist can care for the bulk of his honey better at home than the commission merchant can, only seeing to it that he has it as fast as he can sell it. There is one advantage in sending large shipments—it is not quite so apt to be changed from one car to another, and consequently it is not so apt to be broken up.

If an apiarist has honey enough to furnish a commission man all he can sell, so that he handles no other honey, that also is an advantage both to him and you. In that case it is well to ship to him just before he is out.

Always write him kindly and firmly, as if you expected him to do what is fair and honest. Unless you are personally acquainted, never take a note from him after the honey is sold. If he has used your money, and says he can not pay you, it is a criminal act; for it is criminal to sell on commission and use that money to carry on his business. And if, after all care and painstaking, you are about to lose your money (which you will not do once in a hundred times, and perhaps never), you can put your case into the hands of a trusty attorney, to collect for you. He will charge about 30 per cent, which seems high; but sometimes he will do it for less, which probably would be cheaper for you than to make a trip to the city, if far off, and you are pressed with business at home. More than likely it would never have to be taken to court. If the attorney simply states the case to him plainly, the man would see that the better way would be to get the money for you. In Chicago, 5 per cent is rulable for selling on commission.

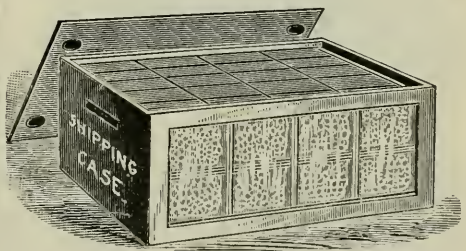
In case of a loss when honey is shipped, get a statement from the freight agent where the honey was shipped or started, the number of cases sent, and in what condition, and put it in a letter, with a statement from your commission merchant of the amount of loss, and inclose with it the original expense bill, and send to the freight agent where the honey was consigned, for him to forward to the general freight agent of the railroad company. Do not send in an extravagant bill, but just what the lost honey would bring you, and you will always, in time, get your pay—at least, such has been our experience. At one time we sent honey to two commission men. It was put together in the same car. One was received all right, and the other was badly broken up—so much so that 150 lbs was unsalable. In that case it was probably broken by the drayman, in transit from the car to the commission house.

In very cold weather, several days before we ship honey we bring the cases of honey into a warm room, so that they may be thoroughly warmed through before starting; and, if packed compactly in a car, we think it not so apt to break down as to ship frosty combs. At any rate, we like to have it in the very best shape when it leaves our hands. We generally try to ship at the close of a cold spell, just as the weather begins to grow warmer, so that the honey may not be out in the coldest of the weather. MRS. L. C. AXTELL.

Roseville, Ill., Oct. 22.

SHIPPING, AND SHIPPING-CASES FOR COMB HONEY.

Just as soon as your crop of honey has been secured, and the sections scraped, they should be put immediately into shipping-cases, providing you have no storage-room which is bee-proof. The cases should be glassed on both sides, in order that the fragile condition of the contents may impress itself forcibly upon the minds of the freight and express men whenever they pass into their hands. It will never do to ship comb honey in a close box, and then mark "fragile" on the outside. Nothing answers the purpose so well as glass. The engraving below represents our 48-pound shipping and retailing case which has been used very largely.

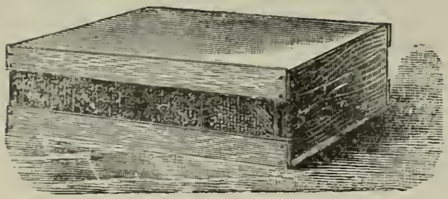


OUR 48-POUND DOUBLE-TIER SHIPPING-CASE.

You will notice that the cover is let into the top. This I regard as a wise precaution. Some of the cheaper cases are so constructed that the cover lies on top, there being no raised edge; but with the one illustrated above, it is impossible to put the cover on squarely without making it absolutely bee-proof. If the cover of the others is not set on squarely, or is warped a little, robbers can very readily gain access to the honey.

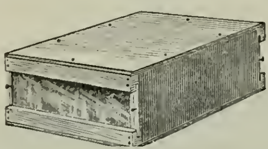
It has been found by experience, that a case holding as many as 48 pounds is too large to be handled with safety to the contents, and consequently a lighter case is required. To meet this demand, one of the same size and same construction is made.

capable of holding only one tier, or 24 one-pound sections.



24-LB. SINGLE-TIER CASE.*

Cases holding only one layer of sections are preferred for the following reasons: 1. Commission men, as a rule, prefer them. 2. They are easy to handle, and consequently are less liable to be broken in the hands of railroad men. 3. Consumers and grocerymen prefer to buy the smaller packages. 4. In double-tier cases, if any of the upper tier drip, the lower ones will become soiled. 5. The glass in the double-tier cases is very much more liable to be broken. In the single-tier case, being much narrower, it is much better protected. 6. The honey shows off to better advantage—only the central portion, which is usually well filled out, appearing.



12-LB. SINGLE-TIER CASE.

The one shown above is rapidly growing in favor, and was first mentioned by Mr. Heddon. It will hold twelve 1⅞-inch sections, or fourteen 7-to-the-foot sections. It is made very cheaply, and in the flat costs only 6 cents. They are so small that a family can easily afford to purchase a whole case, if they feel that they can not afford to take the larger ones.

GLASSED SECTIONS.

Glassed sections are simply sections of comb honey with squares of glass fitted in between the projecting sides of the section. The glass is held either by glue, tin points, or paper pasted over the top and bottom of the section, and lapping over on to the glass a little way. When the section is sold to the retailer, the glass is included in the price of the honey. Of course, the producer can afford to sell glass at from 12 to 15 cts. per lb.; but customers have sometimes objected, and justly, too. But in spite of all this, glass sections have quite a rage at times in the New York and other eastern markets, and occasionally there is some sale for them in the west. The reason is this: Customers will come along and stick their fingers into unglassed honey, so the grocers say. Of course, we bee-keepers think people ought to know better, but they do not. They will pick up a nice neat pearly-white comb, sticking their fingers clear into it, just to see whether it is nice and soft. Again, the unglassed honey becomes dusty and flyspecked. In the west we get rid of the handling and the flyspecks by putting the honey in show-cases or shipping-cases. This is the cheaper and the preferable way. See Sturwold's show-case, next page.

*Shipping-cases are now usually glassed on one side only.

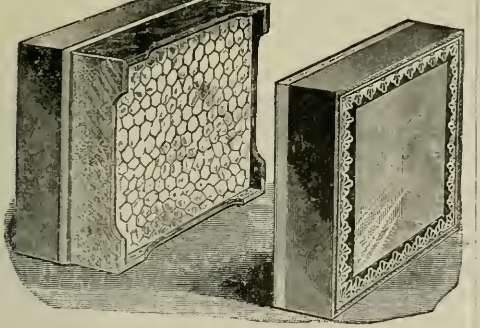
PASTEBOARD BOXES FOR ONE-POUND SECTIONS OF COMB HONEY.

BOX FOR CARRYING HONEY.

This package has a bit of "red tape" attached to it, to carry it by. It is a safe and pretty package for a single section of honey, being very convenient for the customer to carry, or pack in his valise or trunk, if he wants to. It is closed by a tuck flap, and can be quickly opened. Finely colored lithographic labels may be used on one or both sides. Their cost in the flat, without labels, is about $5.00 per 1000, and very pretty labels can be had for about $3.00 per 1000.

Mr. J. E. Crane, of Middlebury, Vt., puts nearly all of his honey into cartons. These cartoons are put into unglassed shipping-cases, the latter neatly stenciled with an old-fashioned straw hive, and lettered. When I visited his place I could not but admire the beautiful appearance of his big piles of cases ready for market. The white poplar wood contrasted very neatly with the stenciling; and the cartons, with their bright clean faces, as they appeared through the sides of the shipping-cases, added not a little to the effect.

Mr. Crane finds a market for all honey put up in this shape, and the demand is greater than he can supply, and he produces tons of honey. His neighbor, not ten miles away, Mr. A. E. Manum, puts up his in unglassed sections, in glass shipping-cases, and he finds a market for all he can produce. There are others who glass a very large part of their product, and this is likewise sold. What we want to do is to build up a trade, and to be ready to supply what the market demands, no matter whether it be glassed, unglassed, or cartoned goods.



BLOW'S SECTION CARTON.

There is used to some extent in England, and advertised by Thomas B. Blow, of Welwyn, Herts, England, a sort of divisible section carton. The back is an ordinary paper box, and the front is a similar box with isinglass face, tastefully decorated. One beauty of it is, that they cover up soiled and dirty sections, and it is not even necessary to scrape the sections. But they are rather expensive, and can be used only for honey-displays and fairs.

MAKING HONEY SELL.

In getting a good price for our honey, very much depends upon the way in which it is cared for and exhibited at the groceries and commission stores. As an illustration of this point, and also as a good suggestion to those who have honey to dispose of, we submit the following, which was published in GLEANINGS for January, 1884:

In former years I had trouble to sell my surplus honey at a live and let-live price at Brookville, the county-seat, on account of the farmers selling their dark strained honey at 5 or 6 cts. per lb., and comb in broken pieces smeared all over with honey, from 6 to 8 cents. I could not afford to sell mine at those prices, and therefore had to ship it to large cities, and I lost considerable by its being smashed while in transit.

I had often noticed, that if goods were placed in a show-window, or fine show-case, they would sell faster than when laid on the shelves; and the thought came to my mind, that if the pretty white sections filled with snow-white capped honey were put in a show-case, and set on the counter in a conspicuous place in a leading grocery, they would draw the attention of the customers, as well as other goods.

I at once ordered one made, $2\frac{1}{2}$ ft. high, by 16 in. square at base and top, three sides glassed, and the fourth side a panel door painted a sky blue; on the pane opposite the door I had the inscription in gilt letters, shaded brown, as in the cut.

I made arrangements with one of the leading grocers to have the case put on his counter, allowing him a commission of 20 per cent on all he sold. I filled it with one and two pound sections, arranging them in the shape of a cone, the two-pound sections at the bottom. On the top of the case I put twelve two-pound jars of extracted honey, arranged in a square, and above them eight one-pound jars, with a pane of glass between them, and one jar on top of that, with a few one-half-pound tumblers on each corner. All the jars were labeled, and capped with tinfoil caps, *a la* Muth. This pyramid of jars was covered with fine white mosquito-netting, to keep the flies from soiling the labels and jars.

STURWOLD'S SHOW-CASE FOR HONEY.

I tell you it looked pretty, and made me feel happy when I heard the grocer exclaim, "Well, well! if that won't sell, Mr. S., I'll give up the grocery business." Do I hear you ask if it did? Well, I should think so. In six weeks all my comb honey, 350 lbs., was gone, and he wrote me for more. You see, if we put our honey up in an attractive manner it will sell, and that at a good price too. I sold my comb at 20, and extracted at 15 cents per pound. The honey placed in and on the show-case was not handled, for I furnished him enough in the shipping-case. J. W. STURWOLD.

Haymond, Ind., Dec., 1883.

KEEPING COMB HONEY.

It is sometimes desirable to keep comb honey for a better market, or that we may have a supply the year round, etc. Well, to keep it with unimpaired flavor it must not be subjected to dampness. If water condenses on the surface of the comb, it soon dilutes the honey, and then it sours, etc. On this account the honey should never be put into a cellar or other damp room. Better put it upstairs; and that there may be a free circulation of air, without admitting bees or flies, the windows should be covered with painted wire cloth. We are accustomed to keeping comb honey the year round, and rarely have it deteriorate in the least. The same remarks will, in the main, apply to keeping extracted honey. During damp and rainy weather, the doors and windows to the honey-room or honey-house should be closed, and opened again when the air is dry.

Comb honey should under no circumstances be stored where it is likely to freeze, as freezing contracts the wax so as to break the combs and let the honey run. Under the head of HONEY-HOUSES will be found some further remarks bearing closely on this subject.

Under EXTRACTED HONEY will be found hints on peddling honey and marketing in general.

CONTRACTION. The principle of contraction consists in reducing the brood-chamber to three-fourths or two-thirds of its original capacity, and thereby crowding the working force of the bees into the surplus-apartment. With this limited brood-chamber the frames should be filled almost entirely with brood, leaving few empty cells for the storage of honey below. The consequence is, that the bees are impelled by necessity to store the honey above in the sections, where ample room is provided. Unless honey is coming in freely, even contraction will sometimes fail of making the bees work in the sections, although you may be able to crowd them above.

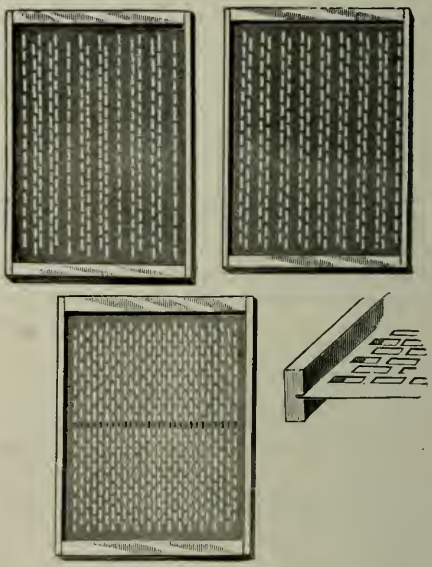
Contraction is ordinarily practiced by taking out two or three frames, as the case may require, and inclosing the remaining ones in as small compass, as possible. The frames left in the hive should be filled with brood as nearly as possible, and those taken out should be given to nuclei or placed in an upper story over a strong colony. On each side of the brood-nest so contracted, dummies or division-boards are placed, thus reducing the capacity of the hive in the lower story. See DIVISION-BOARD illustrated under that head elsewhere.

Mr. Doolittle claims another advantage by contracting; namely, the storing of all the white honey in the supers. This he does by contracting just before the white honey is expected; when the season for white honey is nearly over he restores the brood-chamber to its normal capacity, and allows the bees to fill their brood-combs with the darker honey, which is just as good for brood-rearing, but not as salable.

The tendency of the times is rather against contraction. The eight-frame Langstroth hive is now being used very largely; and in a great many localities it is not necessary to contract this brood-chamber. In other ocalities it may be necessary to remove a couple of frames. But in any case it is seldom desirable to contract the brood-nest to less than six frames.

WHEN TO CONTRACT.

Those who advocate and practice contraction, I believe, encourage brood-rearing just before the honey-flow by every available means; that is, they aim to get their colonies into as strong working condition as possible. When the honey-flow commences the brood-chamber is contracted so as to make a very large part of the bees spend their whole energies in honey-getting and the storage of said honey not in the brood-combs, but in the surplus-apartment.



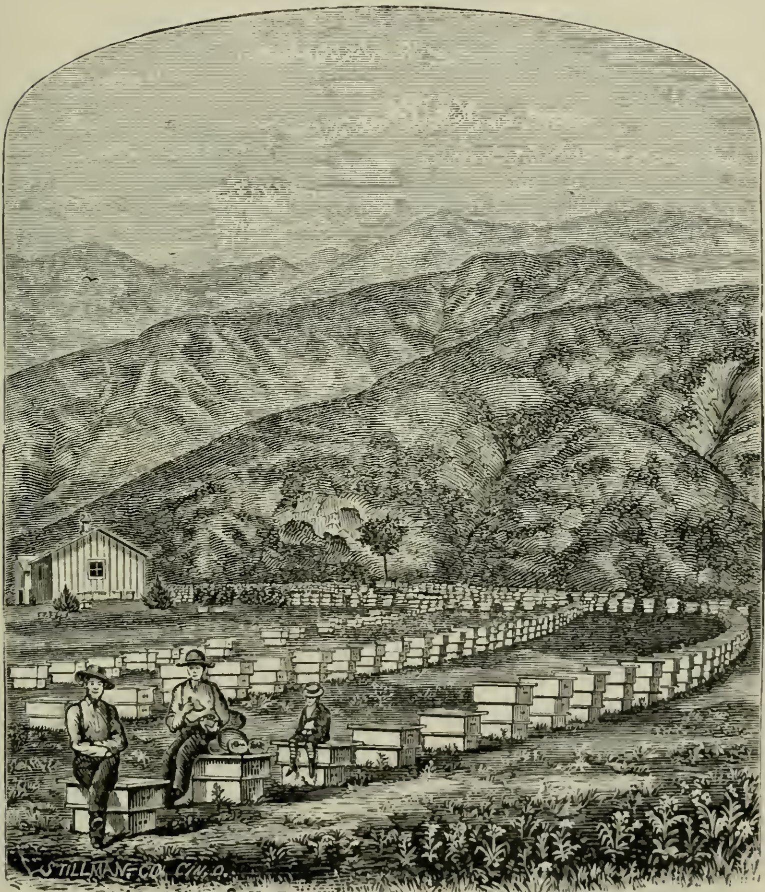
SHEET-ZINC HONEY-BOARD, WOOD-BOUND.

There are, however, one or two drawbacks attendant upon contracting. This high-pressure principle is liable to cause the bees to store pollen[63] in the upper story, and promotes or encourages swarming. The colony is left at the close of the season withou sufficient food, and it depends on the relative prices of honey and sugar whether you get any pay for the labor of feeding. If you contract laterally, and have part of your super without brood combs under them, you will find the bees will not work so well in that part of the super which has no combs under it. Again, the queen, by reason of the limited capacity of the brood-chamber, sometimes lays in the surplus-apartment. But to overcome this last objection,

QUEEN-EXCLUDING HONEY-BOARDS

have been devised. These are of the size of the ordinary honey-boards, and are placed between the brood and surplus apartment; while hindering little if any the passage of the workers to and from the surplus-apartment, they do exclude the queen; *i. e.*, if the perforations are of the proper size. For the discussion as to the best size of perforations to be queen-excluding, see DRONES.

The question is often asked, "Shall I contract for extracting?" This is seldom if ever necessary. If the bees put the honey in the outside combs in the brood-chamber, these combs can be removed and extracted.



A CALIFORNIA APIARY.

D.

DANDELION (*Taraxacum*). This plant. I am inclined to think, is of more importance than is generally supposed, for it comes into bloom just after fruit-blossoms; and as it yields both pollen and honey, it keeps up brood-rearing, when it is of the utmost importance it should be kept going.[65] I do not know that it would pay to raise a field of dandelions expressly for the bees; but as they grow to a great size and luxuriance when allowed to stand and blossom in the garden, I feel pretty sure that a cultivated plat of them would furnish a great amount of honey. What a pretty sight it would be on our honey-farm! They do not ordinarily blossom until the second season, but perhaps, like catnip and clover, they would do so, if sowed early, and cultivated. As Dandelions seem to be much on the increase in the fields and about the roadsides in our vicinity, I think we can safely conclude that the more bees there are kept, the more such plants we shall have; for the bees, by fertilizing each blossom, cause them to produce an unusual amount of good sound seed I do not think of any other purpose for which the Dandelions can be used, except as greens in the spring; if we allowed stock to forage on our yellow flower-garden, I am afraid it would mar its beauty, if not its usefulness for honey.

I really can not say much in praise of the Dandelion honey, for we extracted some that we called Dandelion on account of the taste, and we could not use it at all. It was so dark colored and strong, that we with difficulty gave it away. The honey *may* have been from the shell-bark hickory, however, as that comes in bloom at about the same time.

DISEASES OF BEES. I am very glad indeed to be able to say, that bees are less liable to be affected with disease than perhaps any other class of animated creation. It is perhaps because the individual members of a colony are so constantly giving way to other younger members, as they are hatched out and come on the stage of action. Nothing but a really contagious disease could do very much harm, where vigorous and youthful members are being added to the family circle almost daily, and, for a great part of the year, by hundreds or thousands. Therefore, if your bees lack thrift, all you have to do is to start brood-rearing briskly; and if the queen is in any way at fault, you can simply remove her and substitute another, without even so much as disturbing the regular daily routine.

So long as this is the case, we have little to fear from any disease that does not attack or interfere with the brood or young hatching bees. Luckily we have but one such disease. This is termed FOUL BROOD, and the subject will be found fully discussed under that head. The disease next in importance is DYSENTERY, and many seriously doubt whether this should be called a disease at all, unless, forsooth, we should say a boy had some disease when he ate green apples, or went about with his feet wet on a bitter cold day. The difficulty seems nearly allied to what, for want of some better name, has for the past few years been termed

SPRING DWINDLING.

In olden times, and up to within the past ten years, bees seldom died with honey in their hives; and when it was announced that good colonies of bees were gone, leaving their combs filled with honey, many were incredulous. Very soon, however, some of our best bee-keepers began to lose in the same way, and, ere long, whole apiaries of hundreds of colonies were swept off in a few weeks, during the months of February, March, and April.[67] If I am not mistaken, as soon as the bees began to get new honey from fruit-blossoms or other sources, they began to build up, and then every thing went along as usual. The blame was first thrown on the extractor, because some bees died in hives from which the honey had been extracted, and others in the same apiary that had their combs left undisturbed, came through healthy as usual. This undoubtedly made a difference, for the honey gathered in the fore part of the season is often more wholesome than that gathered late in the fall; but it was by no means *all* the trouble, for apiaries having only box hives were in many instances devastated entirely. Exposure to the weather was suggested as the cause, and fine wintering-houses and cellars were constructed, and for a while every thing seemed prosperous; but very soon they died in these repositories also, the bees coming out on the floors in the dead of winter, besmearing their hives, and deporting themselves in almost any but a satisfactory way. Some succeeded so well with bee-houses and cellars, that they have all along adhered to them; but so have others with outdoor wintering; and in many localities, bees have wintered under almost all circumstances, if only supplied with plenty of food.

In a great majority of cases, it has seemed pretty conclusive that the trouble was caused by bad food; the Italians may have been somewhat to blame for this; for during unfavorable seasons, they stored up large amounts of honey from the aphides or honey-dew, or from other sources that bees are not usually wont to frequent. The use of the extractor has many times, without doubt, aggravated the trouble, as we have mentioned, where all the combs in the hive have been repeatedly emptied; for in such a case, the bees are driven entirely to the late-gathered and oftentimes unsealed stores, for their winter supplies. To remedy this matter, it was suggested that their honey be *all* extracted, and that they be wintered entirely on stores of a good quality of sugar syrup. This course proved successful, in the great majority of cases; but by the time we got well into it, the dwindling mania had partially gone by, and those that were left with their own stores wintered all right also, so that very little was proven. Besides, it was a great deal of trouble to do this feeding at a time when the bees were much disposed to rob, and so it, like all the other remedies, was gradually dropped. This was especially the case when extracted honey became so cheap that it was no object to extract and sell it. Again, this bad fall honey that killed the bees one spring almost as surely as fly-poison kills flies, if kept over until the next, could be fed to them with perfect impunity. This may not have been always the case, but it was in some quite well-authenticated instances. "Of course, then, it was a disease," said many, "and it is a disease that is catching too," said others; "for after it got among my bees, they 'just all went.'"

Well, my friends, I really do not know whether it was a disease or not, and I do not know that it matters very much. We learned pretty thoroughly that, whatever it was, it usually came in the spring, just about the time the bees began to rear brood considerably, and that the old bees were generally gone, just after a spell of bad spring weather. Also that the very "baddest" honey, if I may be allowed the expression, did no harm at all, if fed in very warm weather. One more fact, and I am done. Colonies that were queenless, or that were by any means entirely prevented from raising brood, seldom, if ever, caught the —— the "dwindling." I declare, there *is* one more fact after all, that I had almost forgotten. It is, that very strong colonies with tough old brood-combs almost invariably pull through, especially if they have a good lively queen. Such colonies will stand like the sturdy oak, year after year, while the new stocks that are so rapidly built up vanish like the smoke, from their new combs and small clusters of brood.

In view of the above facts, and after trying almost every thing else, I began, at the suggestion of friend Townley, of Tompkins, Mich., to experiment by making the bees fill their brood-chamber, and surrounding them with chaff, brought up close to the bees.

My first experiment was made on a pretty strong colony. The chaff packing was about 4 inches thick, on all sides. These bees did not commence brood-rearing as soon as the others; but about the time natural pollen appeared, they commenced to gather it briskly; and when fruit-trees bloomed, they began to send a stream of hot air out at the entrance that would melt the frost in front of the hives after a cold night, for several inches. Do you suppose sudden changes of weather affected them? or that they caught the "dwindling"? Of course, they did not; and what is still more cheering, I have had scarcely a case of it in a *strong* colony thus prepared, although I have practiced the plan for the past ten winters. Of course, something may happen yet, to upset all the chaff experiments, as has repeatedly been the case with other things, but I feel pretty sure that a good chaff packing close to the cluster of bees will do away with all the troubles we have experienced with cold and backward springs. With the chaff cushions and chaff division-boards, you can very easily make the experiment on any colony that has begun to dwindle down just about the time they commence to rear brood. When I first stocked our house-apiary, I was much taken up with the idea of having the hives simply covered with a single thickness of cloth, that we might more easily open and work with them. As the house was to be kept free from frost, I thought there would be no necessity of any other covering, even in winter; but I had the worst form of spring dwindling I ever knew, and lost every colony except a few that were in old tough thick combs. The next winter I prepared them just the same, but placed heavy cushions of chaff at the sides and above the bees. They all wintered without a particle of dwindling, and by pushing one's hand under the cushion, directly over the bees, it was found to be as warm as if you were touching a living animal. Now, all this heat, the winter before, had been passing off into the air, almost as fast as the bees generated it. Do you wonder their little bodies were exhausted in the attempt to rear brood and keep warm, and that they "got sick"? See WINTERING.

I believe I do not know any other, unless it be that called *nameless disease.* It afflicts the bees in warm as well as cold weather, and the inmates of heavy hives as well as weak ones. The symptoms are a sort of quivering and twitching motion, and finally the bee becomes so much emaciated that he looks like a shiny black skeleton of what a bee should be. I have seen bees thus affected, in perhaps a dozen or more colonies, but it all disappeared after a time, except in one colony. That one I broke up after it had become pretty well reduced, by destroying the queen, and giving the bees to other colonies. A neighbor has also lost a colony from the same trouble. Reports show that the disease has appeared in a great many quarters, and it is sometimes so mild in form as to be scarcely noticed, and I believe there are no reports of heavy loss from it. The remedy recommended is to change the queen, although some think that if let entirely alone the colony may be expected to recover.

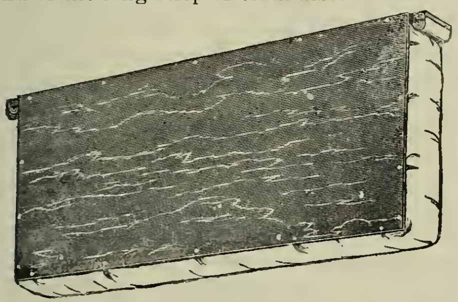
OTHER DISEASES.

It may be well to mention, that when a bee is crippled or diseased from any cause, he crawls away from the cluster, out of the hive, and rids community of his presence as speedily as possible; if bees could reason, we would call this a lesson of heroic self-sacrifice for the good of community. If your bees should get sick from some other cause than I have mentioned, I would advise putting enough together to make a good lot, surrounding them with chaff cushions close up to the cluster, and giving them plenty of sealed honey also close to the cluster. If you have not the honey, and the weather is cool or cold, use candy. If the cluster is small, give them a small piece at a time, right over the cluster, under the cushions.

Weak colonies sometimes get a mania in the spring for destroying their queens; this can hardly be termed a disease, and yet the colony has become to a certain extent demoralized, and out of its normal condition, much as when they swarm out, as given in ABSCONDING SWARMS; they will generally come out all right if fed carefully and judiciously, as we have described. Bees are always prospering when they are accumulating stores, and they are very apt to get astray, in some way or other, when they are very long without some way of making daily additions to their "stock in trade," unless it is during the winter, when they are, as a general thing, mostly at rest. Almost all sorts of irregular vagaries may be stopped by regular daily feeding, and I would advise the candy, for it furnishes both honey and pollen, if made with the addition of flour as we have advised.

DIVIDING. This term is usually applied to the operation of increasing the number of stocks, by putting half the bees and combs into a new hive, just about swarming time; it is really one method of artificial swarming. If you have an extra laying queen to give the queenless portion, it may do very well; but otherwise, it is a wasteful way of making increase, and has mostly been abandoned. If the bees are just ready to swarm, and have queen-cells pretty well along, it may answer very well; but even then it would pay better to take but two combs with the queen-cell, and get a laying queen before making the actual division, as advised in ARTIFICIAL SWARMING.

DIVISION-BOARDS. Make a frame of lath, precisely of the outside dimensions of the frame you use in your hive. As ordinary lath is $1\frac{3}{8}$ wide, you will have a frame quite similar in appearance to the wide frames that hold the sections, except their being roughly made. When this is done, you are to tack stout cloth all round the sides and bottom as shown in the engraving; and as you tack it on, it is to be filled with chaff, so as to make a sort of soft cushion. You had better use duck for this purpose, as our division-board may be required to stand some severe pulling, to tear it loose from the propolis, when it is to be removed. You will need to pucker or gather the cloth slightly at the corners, that they may not draw in when the board is finished. When this is done, nail securely on each side a thin board about $\frac{3}{16}$ in thickness, filling in between the two with chaff. Now our board is finished when we have fastened a small roll of duck to each end of the top-bar, to close the groove in the metal rabbet. To get this roll on securely and in neat shape, it is put on the top-bar before it is nailed to the rest of the frame. The tacks that hold the outside end of this strip of cloth are driven into the end of the top-bar, and the cloth is then rolled over the heads so as to entirely conceal them; the other end is nailed between the top-bar and the end-bar as, in fact, is the end of the long strip of cloth also.

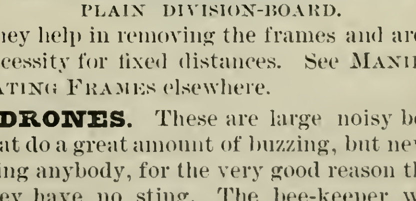


CHAFF-CUSHION DIVISION-BOARD.

This division-board, if made of the proper dimensions, should fit nicely and easily, in any hive. It will stand securely where placed, fits air-tight, even if the hives should vary a trifle in size inside, and yet can be always taken out easily, because the chaff cushions are yielding. When used to contract the space of a small swarm or nucleus, it can be easily pushed up until the bees fill their apartment, and it leaves a warm smooth flat side toward the bees. I prefer the board side to cloth, because if combs are built beside it, they are always smooth and flat, and the bees can never bite through the board, as they will in time through even duck, when used for a division-board. If you wish to use them for dividing two colonies in the same hive, the division is perfect, and no bee ever gets round or over them, to kill a queen in the other apartment. But the principal use of these boards is to fix an ordinary hive for wintering. To accomplish this purpose we put one against each outside wall of the hive; if the colony is not a full one, push division-boards toward each other until it is a full one on a smaller scale; put your chaff cushion on top, and they are in a very good winter nest.

If you wish to feed a nucleus so as to build comb and raise brood in cool fall weather, you can do it nicely, using these division-boards. Place one on each side of the bees up to one side of the hive, and feed liquid food in the empty part, by means of the wooden feeder. Have the apartment for the bees contracted so that some will be crowded out around the entrance, and fold a sheet of duck so as to perfectly close the space above the frames. Get them to wax it all tight with propolis if they will. They will soon find the way to and from the feeder, by passing round the lower corner of the division-board at the entrance of the hive; and as the warm air can in no way escape, they are, to all intents, getting their honey from outside. With such an arrangement in single-walled hives, I have built colonies up beautifully by feeding a syrup made of granulated sugar. Where the space was contracted so as to "squeeze" the bees out at the entrance, except when very cool I have succeeded equally well with space for but three frames.

No hive is complete without a division-board, or, as it is sometimes called, a follower. For summer use the plain board is preferable. The cut shows how it is made.

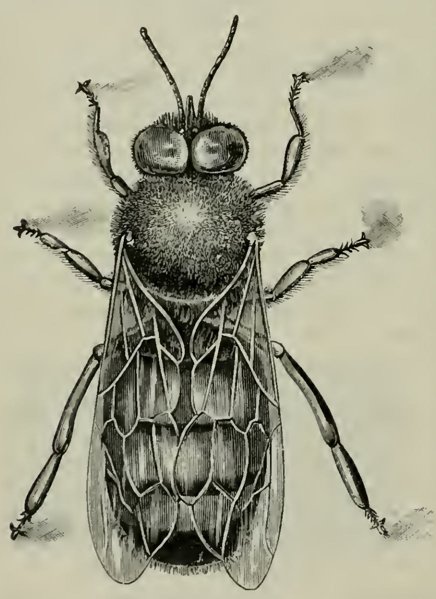


PLAIN DIVISION-BOARD.

They help in removing the frames and are a necessity for fixed distances. See MANIPULATING FRAMES elsewhere.

DRONES. These are large noisy bees that do a great amount of buzzing, but never sting anybody, for the very good reason that they have no sting. The bee-keeper who has learned to recognize them both by sight and sound, never pays any attention to their noise, but visitors are many times sadly frightened by their loud buzzing. We will commence as we did with the worker-bees, at the egg, and see how much we can learn of these harmless and inoffensive inmates of the bee-hive.

If our colonies are prosperous, we may find eggs in the drone-comb of some of the best hives as early as March, but not, as a general thing, until April. You can tell the drone-cells from the worker at a glance (even if you have never seen them) by the size, as you will see by looking at HONEY-COMB. Whenever you see eggs in the large cells, you may be sure they are drone-eggs. I do not mean by this that the eggs that produce drones look any different from any other eggs that the queen lays, for in looks they are precisely the same. They are almost the same in every respect, for the only difference is that the egg that produces the worker-bee has been impregnated, while the others have not; but more of this, anon. The egg, like those producing workers, remains brooded over by the bees until it is about 3 days old, and then by one of nature's wonderful transformations the egg is gone,



DRONE-BEE.

and a tiny worm appears, a mere speck in the bottom of the cell. This worm is fed as before, until it is about a week old, and is then sealed over like a worker, except that the caps to the cells are raised considerably more; in fact, they very much resemble a lot of bullets laid closely together on a board. They will begin to cut the caps of these cells in about 24 or 25 days; the caps come off in a round piece, very much like those from a queen-cell.

The body of a drone is hardly as long as that of a queen, but he is so much thicker through than either queen or worker, that you will never mistake him for either. He has no baskets on his legs in which to carry pollen, and his tongue is so unsuited to the gathering of honey from flowers, that he would starve to death in the midst of a clover-field.

I presume the young drones are ready to leave their hive after they are about two weeks old, and they do this shortly after noon, of a warm pleasant day. They come out with the young bees as they play, and first try their wings; but their motions are far from being graceful and easy, and they frequently tumble about so awkwardly that, as they strike against your face, you might almost think them either drunk or crazy. I do not know how we can very well decide how old a drone must be to fulfill the sole purpose of his existence, the fertilization of the queen, but should guess anywhere from three weeks to as many months.[68] Perhaps they seldom live so long as the last period named, but I think they sometimes do. Many facts seem to indicate that they, as well as the queen, fly long distances from the hive—perhaps two miles or more. We have now satisfactory evidence that the meeting between queens and drones takes place not very high up from the ground. Several observers, during the past season (1889), have reported having seen this meeting not very far from the hives, during the swarming season. The queens and drones both sally forth during the middle of the day, or afternoon, and in from fifteen minutes to an hour, or possibly a couple of hours, the queen returns with a white appendage attached to the extremity of her body, that microscopic examination shows to be the generative organs of the drone. These facts have been observed by hundreds of bee-keepers, and are well authenticated. In attempts to have queens fertilized in wire-cloth houses, I have, after letting the queens out, seen the drones pursue them until both parties vanished from my sight. Still another fact: If you take a drone in your hand some warm afternoon just as he has sallied from the hive, and press him in a certain way, he will burst open something like the popping of a grain of corn, extruding the very same organ we find attached to the queen, and dying instantly.

The manner in which the meeting of the drone and queen takes place was not witnessed until 1888. A correspondent for GLEANINGS IN BEE CULTURE described it as follows:

MATING OF THE QUEEN AND DRONE ON THE WING, AS SEEN BY AN EYE-WITNESS.

On June 21, 1888, I saw this mating take place. The queen issued from the hive, took two circles, and came within five feet of my face, and was there met by a drone. They seemed to face each other, clinging by their fore legs, their bodies being perpendicular, and in this shape flew from my sight. It happened so unexpectedly that I hardly knew what was going on before it was too late to follow them. I could have easily kept up with them. I have described this because your book says they have not been seen, only as they were whirling about each other. I saw these fasten; and as they did so they turned and came together, square up and down; and as they flew away their bodies inclined about like this /, and each bee was using its wings.

Myrtle, Pa., Jan. 2, 1889. E. A. PRATT.

Shortly after this another correspondent reported the one thing yet unobserved; viz., the manner of separation of the queen and drone. He described it as follows:

AN EYE-WITNESS TO THE QUEEN'S SEPARATION FROM THE DRONE AFTER MATING.

I was going out to my bees one day, when two bees came whirling down in front of me and fell on to a pumpkin leaf. It proved to be a queen and drone. The drone acted as if he had been stung by a worker. He held fast to the leaf with his feet, and the queen kept whirling over and over, about as a fly would if caught in a spider's web, until she freed herself, then she flew out of sight in an instant, and the drone remained where he was on the leaf, but showed life for only about three minutes.

S. R. FLETCHER.
Onawa City, Iowa, Feb. 19, 1889.

The whole thing has now been witnessed, from beginning to end.

In the fall of 1876 I saw a swarm of black ants sporting in the sunshine. A close look showed them to be both males and females; and as pair after pair fell to the ground, I had ample opportunity of noting all circumstances. In this case the drones at first seemed paralyzed; but after the queens flew away, they revived and afterward flew away also. One point here particularly impressed me: The ants of both sexes were in such countless thousands, that they must have come from all the ant-hills for, I should say, miles around; the result was, as you see, that there was hardly a possibility of insects from the same family meeting. Now, is there any other way in which the strain of blood could be so effectually crossed with that of some distant colony, as by this huge jubilee of both sexes?

Queen-ants, like queen-bees, seldom if ever come out of their homes at any other time, and, as if by some preconcerted arrangement, they meet and mix up apparently for the very purpose of effectually preventing "in-and-in breeding," as it is usually termed when applied to stock. Do queens and drone-bees meet in the same way, in vast numbers? Many circumstances seem to indicate they do, yet it, like many other things, lacks positive proof. Drones have been seen in out-of-the-way places, in larger numbers than we would think could possibly come from one hive; and many have heard their loud humming who have not seen them. The fact that a queen should become fertilized in so short a time after leaving the hive, seems strange, unless it really is a fact that she is called to the swarm of drones by their loud humming, which she would instinctively recognize from a long distance. Flying among them she meets the drone face to face, falls to the ground, tears herself loose from her dead mate by whirling, and then returns to her hive, having been absent only a few minutes.

DOES THE DRONE HAVE ONLY ONE PARENT?

One of the most wonderful things about the drone, or male bee, is that it is hatched from an egg that is unimpregnated. So wonderful indeed is this, that the matter was for ages disputed, and is even now, by many who have not looked into the matter and examined the evidence. What we mean by unimpregnated is, that queens that have never met the male bee at all, will lay eggs, and these eggs will hatch, but they always produce drones, and never workers. Those who have had the care of poultry, are well aware that the hens will lay eggs right along, if no cock is kept in the yard at all; and, if I am not mistaken, a pullet would commence and lay perhaps nearly her usual number of eggs, if she had never seen a male bird. Now, nearly the same is true with regard to the queen-bee. If she fails to meet a drone during the first 30 days of her life, she usually begins to lay eggs, but she seldom lays as many, or with the same regularity, as a fertile queen. The eggs the hen lays, if she is allowed to sit, never produce any chicks at all. The eggs laid by the queen, under the same circumstances, as I have said before, always produce drones. There is one more fact connected with the common fowl: If the male bird is put into the yard with the hen for one day only, good fertile eggs will be laid for many days, possibly a whole laying. If a Black-Spanish cock should get among a flock of white hens for only a single day, all the eggs laid for many days afterward will produce chicks with more or less black feathers on them. I give these statements from actual facts. The point I wish you to observe is, that the eggs of even the common fowl are fertilized as they are laid by the hen, or possibly a few days before. With the fowls, one meeting with the male bird suffices for the fertilization of an egg daily, for a week or more: with the queen-bee, for her whole life of three or even four years.

I do not know whether the hen has the power of laying fertile or unfertile eggs at will, or not; perhaps not; but I do know that a queen-bee lays both fertilized and unfertilized eggs, alternating from one kind to the other in rapid succession. Skillful microscopists have carefully dissected eggs from worker cells, and found the living spermatozoa in numbers from one to five. These living spermatozoa were precisely identical with those found in dissecting a mature drone. Again: Every egg a queen lays, passes a little sac containing a minute quantity of some fluid; the microscope shows that this fluid contains thousands of these spermatozoa. Is it not wonderful that these spermatozoa should live four years or more in this little sac, awaiting their turn to be developed into a higher life whenever they should be required to fertilize the egg that is to produce the worker-bee? Very well; now the egg that is taken from a drone-cell contains no trace of spermatozoa. Therefore it, like the egg of the common fowl, unimpregnated, should never hatch. But, my friends, it *does* hatch, and produce the drone. The first glimpse we get of the little bit of animated nature, is the tiny speck alive at the bottom of the cell. Does he grow out of nothing, without parentage, at least on the paternal side? If his mother was an Italian, he is also Italian; if a black queen, he is also black. We shall have to conclude, perhaps, that he is the son of his mother, and nothing more. The egg that has never been impregnated in the usual way, must, after all, have some living germ incorporated in its make-up, and this germ must come only from the mother. The great skill and proficiency with the microscope, required to make these minute examinations, is such that but one or two have ever succeeded in exploring as far as I have mentioned, and it is somewhat like our investigations in the polar regions. Who among us will educate himself for the work and carry it along?

Drones are also hatched from eggs laid by worker-bees. These drones are smaller in size than those from a queen,[69] and the question as to whether they are capable of fertilizing queens, so as to be of some value, like other drones, is one that I believe has never been decided. Some facts have been brought to light that seem to be pretty good evidence on both sides of the question; but, so far as I know, nothing very definite. I confess, that I should not want to make use of them, even if they were good, for I want the strongest, healthiest, and largest drones I can get. For a further account of the mothers of these queer drones, see FERTILE WORKERS.

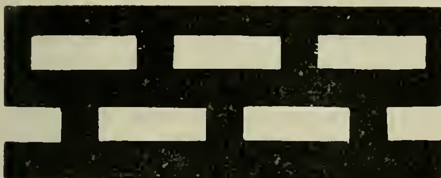
After what I have said, you will perhaps see how clear it is, that the drones are in no way affected by the fertilization of the queen; or, in other words, that all daughters of a purely fertilized Italian queen produce drones[70] absolutely pure, whether they have been fertilized by a black drone or not.

Until the invention and general adoption of foundation we had no easy way of repressing the production of drones in far greater numbers than could ever be desirable. Since the introduction of foundation, however, it is found to be quite an easy matter to make almost every cell in the hive a worker-cell. On the other hand, if we choose we can have a hive filled entirely with drone-comb, and a good queen could, I think, be induced to raise nearly, if not quite, a full peck[332] of drones at one time. By this means we can have our drones raised from such stock as we choose, and we can save the vast amount of honey that has so long been wasted by rearing and feeding drones that we do not need. While extracting, I have found as many as several pounds of drone-larvæ in a single hive; and, to save the honey they would consume as soon as hatched, we used to shave their heads off with a very sharp knife. This is certainly rather expensive business, for it must take more than a pound of honey, to say nothing of the value of the pollen, to get up a pound of sealed brood. If all this labor and material had been utilized in the production of worker-brood, it would doubtless have been equivalent to a swarm of bees. All worker-comb would have insured this without trouble

It is quite probable, that all the drones will be raised that can usually be required, without making any special provision for them; but still, it may be a good idea to devote one hive, in an apiary of 50 or a hundred colonies, to the production of choice drones.

RESTRAINING UNDESIRABLE DRONES.

Drones undesirable for breeding purposes may be prevented from going out to meet the queens, by keeping them from going out of the hive, or by letting them go out into a cage through which workers can pass and they can not. This is done by taking advantage of the fact, that a worker-bee will pass readily through slots in perforated metal where a drone can not. In the figure below we give the form of the perforated metal.

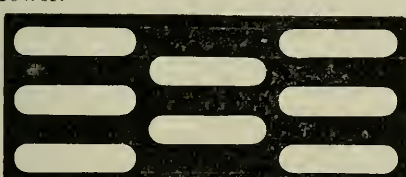


PERFORATED ZINC FOR EXCLUDING DRONES.

Zinc is the material generally used, because it is cheap and will not rust. Some attempt was made to perforate tin as above, but it proved to be very unsatisfactory.

THE PROPER SIZE FOR THE PERFORATIONS.

The oblong holes, as shown above, must be of such a size as to permit the easy passage of workers, but exclude not only drones but even queens (see COMB HONEY and SWARMING). It is no great task to make the perforations drone-excluding; but to make them *queen*-excluding at the same time, and yet not hinder the easy passage of workers, requires a very nice adjustment in the width of the perforations. The first sheet of perforated zinc was cut in England, and imported to this country. This had perforations $\frac{18}{100}$ of an inch in width. While this answered a most excellent purpose, a few claimed that queens would occasionally get through it. To obviate this, zinc was made as below, with the perforations a little narrower.

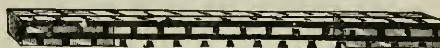


ZINC WITH SMALLER PERFORATIONS.

The width of this was $\frac{5}{32}$ or $\frac{16}{100}$ of an inch. While no queen succeeded in getting through this, reports, as well as my own experience, convinced me that this size was too narrow. It not only proved to be a great hindrance to the workers when their honey-sacks were empty, but, when gorged with honey, they were scarcely able, if at all, to pass through. Very recently, perforated zinc has been made in this country after the foreign pattern, but with perforations exactly $\frac{17}{100}$ of an inch in width, or a *trifle* smaller than the foreign. Perhaps, my friend, you think I am splitting hairs; but when we come to distinguish between the size of small queens and the average worker we must be *exact*. The reports, as well as our own experience in regard to the perforated zinc as so made, have led us to believe that this size of perforations is about right. Having discussed the proper size of the perforations, we will now consider its use in

DRONE-EXCLUDING ENTRANCE-GUARDS.

If we put a strip of this material over the entrance, the worker-bees can go out, but the drones can not; but as a simple strip of zinc is liable to get clogged if there are many drones in the hive, an arrangement like the figure below is ordinarily used.



DRONE-GUARD.

This is simply a strip of perforated metal, $1\frac{1}{2}$ x 12 in. long, folded in the middle at right angles, as shown. Each end is then closed with a block $1\frac{1}{2}$ in. long and $\frac{3}{4}$ in. square fastened in place with a couple of double-pointed tacks. To use, place tight up against the entrance with the selvage downward, as represented in the cut.

When it is desirable to get the drones *all* out of a hive without permitting any to get back again, we put the guard over the entrance and then shake all the bees in front of the hive. The workers will, of course, crawl back on the empty combs; but the drones will have to stay out, and the queen too, unless you watch for her and put her into the hive. In the morning, when the drones are stiffened with cold, they may be fed to the chickens or otherwise destroyed.

If you object to this method as being too much trouble, you can try another way. On a sunny day a very large part of the drones will be out for a fly about 1 P. M., or a little later. You are then to place the drone-guard at the entrance; and when the drones return a little later they will be shut out. In the evening the drones may be disposed of as before.

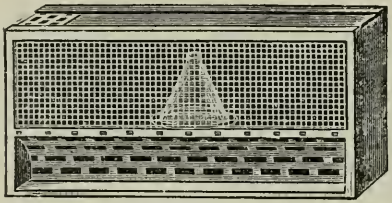
The drone-excluder just described is not automatic. Accordingly, Mr. Henry Alley, of Wenham, Mass., has devised the two following.

ALLEY'S DRONE-EXCLUDER.

It is to be observed, that this is similar to the one just described, only it has a wire-cloth cone in the top. The drones, after making a fruitless attempt to pass the metal, will enter the wire-cloth cone in the top, and escape; but none will have sense enough to go back the way they came, but will huddle together outside and await their fate.

If it is desirable to get the drones into a box, so they may be carried to some other apiary, for instance, a cage is made with an upper story, and a couple of these wire cones conduct the drones "up stairs." If any worker-bees should go up too, they can readily go up through the perforated zinc. This latter arrangement is shown in the next cut.

As to how this trap has worked at the Home of the Honey-Bees, I make an extract from the department of "Our Own Apiary" (see GLEANINGS, p. 461, Vol. XIV.).



ALLEY'S DRONE-EXCLUDER, DRONE AND QUEEN TRAP COMBINED.

"At 10 A. M. I attached one of the Alley traps to a hive of drones, and very soon quite a number of bees hovered in front of their hive, evidently greatly confused at the altered appearance of the entrance. After flying about for a few minutes they no doubt thought that what could not be helped must be endured, and so crawled through when they had thoroughly inspected the perforated metal. A whole day was necessary for the bees to become accustomed to the drone-trap, after which time they passed and repassed as before, but not without some little hindrance. In the height of the honey-flow this would result in the loss of considerable honey, especially if very many of the hives had the traps attached to their entrances.

"IS THE TRAP A SUCCESS IN CATCHING DRONES?

"Although the hive to which I attached the trap contained a large number of drones, none made an attempt to pass the perforated zinc until about 1 P. M. On coming up at this time I was greatly amused to see them tugging at every available hole in the perforated metal. Their clumsy round heads wiggled and squirmed, but to no purpose. In fact, there were so many trying to make their way through that even the workers could not pass, by reason of the multitude of drones blocking up the holes. To say the least, their efforts were "real funny," as the boys say. After repeated attempts the poor drones resorted to the then remaining place of escape; namely, through the cone in the trap. This, as you are aware, leads into a little chamber where the drones are made prisoners. In about an hour afterward I returned, to find about a quarter of a pound of drones—quite a number of which had bumped around until they had worried themselves to death, and some were dead below, as they had been unable to find the cone. On trying two or three hives in this way I find that the trap gives excellent satisfaction. As has been said, drones can be caught and disposed of accordingly. If one desires to take half a pound or so of choice drones to another apiary, I think I should take the trap away in about an hour after they have begun to collect in the upper chamber. If left longer they will worry themselves to death, as I have found by experience."

As to how this trap may be used for catching swarms, see SWARMING, elsewhere.

REARING DRONES OUT OF SEASON.

This is quite a difficult matter to accomplish, especially in the spring; and although we have many times fed colonies with this end in view, we have always found some other colony that would have drones flying just as soon, without any artificial aid. Drones may be kept almost any length of time, by making the colonies containing them queenless, or by putting them into queenless colonies. During warm dry weather in the summer or fall, drones may be procured by feeding, but the feeding must be regular, and given every day for several days or weeks. By feeding one colony a barrel of sugar in the fall, I succeeded in getting a nice lot of drones in October. Of course, their combs were taken away and empty ones given them, to give the queen room. Before we can get drones, we must get worker-brood under good headway, and then, if we put a drone-comb right in the center of the brood-nest, the queen will, if all things are favorable, begin at once to fill it with eggs. The feeding must be kept up, however, for bees are very easily discouraged; and if a stoppage occurs in the daily supplies, they will not hesitate to pull the young drones out of their cells and sacrifice them without mercy.

A queen will seldom produce drones until she is nearly or quite a year old; even though drone-comb may be placed in the very center of the brood-chamber.

DESTRUCTION OF DRONES IN THE FALL.

This does not necessarily occur in the fall, but may take place at any time in the summer; and I have several times known the drones killed off between apple-bloom and white clover, only because supplies ceased, causing the bees to become discouraged and give up swarming for the time being. I know of no way in which you can tell so well that the yield of honey has ceased, as by the behavior of the bees to their drones. When, in the midst of the honey season, you see a worker buzzing along on the back of a drone who seems to be "scratching gravel" to get away from the hive, you may take warning that the yield of honey is failing, and that you had better stop making artificial swarms, and prepare for feeding, if it is your intention so to do. I do not know that I ever saw bees sting drones, but they sometimes pretend to do so; I rather think it is only a feint to drive them away. The poor drone, at such times, after vainly trying to go back into the hive, will sometimes take wing and soar away off in the air, only to return after a time to be repulsed again, until, through weakness perhaps, and want of food, he flutters hopelessly in the dust, and so submits to the fate that seems to be a part of the inexorable law of nature, and of his being.

To preserve drones for late queen-rearing, I have been in the habit of carrying all frames containing drone-brood, to some queenless hive, knowing they would be safe there as long as wanted, even if it were all winter. I believe drones have been, under such circumstances, wintered over; but whether they are of any value in the spring or not, I am unable to say; I should fear they would not be by the time queens could be reared. We usually have drones in some of our colonies as soon as April, and that is as early as I should care to undertake to rear queens, in ordinary seasons. I have several seasons reared queens and had them successfully fertilized, even after all the drones had been gone some time, so far as I could discover; and as they proved to be purely fertilized, I have been not a little perplexed. Is there a possibility that, by some *other* strange exception to the rule, a queen *may* lay eggs that will produce workers as well as drones, without being fertilized? If such is the case, it will account for the rare instances in which queens hatched with imperfect wings, lay eggs that produce worker-brood. We know that aphides and some other insects reproduce their species without any agency of the male, for several generations. It is of no use to say we do not believe it, for the evidence is indisputable. How wondrous are thy works, O Lord!

DRONES WITH BRIGHTLY COLORED HEADS OF DIFFERENT COLORS.

This is a queer feature in natural history. Almost every summer some one writes or sends us specimens of drones with heads of different colors. The matter has been reported and commented on at different times in GLEANINGS. Not only do we occasionally find drones with white heads, but we find them with heads of a cherry-red color; again, of a bright green, and at other times yellow. I confess there is something very wonderful and mysterious to me in this matter. Why queer old dame Nature should decide to single out the heads of drones to sport with in this way will, it seems to me, be a pretty difficult matter to explain. Why should this peculiarity show itself in the drones more than in the queens and workers? Again, why should *heads* be the subject of these bright rainbow colors? Is there really any purpose or design in it? or is it just because it *happened* so? I presume there are very few among our readers but will say there is a purpose and a design in it; and the next thing is to decide why it should be so. Here is a question for scientists.

A singular fact in regard to this matter is, that we find many of these colored drones in one hive; that is, where you find one red-headed drone in a hive, you will probably find more; and a queen that produces them once will do so again. If I am not mistaken, I have seen hives where all the drones were colored in this strange way; and their heads were all alike — of one color.

DYSENTERY.[333] When you see your bees covering the entrances to their hives with a brownish yellow, disagreeable-smelling excrement, you may say they have the dysentery, or what is usually known as such. If the weather becomes very warm and pleasant, they will usually get over it, after they have had a full flight. If, on the contrary, the symptoms show themselves before warm weather, and no opportunity is given them to fly, they may get so bad as to cover their combs with this substance, and finally die in a damp, filthy-looking mass.

CAUSE OF DYSENTERY.

I believe the most common cause is bad food, coupled with an open, cold hive, with a small, or insufficient cluster of bees. I can hardly think any food alone would produce the disease, because we rarely, if ever, find the bees suffering from any thing they will gather, in warm summer weather. Honey gathered from rotten fruit, if we may call it honey, is very productive of this complaint, and cider from cider-mills is almost sure to kill bees at the approach of cold weather. See CIDER. I knew a lady who boiled up a mash of sweet apples and fed to the bees, because they were short of stores, and she could not afford to buy sugar for them. They all died of dysentery, long before spring. Where dampness accumulates from their breath, and settles on the combs, diluting the honey, it is very apt to cause these symptoms. Sorghum syrup has brought on a very aggravated form, and *burnt* candy or sugar is almost sure poison to bees, although it may be fed them with impunity in the middle of the summer. The burnt sugar, or caramel, attracts moisture from the air very rapidly in damp weather, and I am inclined to think it is this moisture that produces the disease.

While it is very certain that no such symptoms are found in warm weather, it is also certain that a strong colony in a hive with soft, warm, dry, porous walls, will stand an amount of bad food that a weak one, or one exposed to drafts of cold air, will not. I have known bees having considerable stores of cider, to winter very well, if the colony were strong enough to keep the whole interior of the hive dry and warm. A powerful colony, if left with their hive uncovered during a rain storm, will soon dry themselves: and while they are doing this they remind one of a sturdy cart-horse, as he shakes the water off his hide and dries himself by his internal animal heat. While they have the health and numbers to repel moisture in this way, they are safe against almost any thing. But to help them to keep this internal strength, they should have close and comfortable quarters, very much such as you would need, my friend, to enable you to pass a severe winter's night in health and comfort. The hives often used are so large and barn-like, in respect to the winter's brood-nest, that comfort is almost out of the question, for it does little if any good to pile straw, corn-fodder, etc., over the outsides of the hives, while the cluster within has no sort of protection at all. If they were in a hollow tree, the diameter of which was so small that they could fill it completely, they would be in a much better place, especially if the sides were lined with soft dry rotten wood. I have seen icicles nearly as large as my arm, in box hives that were tight and large; these had all formed from the condensation of the breath of the bees. Now, should they melt during a thaw, in such a way that this water would run down on the bees and their unsealed stores, it would be very apt to produce unhealthiness, to say nothing further.

THE AGENCY OF THE APHIDES IN PRODUCING DYSENTERY.

Perhaps the most productive cause of dysentery is the honey from the APHIDES; or, at least, most complaints have been made of this honey. As bees seldom touch this, except during droughts or unfavorable seasons, it is quite likely it has been the cause of much of the mischief. If the early honey is all extracted from the brood-combs, and the bees left with nothing but this bad honey, gathered late in the fall, the matter is much worse; and many cases have been reported, of colonies dying where the extractor had been used, while those untouched had been free from the disease. The moral is, refrain from extracting too closely from the brood-apartment. I would at least let the bees fill their brood-chamber with clover or linden honey, just before the yield ceases, extracting toward the close of the harvest, only from the combs in the upper story, unless you choose to feed them up for winter, on sugar or candy. We have had one or two favorable reports of wintering on the aphidian honey, from which we may conclude it is not always deleterious.

PREVENTION OF DYSENTERY.

From what I have said, you will probably infer that I would make the swarm larger or the hive smaller, during the winter season. If we say, also, have the walls of the hive of some warm porous material that will absorb moisture and afterward dry out readily, you have the idea so far. Perhaps the chaff cushions and DIVISION-BOARDS are the readiest means at our command of accomplishing this.[334]

While they might get along on almost any kind of food when thus prepared, I would by no means fail to give them good wholesome stores, as far as possible. Honey gathered in the middle of the season is generally wholesome; for by the time winter comes, it is thoroughly ripened, by the same drying-out power I have spoken of. Honey gathered in the fall, if sealed up, is generally good; but some of the fall flowers produce a honey that seems to separate into a thin watery liquid, and a granular substance, something like candied honey. I am not quite sure this causes dysentery, but it looks in some seasons very much as if it does. A syrup made of white or granulated sugar, I believe is always wholesome ; and when bees are short of stores, it is probably the cheapest and safest of any thing we can feed late in the fall.

I once wintered a colony on sugar stores, that came out so healthy in the spring that they did not even spot the white snow visibly, when they voided their excrement at their first flight in the spring. This, I believe, we may consider perfect freedom from any sign of dysentery. A friend, who is an old - time box-hive bee-keeper, says it is the pollen that makes them spot the snow; that if they are wintered without pollen, they will make no perceptible spot. I think there may be some truth in this, for those wintered without pollen seem to spot the snow but little. Spotting the snow is not always an indication that we should be alarmed, especially if the bees seem to rise without trouble, and get back to the hive in safety; but should they soil the entrance and inside of their hives, and then fall around the entrance in considerable numbers, unable to take wing, it is pretty safe to say, that, without very warm fine weather, they will soon be demoralized and broken up.

CURE FOR DYSENTERY.

Summer weather seems to be a sure and certain cure. One day of summer weather, or a day warm enough for them all to fly freely, is, I believe, a cure usually; especially if they are provided with wholesome food and tucked up warm, after they have had this fly[335].

The question now comes up, Can we not give them this needed fly by artificial means? It has been done, many times with success, by taking the hive into a warm room, and fixing a square frame of thin cloth or netting over it, in which they can fly and empty themselves. This frame should be about a yard square. The room should be light and warm. After they are through, the temperature should be allowed to fall until they are driven back into the cluster on the frames. To avoid soiling the hive and combs, papers may be spread over them, only allowing an opening for the bees to come up into the cage. This is a troublesome and disagreeable task, and I think will hardly pay, unless it is with a few hives, or to save a very valuable queen. A beginner is very apt to be alarmed, when there is no trouble at all ; and I repeat, unless the bees are soiling the combs in the hive, and getting themselves soiled, damp, and demoralized, I would let them alone (after tucking them up with chaff cushions) to take their chances until there comes a warm day. I know of a beginner who, on looking into his hive and finding only a small cluster away down in the combs, imagined they were nearly all dead; and hearing, through the journals, of giving them a fly in a cage, took the innocent and unoffending bees into the house, and warmed them up. The little knot of bees began to unfold under the influence of the warmth, and turned out to be a good-sized colony. They had packed themselves down into a little sphere, so small that an inexperienced person would have been likely, at first glance, to call them only a good-sized handful ; but they were a good swarm, and were in just the shape they should be to stand a zero freeze, or, rather, they had done the very best they could do in a winter broodnest four or five times as large as they really needed.

If the trouble is caused by bad honey, and this is many times the case, they should be removed from their combs, after their flight, and supplied with honey which you know, or have reason to think, is good, well ripened, and wholesome. Every bee-keeper should have a stock of such combs on hand for emergencies. They can be taken from the hives during the yield from clover or linden, in July or Aug. If you can not get these, I would give them candy, a small lump at a time, just over the cluster, the bees, of course, being on empty combs. 'Tis rather risky, I know: for after the bees have become diseased as I have mentioned, they seem to be discouraged, and to have lost all heart to do any thing. I have known them to starve with candy or honey close to them, at such a time. If you can stir up some ambition in them, and get them to clean off their wings and "plumage," and go to work, there will be no trouble; but so long as they preserve that listlessness and indifference, there is but little hope for them ; they will probably swarm out on the first warm day, if you do "tinker them up." If the season is pretty well along, say April or May, you can often stir up their ambition by giving them a little unsealed brood from another colony. The old adage, that an ounce of prevention is better than a pound of cure, will apply most emphatically to dysentery. It may be that we *can not* always *prevent* dysentery, for some cases seem rather difficult to account for, but I think we can in most cases.

E.

ENEMIES OF BEES. These are, so far as I know, taking them alphabetically, ANTS, BEE-MOTHS, birds (KING-BIRDS), mice, parasites, skunks, TOADS (and frogs), and wasps. Perhaps I should also add, wicked boys or men who have so little regard for the rights and faithful hard earnings of their fellows, that they sometimes steal hives, honey and all, just for the trifling amount of honey to be got from the mashed-up ruins, which they generally make of the bees and hives. To be frank, I should add patent-hive men; and these latter, so far as my experience goes, have been worse enemies of the bee than any I have yet enumerated. It has been said, and with much justice, that ignorant bee-keepers are the bees' worst enemies. If ignorance had coupled with it, willful deceit and fraud, I do not know but that I should subscribe to the assertion; but as those who have been ignorant are now very rapidly becoming educated and intelligent bee-keepers, I have much charity for them. The man who is persistently and willfully bad, is not only the worst enemy of bees, but of all mankind, himself included; and of this class are the greater part of those who take money for their pretended inventions in bee-hives. I am speaking severely, I am aware; but could you, year after year, hear, as I have, the statements of those who have taken up the pursuit with all honest enthusiasm, and hear them tell of how they have invested money and time, all in a wrong direction, of how they have been purposely kept in the dark in regard to what was really known about bees, of how they have been told that the bee-moth is the one great enemy, and that no one else has the secret of its banishment, I think you would agree that these land-sharks in human form are worse enemies than all the moths, birds, and toads combined, that ever infested the neighborhood of bee-hives.

Ants and bee-moths have been noticed already in their respective places; under the head of KING-BIRDS we shall mention what is known of the depredations the feathered tribes make on bees.

MICE.

Mice do harm only when they get into the hives, and this part of the subject will be sufficiently noticed under the head of ENTRANCES. It may be well to remark that mice sometimes make sad havoc among surplus combs, when stored away with small patches of honey in them.[73] The combs will be completely riddled[336] during the winter time, if they are left where mice can get at them. On this account, the honey-house should be mouse-proof; and for fear that a stray one may by accident get in, it is well to keep a trap ready, baited with toasted cheese. If you have not a tight room, make a tight box, large enough to hold all the surplus combs which have honey in them.

PARASITES.

The only parasite we have ever seen is the *Braula*, or Italian bee-louse, and we have never seen them except on bees just imported from Italy. I feel safe in saying no fear may be anticipated from them, if the bees are kept in strong colonies, and in clean tight hives, with no old refuse and rubbish accumulating about them. One or two reports have been received of bee-lice in our own country, but they were exceptions.

SKUNKS.*

Skunks have been known to approach the hive at night time, and, by scratching on or near the alighting-board, to entice the bees out where they could "gobble them up." It would seem a little strange that these animals have no fear of stings, but they, doubtless, are guided by a sort of instinct that enables them to divine how to get hold of the bee with its sweet morsel of honey in its honey-sac, without receiving harm from the sting.

SPIDERS.

Spiders, and the method of repelling them, we have mentioned under ALIGHTING-BOARDS and PORTICOS. They too, as well as toads, seem to have a rare appreciation of a heavily laden bee as he returns to the hive; we should therefore be careful that

* A lady correspondent in *Gleanings in Bee Culture*, page 866, Vol. XV., writes that she effectually got rid of skunks by the use of Rough on Rats stirred in an egg. This mixture was placed at the entrance of hives previously visited by skunks. After the doses had been repeated two evenings in succession the skunks never again paid their visitations.

all spider-webs be faithfully kept brushed away from the hives, and that the hives have no corners or crevices about them, to harbor such insects. Be sure that there is no place which the broom will not clear out at one sweep; for where we have a hundred hives we can not well spend a great amount of time on each single one. The house-apiary is quite convenient in this respect, and it gives me a fine appetite for breakfast to go out bareheaded, and brush off every trace of a web, with such genuine good will that the poor spiders, as soon as they have recovered from their astonishment, with one accord agree that the locality is an unhealthy one for those who believe in driving a thrifty business.

I am inclined to think that many of these so-called enemies only take up the destruction of bees as a chance habit, and that it is not always to be looked for or expected. Common fowls sometimes get a habit of eating their own eggs; but it is so unusual an occurrence that we can hardly regard it as a matter of any very serious importance. It may be well, at times, to look out for the enemies that prey on bees; but, as a general thing, I think they are quite capable of fighting their own battles, if we give them the proper care and proper hives.

WASPS.

Wasps and hornets sometimes capture and carry off honey-bees; but unless they should take part in the work in great numbers, I would have no solicitude in regard to them.

A large fly, called the bee-hawk, or mosquito-hawk, has been mentioned by our Southern neighbors, but it is said to be easily frightened away by opening a vigorous warfare with whips and sticks.*

THIEVES AND PATENT-RIGHT VENDERS.

Under APIARY I have mentioned how we can protect our hives from the inroads of thieves, but I fear it will require something more than tight high fences to protect bee-*keepers* from venders of patent hives. I do not know a single patented feature on bee-hives and implements (and there are hundreds and hundreds of them), that would come into general use if the patent were removed.[75] Almost constantly I am receiving descriptions and circulars of some patent hive, asking if I would advise investing in them; and although I have faithfully examined every thing that has come up, I find them pretty much all alike; either wretched mistakes and blunders, or the work of greedy, unprincipled, bad men. Have nothing to do with them, and under no circumstances think of paying them money. No, not even if they are ministers of the gospel, as many of them claim to be; and some of them are, I presume, God-fearing men whom the sharpers have, by oily words, persuaded to undertake the work; for they know full well that there is no advertisement in the world like having Reverend attached to the name of their agent, or among the testimonials appended to their circulars. I would that I were able to convince *some* ministers of the sacredness of their calling, and of the importance of the most zealous care in guarding it from contamination.

So far as the winged, feathered, and four-footed tribes are concerned, we have, my friends, but little to fear from enemies of bees, and we shall have but an easy task to keep them in subservience; but from ignorant and unprincipled men we have much to fear; and we have abundant need of the most earnest and faithful work, in the shape of Christian kindness, united with a firm and decided stand against speculators and sharpers.

ENTRANCES TO HIVES. I do not know that it makes any *very* great difference to the bees, or with the amount of honey gathered, where the entrance is; whether at the very lowest part of the hive, or right in the top. I have had them do well with their entrance in almost all positions. On many accounts, an entrance even with, or a little below, the bottom-board of the hive would be most desirable. This gives the bees every facility for removing filth, or dead bees that frequently clog the hive and combs in cold weather, also bits of refuse comb, cappings from the cells, dust, etc., for this all falls to the bottom of the hive, and is naturally carried toward the entrance by the passage, out and in, of the inmates. Also, if the upper part of the hive is close and warm, the warm air generated by the cluster, rising by its lightness, compared with the colder air outdoors, has a much less chance for escape than if the entrance were nearer the top of the hive. If the entrance is a little below the bottom-board, cold winds and storms are not so readily admitted.

It has been said, that an entrance part way up will not be so liable to become clogged with dead bees. This I admit; but I think it would be much better to have no dead bees at all in the hive, and we seldom, if

* For further particulars, and also for descriptions of *Asilus Missouriensis*, *Mallophora orcina*, *Mallophora bomboides*, and other insect-enemies to bees, see Prof. Cook's *Manual*.

ever, see any in the chaff hive or in any hive that is equally well protected[337]. It has also been said, that if the bees could get in nearer the top of the hive, they would have a short path to the center of the brood-nest, where they generally make their way about as soon as they gain a foothold. This I admit in part; but if we give the bees this short cut *in*, we also give the warm air of the brood-nest a short cut *out*. Besides, with the shallow L. frames we use and advise, the bees have but a short distance to climb. All things considered, I think we can not do better than to have the entrance just below the bottom-board, as in the two hives we have illustrated. In the Dovetailed hive the entrance is formed by the cleats on the bottom-board. This is contracted in the usual way by three-cornered entrance-blocks. See ALIGHTING-BOARDS.

I need hardly add, that where we have the entrances arranged in this manner, close to the ground, we *must* have the ground clean and free from weeds for several feet around and in front of the hive. See APIARY and ALIGHTING-BOARDS.

The entrances to all hives, in the winter time, should be closed to such a width that no mice can by any possibility get in; if they do not exceed ⅜ of an inch, there will be no danger. When bees are wintered in the open air without protection, the dead bees are liable to fall down, and clog the entrance. When a warm day comes, the live bees will try hard to get out. The apiarist should be on hand at such a time, and while he lifts the hive from the bottom-board, an assistant with a broom should quickly brush off every accumulation. The hives and combs should then be fixed so that no more may straggle away from the cluster and get frozen between the empty combs.

SIZE OF ENTRANCES.

With strong colonies this is a matter of no great importance, providing the entrance is large enough to let all the bees out and in readily, in the height of the honey season, and not so large as to let in too great an amount of cold air during the severest winter weather. In the house-apiary we use a two-inch auger-hole, but it is, in reality, reduced to about 1⅜, by a piece of thin whitewood veneer steamed and rolled up into a tube. The size of these entrances seems about right for a strong colony; if the colony is weak, we reduce it with a wad of paper. The entrances are left full size all winter, and, all things considered, I think the size is about right. We were, one winter, troubled somewhat by mice getting in at the lower ones, and metal guards were made, reducing the size to a ⅜-inch slot; this kept out the mice, but it bothered the bees so much that we were glad to take them away and get a big cat to guard the outside, which he has done so faithfully that we have had no further trouble. See ENEMIES OF BEES.

The entrances to the chaff hives are ⅜ wide, by 14 inches long[338]. If the colony is a full one, we leave them open full length all winter. If weak, contract to about one inch; and for nuclei, sometimes, so that just a single bee can pass. We contract them by cutting a piece of wood 13 x 2 x ½, and covering it with some warm thick woolen cloth. Some apiarists, I believe, practice closing the entrances to all hives during very severe weather, opening them again when the weather moderates. This, I think, is carrying the matter entirely too far, and it reminds one of the philanthropic old gentleman who stood in the rain while he held his umbrella over the ducks in a puddle. We have wintered bees in the chaff hives, with the entrance open its whole length, during the most severe winters, with scarcely a dead bee having been brought out when it came off warm, and I think the bees are perfectly capable of taking care of themselves for at least six months of the year, if they have proper food and protection. To have the entrance left open full width, of course we must have the hive contracted to a small compass, and perfectly closed above, or the entrance will draw in the cold air, like the draft to a stove. Stop every crack and crevice, with chaff cushions tightly crowded in; and if you do your work well, instead of cold air forcing its way *in* at the entrance, you will find the bees can keep warm, and send a stream of hot air *out* at the entrance besides, as soon as they commence rearing brood in the spring. If you have hives that you can not close up with the chaff cushions, as I have advised, it may be best to close the entrances during very severe weather; but I think I would always leave room enough for one or two bees to pass, lest they be forgotten, when warm weather comes unexpectedly. It is very bad policy to confine bees to their hives when the weather is such that they would try to get out. Bees wintered in a dark cool cellar may have wire cloth tacked over the front[339] and top to keep them from getting on the floor, if you choose, but in this case you should take them out and release them should the weather get so warm that they are impatient or uneasy. When bees are wintered on their summer stands, they are always ready for a fly whenever a warm day occurs, and are in shape to take care of themselves, under almost any circumstances, providing they have a free and unobstructed entrance.

Mr. Quinby and others have recommended having an auger-hole in the front end of the hive, and adduce, as proof of its utility, that the bees at once show a preference for this pass-way. I have no doubt of it, and I think if an auger-hole were made directly in the top of the hive, they would show a still greater preference for that; but for all this, I do not think it would be best for them. With tall frames, I think such an auger-hole might be a great advantage, but with our shallow L. frame I would prefer not to have it, although it would perhaps do no perceptible harm to a strong colony with old and tough combs. You can easily make the experiment; and if you do not like the auger holes, plug them up again. I much prefer you should verify these statements by tests of your own. If I have made a mistake anywhere, write, and I will correct it before I send out any more A B C books.

EXTRACTED HONEY. Liquid honey, taken from the comb with the honey-extractor, has been before the world since the year 1865, and much has been the discussion, pro and con, in regard to its merits, and its desirableness compared with comb honey, for table use. If I have made no mistake, I extracted the first ton of honey ever taken from one apiary, with the extractor; and as it was put directly into market, and such honey has been kept in market constantly ever since, I have had a pretty good opportunity of knowing all about it.

If all the extracted honey put upon the market were as good as some we have raised and purchased, there would, I am quite sure, be no trouble at all in deciding that it would drive honey in the comb almost out of the question. Much has been said about adulteration, but I have very little fear in that direction. It is almost as impossible to imitate a really fine article of clover or linden honey as it is to imitate fresh strawberries. Let the people taste of the honey they are asked to buy, and they will very soon say whether they want it, and what they can afford to pay for it.

A really nice article of extracted honey will bring 10 or 12 cts., quicker than a poor article will bring 6 or 8; and I have seen some, aye, and have offered it for sale too, that I do not honestly think was worth over 3c., if it was worth anything at all, unless to feed bees. Is all this difference on account of the source from which it was gathered? Not at all; for all the honey we get here, in the great majority of seasons, is from clover and linden. Then where is the great difference? It is, so far as my experience goes, simply because it is taken from the hive before it is ripe. I know there are many who do not agree with me, and I presume in some seasons, and in some localities, the honey may be ready to extract as fast as it is gathered from the flowers.[76] I make this admission solely from what others have said, for *I* have never seen any honey I thought was fit to extract, until it was all sealed over. Still further, I do not believe it is nearly as nice[340], even when it is all sealed over, as it will be if left in the hive three or four weeks *after* it has been all sealed. I will tell you some of my experience to illustrate the point.

In 1870 we extracted, from our apiary of less than 50 colonies, over 3 tons of honey. It was put up in 1-lb. bottles, and more than half was sold for 25c. per lb. During the fore part of the season, the honey was allowed to get pretty well capped over: but during basswood bloom, we, bees and all, got somewhat crazy, I fear, and they brought in what was but little better than sweetened water; we extracted and put it into bottles, and hurried it off to fill orders, hoping it would all get "good," as soon as the weather got cool. It candied when the weather became cool, for almost all honey will candy, or at least one portion will candy, leaving a thin watery part, which, if it does not sour, acquires in time a disagreeable brackish flavor, like that acquired by liquids standing in an old barrel. At about this stage it shows that peculiar quality of pushing the bungs out of the barrels, and the corks out of the bottles, running over on the shelves and tables, to the discomfiture and disgust of everybody who likes to be cleanly in his habits. When I tasted some of the honey in one of these bottles, 6 months afterward, I did not wonder it had stopped selling, and I made up my mind it should no more be offered for sale. I believe it was all poured out of the bottles, and sold to a tobacconist. The contents of the jars were not all alike, for the thin watery honey has quite a tendency to swim on top. We, one season, commenced to retail from a barrel of what all pronounced fine clover honey. One day a customer returned some, saying it was not like what he bought before. We assured him it was drawn from the same barrel, and went and drew some, to convince him. Behold! it was sweetened water, compared with the first. The thin honey having risen to the top, it was the last to be drawn out.

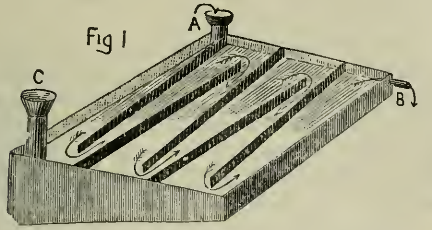
Again, new honey has, many times, a rank, disagreeable odor and taste. I have been told that in the Eastern States much honey is sometimes obtained from the fields where onion seeds are raised for the market, and that this honey, when first gathered, is so strong of onions that it can not be used. In a few weeks, however, this rank and disagreeable flavor is all gone, and the honey is very fair. Few persons can tolerate the strong, aromatic flavor of basswood honey when first gathered, and some of the jars I have mentioned, when opened, gave one an impression that something akin to turpentine had been mixed with the honey. This was because it had been closely corked when first gathered; had it been left in the comb until sealed, the unpleasant taste would have been mostly gone. I say mostly, for even sealing does not seem to entirely remove the rank flavor, unless the combs have been some weeks in the hive. I remember I once took a beautiful-looking piece of comb honey out of a jar that was found in the market. On opening the cells I found the honey had such a rank basswood flavor, that it was, to me, quite disagreeable, and yet I am fond of the basswood flavor. Very white, new comb honey is seldom of the fine, pure, sweet flavor of honey that has been a long time capped over, such as is found in the dark-looking comb. To which shall we give the preference — looks or taste? We once were so busy that we could not attend to extracting, and so we raised the filled stories up, and put those filled with empty combs just under them over the brood. This occupied little time, and the bees were not hindered in their work, a single moment. I have never seen bees amass stores faster. Some swarms filled four stories to repletion, and the whole was left on the hives until the latter part of the summer. In fact, I left them on the hives to be safe from the depredations of the moth, intending to cut out the honey and sell it in the comb, or to extract it, whichever form should prove most marketable. This honey was cut out of the frames and sold the following winter, and it was the nicest and richest honey I ever saw or tasted. To my astonishment, the liquid portions, that ran out when the combs were cut, would not candy at all, even when exposed to a zero freeze. The honey was so thick, that a saucer full could be turned over without spilling, and it had a bright crystalline clearness, when compared with ordinary extracted honey.

Extracted honey, if taken out while "green" (as I have often termed the unripened state), has a greenish tinge, which well-ripened honey has not. Some specimens have a turbid, or cloudy look, and I believe such honey is never really fine flavored. I am well aware that I am condemning the very honey I once sold, by these remarks, but I can not help it. If I had now some extracted honey such as was taken from those well-ripened combs, I would feel that it was preferable, at 15 cts., to that which sells at 8 or 10 cents. Properly ripened basswood or clover honey has a sparkling clearness, like white flint glass, and the flavor is pure and exquisite. I have never seen any nice-looking comb honey equal to it, for the market always demands comb honey that is white, and has not remained on the hive a long time.[17] I do not mean to say that extracted honey should be without color, like water, for it usually has an amber tint, or it may be quite yellow; but it should be clear, so that you can read print, without trouble, through a jar of it. After it has candied, if it does candy, it should be hard and free from any liquid portion, like that in unripened honey. This thin liquid portion is the part that usually changes and gives it the bad taste. In fact, if the liquid portion be drained off, as directed under CANDIED HONEY, the solid portion may be melted, and it will be found very nearly like that ripened in the hive.

RIPENING HONEY BY ARTIFICIAL MEANS.

At several different periods, machines have been suggested for evaporating thin honey without the aid of the bees. The advantage to be gained in so doing is, that a much larger quantity may be obtained by taking it from the hive every day as fast as it is gathered; or, at least, the votaries of these evaporating machines claim as much. The one illustrated on next page is used by L. C. Root, of Stamford, Ct.

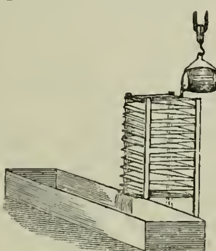
It is a simple apparatus made of tin, with an inclined top. Upon the top surface are strips of tin made so as to guide the honey down the inclined strips, as shown by the arrows. Of course, the honey is to be extracted before it is capped, or just as fast as the bees collect it. In its unripe condition it is run over the evaporator, entering at the tube A, and running out at B, fully ripened.



APPARATUS FOR EVAPORATING THIN HONEY.

The tube C is to fill the tank with water. A thermometer is also placed in this tube, to indicate the temperature. The heat is maintained by an oil-stove.

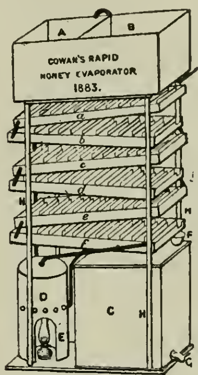
In the following cut we have an arrangement for accomplishing the same object. It is the invention of Mr. S. T. Pettit, of Belmont, Ontario. Mr. Pettit states, that during a bountiful yield he often extracts as often as once in three days; and when he gets a barrelful it is raised by means of a pulley to the top of his honey-room. The faucet of the barrel is then opened slightly, and a small stream of honey allowed to trickle upon a sheet of tin. The honey drips upon the edge of another sheet placed so as to be inclined in the opposite direction. From the lower edge of this sheet the honey drips upon the upper edge of the third sheet; from the third to the fourth, and in this manner it continues to flow from sheet to sheet, until it passes over about thirty, when it runs into a large vat. To prevent the honey from running off the sheets, the edges are turned up slightly. Mr. Pettit says he has never thought it necessary to run honey through the evaporator more than once.



PETTIT'S HONEY EVAPORATOR.

Mr. W. S. Hart, of Hawks Park, Fla., ripens his honey artificially by means of sun heat. He has a large pan made that has upright partitions passing backward and forward (the same as in L. C. Root's evaporator) in such a way that the honey has to pass a good many feet under glass under a tropical sun, before it finally runs into a barrel. This method, Mr. Hart says, gives him beautiful thick rich honey, and I have no doubt the solar heat might be utilized to good advantage in California, and perhaps in our Northern States, in ripening honey artificially.

The accompanying apparatus is the invention of Mr. Thomas William Cowan, of London, England. The 6 trays, *a*, *b*, *c*, *d*, *e*, *f*, with transverse partitions, have a double bottom, with an inch space between each, for the passage of hot water. Each tray is connected by a pipe. D is a boiler heated by a lamp or gas-jet. The hot water passes from the boiler successively through each of the trays until it overflows into the compartment A, from which the water is conveyed again to the boiler. The "green" honey is put into B. From here it passes to the upper end of tray *a*, back and forth through the partitions, until it reaches the lower end, whence it discharges into *b*, and so on to the funnel F, and finally into the tank C. The honey travels a distance of 100 feet over a heated surface, and by this time has the proper thickness. Mr. Cowan considers honey so ripened just as good as that ripened by the bees.



I have never tested any of these machines, and am therefore not prepared to give an opinion of much value on the subject. For all that, I feel like expressing a doubt that such arrangements will ever be found cheaper and better than to let the bees manage it after their old-time fashion. You will see by Doolittle's 24th comment that he thinks the honey ripened by artificial means is fully equal, however, to any ripened by the bees.

HOW TO SELL EXTRACTED HONEY.

Get it well ripened, as I have just told you, and then strain it into clean tin cans, into barrels coated with paraffine or beeswax, or into some utensil that you know will not taint it in the least. Honey is very easily damaged by any thing that will mar its pure flavor, or clear transparent appearance to the eye. If you are going to retail it you can keep it in a tall can, with a honey-gate at the bottom. Set it up at a convenient height, and have a pair of cheap scales directly under the gate, on which you can set the bowls, pitchers, or pails, that your customers may bring. You can by this means weigh it out to a fraction.

without any dripping or daubing. If it is to be sold in honey-jars, set your jars in a basin, under the gate. I say in a basin, for unless you are more careful than people generally, you will get some over the sides, or run a jar over, and it is much pleasanter to have it in the basin than on the table or floor. I have given the preference to the self-sealing quart fruit-jars, because everybody has use for these, and will be likely to keep them. If the jars are purchased by the gross, they can be retailed with the honey, at a slight advance on first cost, full enough, usually, to pay all expenses of handling, and a good interest on the use of the money invested. The Mason jar, which we generally use, costs $10.00 per gross, and we charge for them, with the honey, 10c. A quart jar holds about 3 lbs. One-pound jars sell rather better, but we have to sell three times as many, and consumers have little or no use for the jars when empty. I think it will be well to keep both kinds on hand, as well as some ½-lb. tumblers or jelly-cups, for the multitudes who want " just a little " for one reason or another. If you commence giving, now and then, a little without any charge, you will find the demand a severe task on your time as well as honey; and if you have these small packages all ready at hand, for 10 or 15c., you will find a great many will be sold in the course of a year.

If you wish your honey to keep from candying, seal it up hot, like fruit, as directed in CANDIED HONEY. The self-sealing fruit-jars need no directions, but the bottles with corks will have to be made tight with melted beeswax. Dip the corks in melted wax until they are perfectly coated on both sides, and then push them in place while the mouth of the jar is hot, and perfectly *dry*. If it is wet, or has the least particle of honey on it, you can never make it air-tight. To make a neat job of it, you can dip the mouth of the jar carefully in some bright nice yellow wax, and then you will have it, as far as possible, protected from the air with a capping of wax, precisely as the bees do it.

Thin, watery honey, when heated to melt the candied honey, with which it may be commingled, even if it is exposed to a heat much less than the boiling-point, will turn a dark reddish color, and the flavor is something as if the honey was burned slightly. I, at first, was inclined to blame my wife for overheating it, when I desired her to make the experiment; but as the honey was white when this liquid portion was entirely drained off, I finally guessed at the truth. We can get some beautiful, pure, ripe honey out of a very bad lot, by draining the candied portion for several weeks, and then melting it.[341]

Some attempts have been made to get honey into a marketable shape in its candied state, but so far have been unsuccessful, so far as I know, although candied honey can be drained out so dry that it may be done up in a paper safely, and we have had some specimens nearly as white as loaf sugar.[78]

PEDDLING EXTRACTED HONEY.

Since extracted honey was first put in the market, there have been a good many ups and downs in the sale of it, largely in consequence, however, of want of care in putting it up. During 1887 a young friend living in a county near by succeeded in building up a very large business in extracted honey, something after the following plan: He goes into our large cities, such as Cleveland, Toledo, or cities of even smaller size, and starts out on foot, exhibiting a sample of his honey in a one-quart Mason fruit-jar. His reason for using this package is, that almost any family will be willing to take a jar at 10 cents, at which price there is a little margin above cost. Friend Moore gives them a little honey in a dish as a sample. Every housewife can furnish a spoon and dish, so the agent has no trouble with cleaning or washing utensils. He charges 50 cents for one quart of honey and 10 cents for the jar, taking as many orders as he can in a day; then with a small hand-cart, made on purpose, he takes as many jars as he can draw on the pavement, say 100 or more, according to the weather. By taking orders first and delivering afterward, the purchaser is enabled to have the money ready, so business can go right along rapidly on a cash-down basis.

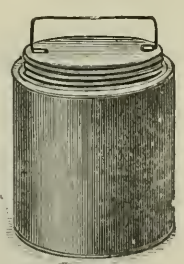
Our friend commenced on the above plan; but as the business increased he hired a man to do the delivering while he took orders; and at the present time he is employing four different individuals besides himself. Two men assist him in canvassing the city; and a woman (the wife of one of the men) assists in washing the jars and filling them. At the present time he is disposing of one ton of honey a month. This honey costs him, in ton lots, from 9 to 10 cents a pound. As there are three pounds in a jar, he gets between 16 and 17 cents. Where he is enabled to get hold of a nice large lot of honey at a low figure, he almost doubles on his money. But this is a necessity, in consequence of the great expense of doing business in large cities. Of course, he is careful to have the honey nice, and a first-class article; and he gives his customers satisfactory proof that it is absolutely without adulteration of any kind. Selling honey in this way is a trade, without doubt; and friend Moore admitted, when questioned, that he could sell almost twice as much as any man he could employ, for he has developed the business and worked it up himself. I think almost any bee-keeper may dispose of his honey in the same way, if he has the energy and determination to work it out that H. F. Moore has.

HOW TO KEEP EXTRACTED HONEY.

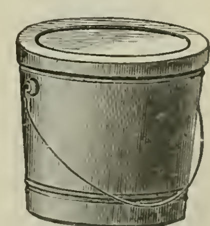
Where one has a large crop of it, and but a small price is offered, it is sometimes quite an item to know what to do with it. Without question, the very best way to keep it is to seal it up while hot, as before described, either in self-sealing jars, or in glass bottles with their corks coated and made tight with beeswax. The expense of the jars, and the troublesome job of sealing them, is the principal objection. Perhaps the next best way to keep it is in the coated barrels, or in tin cans.[79] A friend keeps his very nicely in stone crocks, with stone covers over them. In these it is candied and is as hard as tallow; but it can easily be cut out, when wanted. After it is candied in the barrels, the hoops must be moved to get it out. See BARRELS. Both extracted and comb honey should be kept in a *dry* room. If this room can be at the same time frost-proof, it will be much the better;[80] for when dew or dampness of any kind forms on the surface of honey, it is absorbed, and thus dilutes and injures the honey. This process will, in time, cause it to sour or ferment on the surface, and will surely injure your reputation if you try to sell it. Jars that are used to hold extracted honey are sometimes so hastily washed and rinsed, that enough water is left sticking to the glass, to produce the same effect, and I am quite sure that not a little of the trouble experienced with bottled honey has come from this cause. Let the bottles be clean and dry, and the honey perfectly sealed while hot. Then you can keep it down cellar, or up stairs, or anywhere you wish. A friend in the West says he keeps his extracted honey outdoors in an open shed all winter, and that when the neighbors come for it, he cuts it out of the barrels with a spade. Such a place would be preferable to a damp cellar.

VARIOUS PACKAGES FOR SHIPPING AND SELLING EXTRACTED HONEY.

Since 1882, extracted honey has taken an impetus in public favor. To my surprise, people have begun to demand honey that is candied, instead of making it an objection. Our friend C. F. Muth, of Cincinnati, one of the largest honey-dealers in the world, says he now has many customers who will not have honey unless it *is* candied. Friend Jones, of Canada, of whom mention has been made, has also done much, as has C. Dadant, of Hamilton, Ill., toward getting the honey into convenient packages to bring it before the public. Friend Dadant has given us five sizes of covered pails; viz., 1¼, 2½, 5, 10, and 25 lbs. respectively. Friend Jones struck on the idea of putting it up in packages still smaller, and commences with a package of only ⅛ lb. that can be sold for 5 cents, or given away as a sample of the honey. The sizes are ⅛, ¼, ½, 1, 1¼, 1½, 2, to 6 lbs. For each size, friend Jones has originated beautiful lithographed labels, which are, in fact, beautiful chromos; and as the surface is varnished, these labels are easily cleaned, if any honey gets daubed on their surface. The ⅛ and ¼ sizes are simply tin boxes with a cover slipping over, and are to be taken to the grocer, with the honey in a tin can, and he fills them as they are sold. They are easily handled when filled, after the honey has become candied. The ½ and 1 lb., as well as all the remaining sizes up to 6 lbs., are made with screw caps. The accompanying cut shows a 3-lb. size. These cans, although more costly, seal more rapidly. They are also very convenient for shipping.



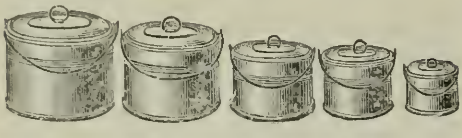
SCREW-CAP PAIL.



SLOPING-SIDE PAIL.

The other is a honey-pail holding 7½ lbs., made with sloping sides, so they will nest together for the purpose of shipping. By this means we are enabled to pack 100 pails and covers in a good-sized common barrel.

It would seem that we have had packages enough already; but there is a great demand for tin pails, which are purchased very cheaply in nests. We give the picture of a nest of five pails.



A NEST OF FIVE RAISED-COVER PAILS.

The smallest holds a pint, and the largest one four quarts. One reason, perhaps, why these pails are sold for the purpose in such enormous quantities is, that they are of just such sizes as to be extremely convenient for household purposes. Well, now, if you will be patient I will show you *still* something further. The pails shown above are short, so as to be handy for a little girl's or boy's dinner-pail, or other like purposes. Such a pail does not give the greatest economy of tin, however, nor is it suited for a graduated measure like those pictured below.

THE GRADUATED TIN PAILS.

The picture explains the great point in their favor; that is, that they will measure accurately any liquid, going down to as small a quantity as half a pint, and as large a quantity as a gallon, where one has a complete nest. Of course, suitable labels are to be used for these pails when they are full of honey; and furthermore, none of these pails can be turned upside down without leakage, unless, indeed, the honey be candied so solid that it will not run in cold weather, as is often the case with a well-ripened article. These packages are used principally by retailers who purchase their honey by the barrel, and put it into pails about as fast as their customers want it. They are to be carried about, however, rather than to be shipped long distances.

While Mr. Jones and others have done so much to develop *tin* packages for extracted honey, it will be seen that Mr. C. F. Muth, of Cincinnati, O., has been equally active in giving us nice packages made of *glass*. Below we illustrate the four jars that he uses. The smallest size is what Mr. Muth calls the "dime" jar. It holds about five ounces.

The price of these is $3.00 per gross, shipped from Cincinnati, which would be a little over two cents each. Corks and labels would make them toward three cts. each. Counting the five ounces of honey worth four cents (putting the honey at 12 cents per lb. for such small quantities), your dime jar would cost you seven cents, allowing three cents profit to the retailer. One great trouble with honey in glass is its candying property; but as a great many like it best in a candied state, this offsets a part of the objection. Another thing: These small jars may be very quickly melted by setting them on a thin board laid on the stove where it is not very hot.

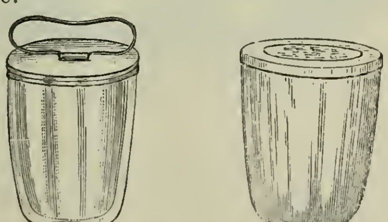
HONEY-TUMBLERS.

A large trade has also sprung up in honey put up in jelly-tumblers. These are of two

sizes, chiefly; those holding ½ lb. and 1 lb. They are made honey-tight by laying a piece of soft paper over the tumbler before the tin cover is pressed on, and then tearing off the surplus paper. Covering the paper on the side next the honey, with the white of an egg, makes a hermetically close joint. The tumblers cost only three and five cents each respectively. Below we present you with a handy stand for exposing for sale honey put up, invented by Geo. F. Williams, of New Philadelphia, Ohio.

WILLIAMS' STAND FOR SELLING EXTRACTED HONEY.

In pleasant weather this stand may be placed on the sidewalk in front of the store, and the grocer can be paid a commission for simply keeping the stand full. After he has got a trade started, he will usually be willing to buy the honey for cash, at a reasonable price.



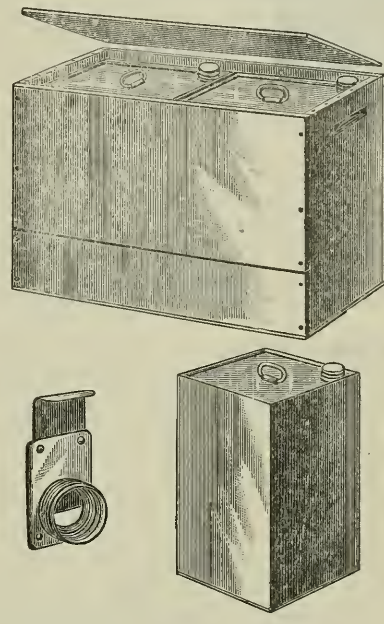
GLASS HONEY-PAIL AND TUMBLER.

While almost everybody wants some kind of a pail to carry honey in, many also prefer, for liquid honey, a glass utensil to any thing else. Both objects have been secured by the pail shown in the engraving. The top screws on, like the cap of a fruit-jar. The bail turns down out of the way, when they are to be packed, or when it is necessary to set them on shelves.

The packages just mentioned are hardly suitable for shipping extracted honey in large amounts. For shipping in quantity, barrels, kegs, and square cans should be used. See Barrels.

SQUARE CANS FOR SHIPPING HONEY.

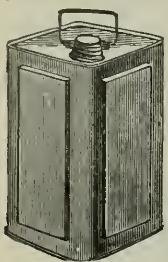
The package used for liquid honey by the friends in California is, at least for the most part, a square tin can, either soldered up tight or having a screw cap at the corner to pour out the contents, as shown below.



THE 58-POUND HONEY-CAN.

A square tin of itself would hardly be safe to ship by freight; but a stout box can be made to contain a single can, at an expense not to exceed 7 or 8 cents; and where two cans are crated together, which is the usual way the friends in California do it, the outside protecting box could be made for an even 10 cts. The figures above explain the matter so fully that no further description will be necessary.

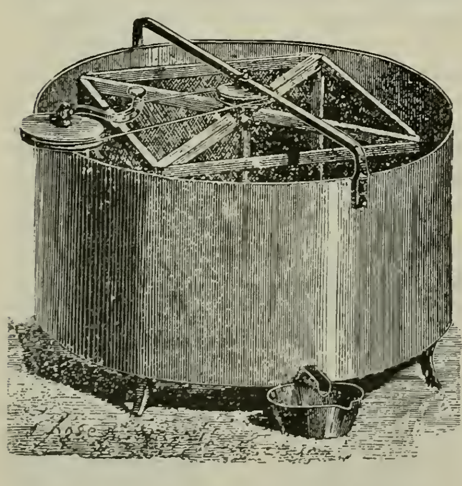
A honey-gate is shown in an enlarged view at the left, below the large cut. It is made of a piece of stout charcoal tin, $2\frac{1}{2}$ x 3 inches. A piece of heavy leather is fastened by four rivets to this tin. The leather is 2 x 3 inches, so that we have ¼ inch of the tin projecting on two sides. Fold this tin which projects, in such a way as to take in the tin slide, as shown in the cut. With a punch, you cut a hole through the leather and tin. In like manner make a hole through the screw cap, and solder to the tin, as shown in the cut. This gives us a honey-gate that will fit on any of our square honey-cans, so your grocer need have but one honey-gate, and he can attach it to his square cans as fast as he retails from them. These gates should not cost you over 15 cts. each.



ONE-GALLON 12-LB. SQUARE CAN.

More recently, to meet the wants for a smaller package on the same plan, manufacturers have introduced a gallon square can with a capacity of 12 lbs. of honey, shown in the accompanying cut. They are put up in boxes of ten each, and are sold at $1.50 per box, or $12.00 per hundred without boxing. In many cases it may be desirable for the dealer to order a part of his extracted honey in the 60-lb. square cans and kegs, and a part in the 12-lb. square cans, so that he can distribute to his customers according as they want a large or small package of liquid honey.

EXTRACTOR. The extractor, like the movable frame, is one of the things that have made a revolution in bee-keeping. It was invented in the year 1865 by Major Francesco de Hruschka, of Venice, who died at the good old age of 75, in the year 1888. Like a good many other inventions, its discovery was made by accident. His little boy chanced to put a piece of comb in a basket to which was attached a piece of rope. With rope in hand, the boy began to whirl it. The centrifugal force caused a few drops of honey to be thrown out of the basket around in the air, and the father seeing



HRUSCHKA'S ORIGINAL HONEY-EXTRACTOR.

it, was shrewd enough to see that in this was a *principle*, and the nucleus to a big invention, and that it was not necessary any longer to smash the combs up and strain the honey out in the old-fashioned way. He very soon constructed a rude extractor that demonstrated the practical utility of the discovery; and, shortly after, perfected the machine shown in the foregoing engraving.

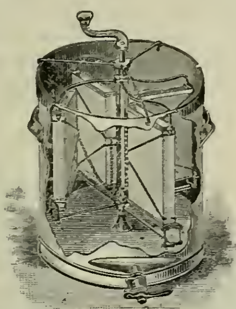
Among the early extractors made in this country was one made by George Peabody. This was so constructed that the whole can revolved, and the honey ran out through a hole cut in the center. But this was poorly adapted to the wants of the bee-keeper. In 1867 (see introduction) I constructed what I have called the "Novice" honey-extractor.

EXTRACTOR WITH SPACE FOR HONEY BELOW REVOLVING-FRAME.

This was so great an improvement over all those that had preceded, that they found a ready sale at once; and now there are something like 10,000 of them in use. The inside baskets for holding the combs, in order to combine lightness with the greatest strength, are made of folded-tin bars and tinned wire cloth, four meshes to the inch. The center shaft is simply a tube rolled out of a heavy grade of tin, instead of the old heavy iron rod that was formerly used. The crank is geared so that one revolution makes three revolutions of the baskets. The whole thing weighs only about 30 lbs., and is made, ordinarily, to extract two combs at a time. It is also constructed to take four combs, to suit the needs of large apiaries.

THE STANLEY AUTOMATIC EXTRACTOR.

The extractors already described require that. when the combs are emptied on one side, they shall be lifted out and replaced in the baskets, the other side to. This is an operation that requires a little time. To overcome this, and to do the work more expeditiously, Mr. G. W. Stanley, of Wyoming, N. Y., was one of the first to construct a practical extractor on the automatic reversing principle. This is so built that it can take two, four, or six combs; and when the honey has been thrown out on one side of the comb, the reversal of motion causes the combs to be reversed, and the other side to be emptied.



STANLEY'S AUTOMATIC HONEY-EXTRACTOR.

You will observe by the engraving, that the baskets, or, rather, wire-cloth pockets, for holding the combs, are hinged on one side. The lower hinge is after the style of that on the old-fashioned gates, that had two centers of revolution. This feature, you will see by referring to the engraving, will cause the baskets, when at rest, to radiate like the spokes of a wheel from the center shaft; but just as soon as the machine is started, they revolve, by their inertia, to one side, and form the circumference of a polygon, the chains holding them so the pockets, as it were, do not fly out too far. The reversal of the motion when the speed is somewhat reduced will cause the baskets to turn their other side toward the can.

These extractors seem to be suited only to large apiarists, and I understand that they do not please even all of these. The fact that the baskets have to have clearing room between the outside and the center shaft makes it necessary to have an extraordinarily large can—a can so large, indeed, that one fellow said he had to have a barn-door to get it through into a building. While this is an exaggerated estimate of its size, the can has ten times the cubic capacity of the non-reversing three and four frame machines. But some large apiarists, notably, A. W. Osburn, of Cuba, speaks high in his praise of it. In view of the defects pointed out in the Stanley machine, inventive genius is now at work trying to construct a reversible extractor without these defects. At present the Stanley seems to be as good as any reversible extractor sold. It is now made by Edward R. Newcomb, of Pleasant Valley, N. Y., and he has improved it by a multiplying gear, and by the substitution of better material throughout.

THE ADVANTAGES AND DISADVANTAGES OF AN EXTRACTOR.

Some of the advantages and disadvantages of using a honey-extractor in the apiary are considered under the head of extracted honey. That more honey can be obtained by the use of the machine than by having it stored in section boxes in the shape of comb honey, all are agreed; but all are not agreed as to *how much* more. If it is nicely sealed over as it should be before being extracted, I do not think more than twice as much will be obtained, on an average, although the amount is placed by many at a much higher figure. A beginner will be more certain of a crop, than if he relies upon having the bees work in sections; he will also be much more apt to take away too much, and to cause his bees to starve. This last is a very disagreeable feature attendant upon the use of the implement, especially where the bee-keeper is prone to carelessness and negligence. To secure the best results with the extractor, plenty of empty combs should be provided, that ample room may be given, in case the hives should become full before the honey is ripe enough to remove. If a second story does not give room sufficient, I would add a third for a heavy stock, during a good yield of honey.

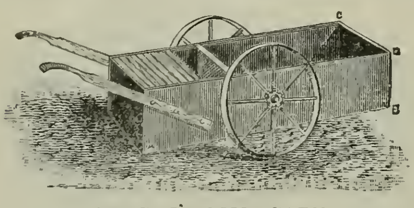
DIRECTIONS FOR USING THE EXTRACTOR.

As most of you who read these pages will probably use the Novice extractor, I will make the directions conform to that, and you can then very readily adapt them to any other machine you may purchase. Screw the extractor fast to a bench or box, just high enough to allow the honey to run into the bung-hole of the barrel.

To strain the honey, I know of nothing that answers so well as a little cheese-cloth bag tied to the honey-gate, the same to hang in the bung of the barrel. This keeps it all close from flies and dust; and when you stop work for a little while, it is all safe. As the sediment always settles to the bottom of the bag, the sides work well as a strainer for a long time. Cheese-cloth strains honey more perfectly than wire cloth.

The box which holds the extractor should be a good substantial one, and should be fastened securely to the floor. Now, if you are a beginner I would not advise you to extract unless the bees are gathering honey. If you have had some experience you may profit by leaving your honey on the hives until it is thoroughly ripened, and extract after the bees have stopped gathering honey. But in this case you will be obliged to have a large surplus of empty combs to tier up on the hives as fast as the first set of combs is filled. The best time for you to extract, if you are a beginner, is when the bees are busy in the fields; and if the yield is good you can hardly begin too soon. Now, to save unnecessary running to and from the hives with combs, you or your assistant should have a pair of comb-buckets (see COMB-BUCKETS elsewhere). These will hold all the combs that come out of one upper story; and when they are empty they can be carried to the honey-house, or wherever the extractor is. To make things go along lively, and with as little interruption as possible, bring back the set of combs already extracted, in the buckets, and put them in the hive from which you have already taken the filled combs.

If you are an extensive bee-keeper, you will want some sort of comb-cart in which to carry the combs back and forth. The accompanying cut shows one used by A. W. Osburn, of Punta Brava de Guatao, Cuba.



OSBURN'S COMB-CART.

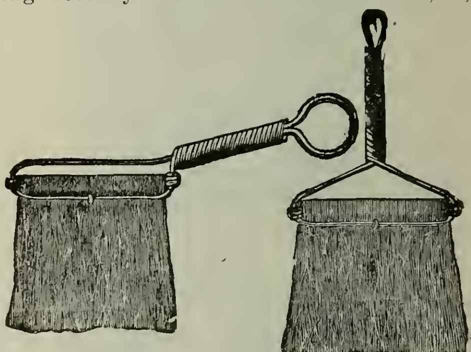
Perhaps I should remark, that the box of the cart should be used wide enough and deep enough to take the combs you are using, and the length may be whatever is most convenient. The one shown in the illustration was made to hold 30 combs; but Mr. O. now uses one that will carry 80 or 85.

To work to the best advantage, there should be at least one assistant—one to carry the combs to and from the hives, and the other to extract and uncap.* Usually one man will have all he can do while the other extracts. If your wife has not already more than she can attend to, she will do this part of the work much better than anybody else. If she has more than she can do, perhaps you have an enterprising boy or girl who can.

*This is on the assumption that you allow the honey to ripen in the combs.

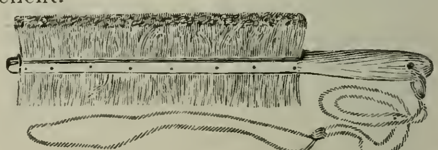
TAKING THE COMBS OUT OF THE HIVE, AND GETTING THE BEES OFF.

There are several ways for getting the bees off. Remove the cover from the upper story of the hive (for I assume that you extract only from this part of the hive), and blow considerable smoke down among the frames, to drive the bees below. Now lift out the combs, and shake each one successively before the entrance, with a quick, nervous jerk. Italians will stick worse than hybrids or blacks. Remove the few remaining bees by the use of a Davis brush, or, better, with a brush broom, like that shown under VEILS, attached to Mr. Coggshall's person. This broom is 14 or 15 inches long, and is made long and slim. To make it sweep a little softer, Mr. Coggshall removes about half of the strands. This sort of implement, he says, will sweep the bees off with one sweep; and it is away ahead of many of the bee-brushes that have been recommended in the books. Mr. Coggshall's entire product of extracted honey runs up into many tons, and he is competent to judge of the value of the implement.



DAVIS' IMPROVED BEE-BRUSH.

Here is also another that is said to be excellent.



SAYAR'S BRUSH.

It, like the Coggshall broom, is long enough to sweep clean the whole surface of a comb with one sweep.

FREEING COMBS OF BEES BY A BEE-ESCAPE.

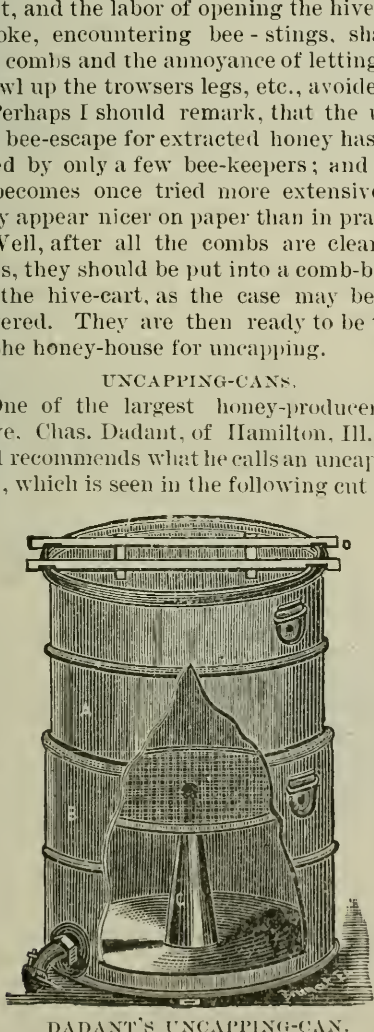
Under COMB HONEY the uses of the bee-escape are illustrated and described; and although they have been used only a year or two, they promise to supersede all other methods of freeing bees from supers of both comb and extracted honey. Their use for extracting has been called the "poetry of extracting." A lot of them, toward night, are inserted between the brood-nest and supers of hives that are to be extracted on the morrow. The next day, all that is necessary, it is said, is to come around and pull off the upper stories and carry them to the honey-house; for almost every bee will have gone down during the night to the brood-nest, and the labor of opening the hives, the smoke, encountering bee-stings, shaking the combs and the annoyance of letting bees crawl up the trowsers legs, etc., avoided.

Perhaps I should remark, that the use of the bee-escape for extracted honey has been tried by only a few bee-keepers; and when it becomes once tried more extensively, it may appear nicer on paper than in practice.

Well, after all the combs are cleared of bees, they should be put into a comb-bucket or the hive-cart, as the case may be, and covered. They are then ready to be taken to the honey-house for uncapping.

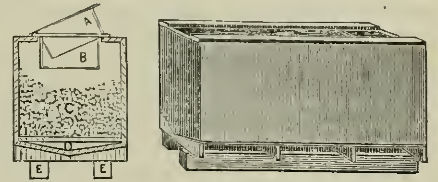
UNCAPPING-CANS.

One of the largest honey-producers we have, Chas. Dadant, of Hamilton, Ill., uses and recommends what he calls an uncapping-can, which is seen in the following cut:



DADANT'S UNCAPPING-CAN.

This is something like an ordinary extractor-can, only it is made in two pieces—the upper one slipping into the other. A wire-cloth partition, as shown in the cut, catches the caps as they fall, and the honey drips down, to be drawn off through the gate. The very finest of the honey will come from this uncapping-can, as it has been all ripened and sealed. While shaving the caps off with the honey-knives, the combs rest on the tin bars, as shown suspended just below the top of the can.



M'INTYRE'S UNCAPPING-BOX.

The cut above shows the device used very successfully by Mr. J. F. McIntyre, one of those extensive bee-keepers in California who produce honey by the carload, and the following is his description, taken from GLEANINGS, page 770, Vol. XVIII.

It is 2 feet wide, 2 deep, and 6 long outside, made of ⅞ lumber dressed on both sides. The bottom is 2 inches lower in the middle than at the sides, and is lined with tin to keep it from leaking. Eleven pieces of wood, 1x1x22 inches, are laid across the bottom about 6 inches apart to support the screen which the cappings fall on. This leaves room below the screen for the honey to run to one end, where it passes out through a tin pipe. Two pieces, ⅞x3x72 inches, are nailed on the top edge, one on each side, to contract the top of the box to the same width that a Langstroth hive is long inside. Two pieces, ⅞x⅞x18⅜, nailed one on each end between the two last mentioned, bring the ends up even with the sides. One piece, ⅞x3x18⅜, is fixed across the top of the box about 14 inches from one end, with an iron pivot sticking up through it, 1½ inches high to rest the combs on. When uncapping you set one end of the comb on this pivot, uncap one side, whirl it around, and uncap the other side, and set the comb in the end of the box, as in the diagram. When we have a surplus of combs we often hang them in the other end of the box, in the diagram. C is cappings, and D the space for the honey to run out.

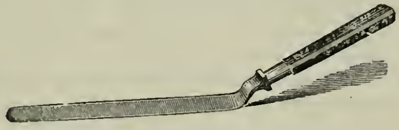
The bottom of the box is 7 inches from the floor, which leaves room for the honey to run into the strainer illustrated on page 248. This makes the top of the box about 32 inches from the floor, which is about the right height for me to uncap easily. A shorter person might make the box a little shallower, or lay a plank on the floor to give the righ height, which is the way I do when my wife uncaps. I know most people will think this box unnecessarily large. I will tell you why I think it is not. When uncapping over a round can like Dadant's, the cappings fall on top of those taken off earlier in the day; and when the can is half full the honey has to pass through such a pile of cappings that it takes a long time to all run out; and when you put the cappings in the sun extractor they are heavy with honey. With this box, when a pile of cappings accumulates under the knife we take a four-tined fork and pitch them over to the other end, where they may drain for four or five days. There is a small stream of honey running out of the box all the time, day and night, during the extracting time; and when the cappings go into the sun extractor they are almost dry. I think it pays well for the extra space in the box, because all the honey which goes into the sun extractor is spoiled for the market.

J. F. McIntyre.

There are many substitutes for uncapping-cans. W. S. Hart, of New Smyrna, Fla., sends us a sketch of one he uses, made of a common cheap wooden bowl. A tube is fastened to the bottom of the bowl, extending down through the table into a honey-can or barrel. A wire-clothscreen is put over the top of the bowl, to catch the cappings; and as the bowl turns on the tube the comb can easily be swung around in any position while shaving the caps off.

UNCAPPING KNIVES.

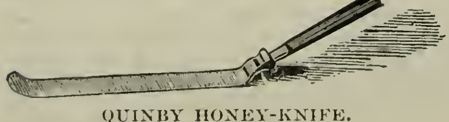
Before we can extract the honey, the caps of the cells must be sliced off; and several patterns of knives have been designed for this purpose, called honey, or uncapping knives. It is true, we may throw out the honey before the bees have had time to seal it over; but I believe the most of our friends have decided in favor of letting the bees keep it till they have it thoroughly ripened and thick, as we have before remarked. The knife first shown is one devised by myself, and very extensively used the world over.



THE NOVICE HONEY-KNIFE.

This knife is almost as good as any for uncapping, and it is also very handy indeed for cutting honey or combs. The blade is very thin, sharpened on both edges, and of the very best steel and temper. When it is desired to cut combs free from the sides of the hive, or when the bees have carelessly been allowed to build against the cover, this knife will spring down straight and close to the wood, so as to do a nice job, scraping off every bit of the wax.

Shortly after my knife was put into the market, our veteran friend M. Quinby had one made with a curved point, as shown below.



QUINBY HONEY-KNIFE.

The curve is to enable us to go down into cavities and hollows on the combs. While Mr. Quinby and many others considered this quite an improvement, I have not found it so convenient as the sharp-rounded point of our own knife. For a knife for uncapping the cells alone, the Bingham & Hetherington knife shown in next cut is probably ahead of any other.

BINGHAM & HETHERINGTON HONEY-KNIFE.

The above knives cost from 70 cents to $1.00 each; but many of the friends have devised several good home-made substitutes, among which is the common mason's trowel, which can be purchased at a cost of about 50 cents; and recently some Yankee friend has suggested that a 10-cent steel garden-trowel will do as well as any thing, although it doesn't make so wide a cut. Of course, the edges are to be ground sharp.

USE OF PERFORATED ZINC FOR EXTRACTING.

Unless perforated zinc is used to prevent the queen from going into the upper story, she will, to a greater or less extent, deposit eggs there; and the consequence is, brood is reared just where we do not desire it. The practical bee keeper wants all of that confined to the brood-nest. During 1889 and '90 we had several testimonies to the effect that zinc excluders, placed between the brood-nest and the extracting super, did that effectually. Here is an article, written for Gleanings, which I take pleasure in copying. It is from the pen of Mr. McIntyre, as referred to above.

I have taken so much comfort with my 450 zinc queen-excluders this season, I am sure it will be doing my neighbors a kindness to tell them how they work. My hives, and, in fact, nearly all the hives in Ventura County, are made with a bee-space in the bottom and top of both super and brood-chamber, which, when the super is on, leaves ¾ of an inch space between the super and the brood-frames. I have always thought this a m stake; but when I began to think of using queen-excluders, I saw that, if a plain unbound zinc excluder, the size of the outside of the hive, were laid on the brood-chamber, and the super on the excluder, the bee-spaces would be all right. I ordered 480 of Root's No. 1 unbound zinc excluders large enough to fit my hives. I think No. 1 the best, because they allow the bees to pass up and down more freely than the break-joint excluders. After trying 450 of these unbound excluders one season, I am satisfied that they are better in every way than the bound excluders. The super is easil lifted off the zinc, and, by taking hold of one end of the zinc and pulling up and out, they can be peeled off almost like cloth; and if they bend a little, just turn them upside down when you put them on again. I bought the excluders because I had a good many drone combs in my supers; but I would not do without them now, if my super combs were all worker size. It makes a fellow feel good to open a super just before swarming commences, and find about a square foot of drone comb all cleaned up for the queen to lay in. It is ever so much nicer to fool the bees in this way than to shave the heads off the drones. You don't always get around in time to shave the drones' heads off, and what a lot of honey is wasted in rearing them!

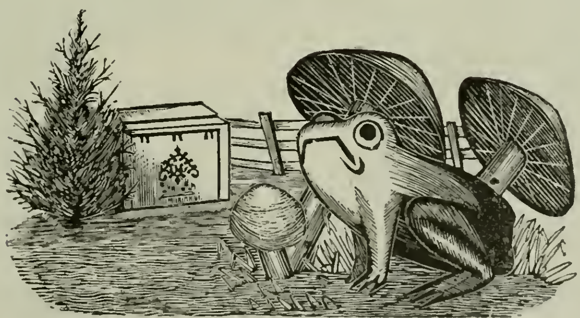
When you have no excluder on a ten-frame L. hive, the bees will fill about 7 combs in the brood-chamber with brood, and then run it up in the super instead of filling the brood-chamber clear across. This brood in the super is a great nuisance when you are extracting. In California we leave our supers on all the year round; and if the super is full of honey in the spring the bees will build up faster than they would if the hive were contracted. Another point I did not discover until I put excluders on all my hives: When the queens are allowed to go into the supers, a good many are knocked off on the ground, and lost, when brushing the bees off the combs. I did not find a fourth as many queenless colonies after extracting this season as usual. I found a few queens that could run up and down through the excluders, but not enough to trouble seriously.

J. F. McIntyre.

The use of perforated zinc promises, at no distant day, to revolutionize the methods of producing extracted honey.

COVER FOR EXTRACTOR.

No cover is ever needed over the extractor while at work, for it would be greatly in the way; but after we are through, or stop only temporarily, the machine should be covered to keep out dust and insects. The most convenient thing for this purpose is a circular piece of cheap cloth, with a rubber cord run in the hem. This can be thrown over in an instant, and all is secure. When honey is coming in abundantly, it may be safe to carry the machine, located on a suitable platform, around to the hives, especially if the apiary is much scattered about. But if the bees are disposed to rob, all such attempts will "come to grief" very quickly.



"HOME, SWEET HOME."

A PARTIAL VIEW OF THE APIARIAN EXHIBIT AT THE COLUMBUS CENTENNIAL.

A PARTIAL VIEW OF THE APICULTURAL EXHIBIT AT THE COLUMBUS CENTENNIAL, WITH SOME OF THE PROMINENT BEE-MEN IN THE FOREGROUND.

F.

FAIRS—*How they may be used in the development of the bee and honey industry.*—Of late, very much indeed has been accomplished by the exhibits of bees, honey, and apiarian implements at State and county fairs. Several of the larger societies have had very pretty buildings erected on the fair-grounds for these displays, and often the bee-keepers who meet at such places have very interesting conventions during the day time or evening.

Such exhibits have a decidedly educational influence on the public. They show *how* honey is produced; and not only that, but that it can be produced by the ton and carload. On account of newspaper yarns started by one Wiley as a piece of "pleasantry," there seems to be a general impression among people that comb honey is manufactured, and that the extracted article is adulterated with glucose. It is absolutely impossible to manufacture comb, fill it with honey, and cap it over with appropriate machinery—just as impossible as it is to manufacture eggs. I have had for several years a standing offer of $1000 to any one who would show where comb honey was manufactured, or even procure a *single manufactured sample* which could not be told from the genuine. Although this offer has been published broadcast in the daily papers, no one takes it up. I have also had the conditions of this offer printed on a neat little card, the same distributed by bee keepers at fairs and other honey-exhibits, so that the general public could see at once, that, if such a thing were possible, and that if A. I. Root is responsible, there would be a bonanza for somebody. As to extracted honey, there is, perhaps, some adulteration, but there is comparatively little of it. Honey is now produced so cheaply that it would not pay.

Bee-keepers, besides educating the general public as to the *genuineness* of their product, can create a larger demand for honey. As a usual thing, exhibitors are allowed to sell their honey, distribute circulars, and do a great deal of profitable advertising. This not only helps the individual, but helps the pursuit in general. Those who have done efficient service in this line are, Dr. A. B. Mason, of Auburndale, O.; W. Z. Hutchinson, of Flint, Mich.; H. D. Cutting, Clinton, Mich.; M. H. Hunt, Bell Branch, Mich.; R. McKnight, Owen Sound, Ontario; and D. A. Jones, Beeton, Ontario.

The accompanying engravings will give you an idea of how a model exhibit should be arranged. This exhibit was under the direct supervision of Dr. A. B. Mason, at the Columbus, Ohio, Centennial. The pictures are taken from photographs of the apiarian hall; and the big sign, "A. I. Root," covers only a part of the exhibit, although it represents a carload of apiarian supplies. Engravings in the back volumes of GLEANINGS IN BEE CULTURE, as well as the Picture Gallery of this work, will give other suggestions.

There should be shelving arranged in the form of pyramids, octagons, semicircles, etc. The honey should be put up in tin and glass, in large and small packages, and the whole should be neatly "set off" with appropriate labels. As a general thing, glass packages should have a very small label, so that as much of the liquid honey as possible may show. Tin receptacles should have labels to go clear around the can. Comb honey should be put up in cartons and in shipping-cases; and yellow cakes of wax should be shown in a variety of shapes. Besides the exhibit of honey in various styles of packages, there should be a moderate collection of bee-supplies, so that, when the eager public come along with their strings of questions, they can be shown step by step the process of producing honey, and its final putting-up for market. A good many questions will be asked in regard to the extractor. It will be called a churn, a washing-machine, and every thing else except what it really is. Set yourself patiently to answering all such foolish questions, and you will be rewarded for your labor. And last, but not least important, there should be one or more observatory hives to show the folks how the bees behave when at home. A good many will want to see the "king-bee." Tell them it is not a *king* but the *queen* that bosses the establishment, lays all the eggs, etc., and then point her out on the comb.

By all means look well to what may be accomplished at your county fairs; and if those near you are too much given to gambling schemes and horse-racing, make it your business to interest the boys who go there, in learning some wholesome, honest industry. Our own State of Ohio has recently erected a very pretty building on the fair-grounds at Columbus, for bee-exhibits.

FEEDING AND FEEDERS. As a general rule, I would not advise beginners to take honey from the bees and sell with the idea of feeding them up in the fall with some substitute for honey; and if a person is inclined to be careless and neglectful he had better never think of feeding at all. Leave the ten combs in the lower story untouched by the extractor, and you will very seldom have reason to feed.[81] If you use section boxes in the lower story, you had better take them all out in time to let the bees fill combs for winter stores, in their place, unless you have very heavy surplus combs laid away, that will contain on an average 5 lbs. of sealed stores each; in this case, give them 6 of these combs and a chaff-cushion division-board on each side of them in place of the sections, and you have them then in the safest shape for winter you possibly can, providing they are in a chaff hive (according to *my* ideas of wintering). Now, if we were only sure of having the well-filled surplus combs, we might skip "feeding" entirely; but, alas! there will come seasons and circumstances when we *must* feed.

Again, where one raises bees and queens for sale, he may divide and sub-divide to such an extent as to have many colonies with bees enough, but with too little food. The only remedy in these cases is to feed.

WHAT TO FEED.

If I had sealed honey in the combs, I should use it for giving the requisite stores in preference to sugar, unless I could sell it for more, pound for pound, than the sugar could be purchased for. If the honey is late fall honey, such as buckwheat, goldenrod, autumn wild flowers, etc., I should consider it just as safe as any other, if well seasoned and ripened, unless I had by actual experiment good reason to think otherwise: in such a case I would feed sugar. Quite a number of reports have been given that seemed to show bees wintered safely on the spring honey, or that gathered in the early part of the season, when others in the same apiary where all this spring honey was extracted, and they were confined to the autumn stores for winter, were badly diseased. If the colonies are carefully packed in chaff on their summer stands, or are put in a good dry cellar, with plenty of bottom ventilation (no top ventilation), they will, as a rule, winter on almost any kind of fall honey, providing it is well ripened. Honey-dew (which see) should be extracted, and sugar syrup fed.

Well, supposing we have *not* the honey in frames, what then? If we have extracted honey, two questions come up; which is better—sugar syrup, or honey? and which will cost the more? I would unhesitatingly take syrup made of granulated sugar,[82] in place of the best clover or any other kind of honey, if offered at the same price. I say this after having fed many barrels of sugar, and after having carefully noted the results of feeding both sugar and honey.

Hon. R. L. Taylor reports that he made an experiment in feeding honey and sugar syrup to a number of colonies apparently alike in strength and condition. Of those fed on honey, the average consumption was from 14 to 18 pounds, while those fed on sugar syrup consumed from 3 to 7 pounds. The idea was, that, while a pound of honey had less strength than a pound of sugar syrup, it was more stimulating, causing the bees to eat more.

HOW TO MAKE THE SYRUP.

Get your wife's wash-boiler, if she will let you have it, or something large enough to make 50 or 100 lbs. or more of syrup at once. Into your melting-can pour granulated sugar and water, in the proportion of 20 lbs. of sugar to a gallon of water. Heat slowly, stirring it occasionally. Heat the mixture until you bring it to a temperature of about 180°—a little too hot to stick your finger into it. You may bring it to a boil, if you choose. It will not do a particle of good; and should you burn it a little it may do it a great deal of harm. To facilitate matters, perhaps it will be well to pour boiling water into the boiler first, and then the sugar, in the proportions above named. Keep stirring until all the *granules of sugar are thoroughly dissolved*, and do not remove the can from the stove until they are. When we make syrup here at the Home of the Honey-Bees, we pour into a large extractor-can the sugar and water, in the proper proportions. Into this we put a rubber hose, and heat the mixture with steam. This is by all odds the nicest way of making syrup; but the majority of my readers will not probably be so conveniently situated.

Cream of tartar, tartaric acid[342], vinegar, and the like, have been used for preventing granulation, but I feel sure we do not need any thing besides pure water and pure sugar,[83] and I think it makes little difference what the proportions are. If the sugar and water be *boiled* together, there is perhaps less liability to granulate.

In regard to expense: A gallon of water to 20 lbs. of sugar will make 28 lbs. of nice thick syrup; and as the sugar is now worth about 5 cents by the barrel, our syrup will cost us nearly 4 cents per lb. I think, if my extracted honey were all ready to ship, and I could get 5 cents cash for it, I would sell it and buy the sugar. Perhaps a safe rule will be to say, that whenever we can trade a pound of honey, already extracted, for a pound of sugar, we had better do so, for the difference in favor of sugar will certainly pay for all trouble of making it into syrup.

In regard to the cheaper grades of sugar than the granulated, I will say that I have used the A sugar, without being able to detect much difference in the results; but as the price is but very little different,[84] I decided in my own mind, without any definite proof, that the granulated had about the same amount of pure sugar, *for the money*, as any of the cheaper grades. I also fed a few colonies for winter on the cheapest brown sugar, and, somewhat contrary to my expectations, they wintered tolerably well. I have not used brown sugar extensively, because in my experiments with candy for feeding, I discovered that burnt candy or sugar—caramel—was certain poison to bees when confined to such stores in cold weather. See Candy. As brown sugar frequently owes its color and taste to this same caramel, it is very unsafe for winter food.

Mr. Simmins, of England, practices feeding sugar without making into syrup, using moist sugar, as Porto Rico. It is less trouble, and he thinks better, but Cheshire thinks that at times large numbers of bees are lost in flying for water to dissolve the sugar.

FEEDING TO STIMULATE BROOD-REARING.

Bees are fed for one of two purposes; viz., to stimulate brood-rearing or to supply needy stocks for winter. It will make some difference, both in feeders and in the amount fed at one time, as to what the bees are fed for.

We will suppose that you have one stock which you have divided into, say, three or four. To each of these several nuclei has been given a cell. After the cell hatches, and the queen begins to lay, you desire to have the bees and the queen raise as much brood as possible. Or, again, we will suppose that you have several weak stocks in early spring. To get them strong enough to gather honey during the summer, you desire to have brood-rearing progress as rapidly as possible. In either of these cases, or in any other case where it may be necessary to stimulate the colony, give them about half a pint, or a pint, daily, of thin sugar syrup, made as previously directed. If you happen to have any old sweet, such, for instance, as soft maple sugar that is unfit both for the table and for the market, make a thin syrup of this, and give to them a small amount daily, or lay the sugar right on the frames under the quilt. Now, I would not give the bees a syrup made of cheap sugar, if you are obliged to buy it. Granulated sugar at ordinary prices contains just as much sweet for the money, and it is not only just as cheap, but it is the very best food that bees can possibly have. In feeding the weak stocks, be careful not to get the bees of stronger colonies to robbing them. The most convenient method of feeding, where it is done by night, is to put the feeder in front of the entrance. A little colony ought to be able to take a pint, and a strong one a quart, during the night, providing it is not too cool. Never feed outside of the hive, at the entrance, during the day. It will result in the probable destruction of the weak colony, and a general uproar among your other bees. Just before dark, or at least when the bees have stopped flying for the day, pour the feed into the feeder, at the entrance. In early spring, or when the air is cool, or perhaps frosty, it will be necessary to feed inside the hive, because the bees will not come out at the entrance to take any feed; and the next morning will find the syrup untouched, ready for robber-bees when it begins to warm up. Put the feeder under a super, or under a cover large enough to accommodate it, or pull out the division-board or a comb or two, and set the feeder down in its place, and at night open the hive; lift up the enamel cloth or quilt, pour in the feed, and close the hive. For carrying the feed from one hive to another, nothing is more convenient than a large coffee-pot. Fill this full and then distribute the syrup from one hive to another. Now for

FEEDERS.

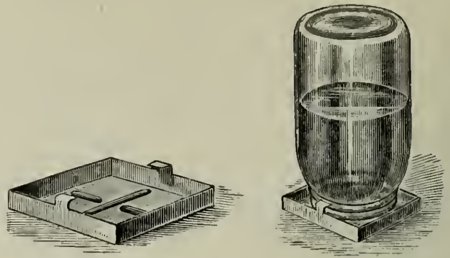
For stimulating brood-rearing, or for feeding in general, I much prefer a feeder made entirely of wood. One of glass or tin, in cool weather will not be visited by the bees nearly as readily as one of wood. I know of nothing better for the purpose than the little Simplicity feeder.

SIMPLICITY BEE-FEEDER.

It is simply an oblong block of wood, grooved out so as to leave two thin partitions through its center, the two partitions being cut down in the center to let the syrup pass from one compartment to the other. The bees can not get drowned, because they can readily reach the sides and crawl up, when the other bees will lick them off, clean them up, and wash their faces. This feeder may be used either at the entrance, on top of the brood-combs, or down in the hive, in place of the division-board. It is sold in lots of ten, for 30 cents. Although it is very cheap, there is something more economical yet, which answers the purpose nearly as well. It is nothing more nor less than an ordinary wooden butter-dish, such as your grocers give you when you buy a pound or so of butter. They will hold about the same amount of feed, and we have used them in our apiaries very largely, along with the Simplicity trough feeder; and, contrary to what we might suppose, bees will not get drowned.

Thus far I have mentioned only two feeders for stimulating bees. There are others that may be used, and, in the hands of some people, may be better. One is the pepper-box feeder. A pepper-box explains the whole principle if you fill it with water and invert it; and, in fact, you may choose tin pepper-boxes, if you have but few colonies. Fill one with honey or syrup; place it in front of the hive, inside, at nightfall, and you will find it emptied in the morning.

There is another class of feeders that work on the atmospheric principle. The one illustrated below shows the Hains feeder, adapted to an ordinary glass Mason fruit-can.



HAINS FEEDER OR FRUIT-JAR.

To fill this feeder, fill the jar level full o syrup. Screw on the tin cap, and invert it. Just as fast as the bees take away the syrup, the little pan is replenished, on the atmospheric principle, from the jar.

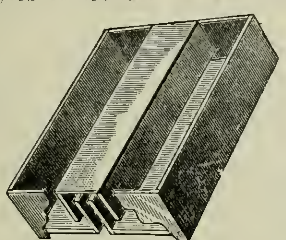
You can extemporize a very good feeder out of a tin pan and a piece of cheese-cloth. Fill the pan and lay the cheese-cloth directly upon the syrup. The bees will receive the feed through the cloth, the latter clinging to the surface of the syrup as it is gradually taken up. While this works nicely, I should prefer the Simplicity or the butter-dish, because these latter can be refilled without lifting up the cheese-cloth, which has a very unpleasant way of sticking to the pan.[85]

WHEN TO FEED.

If we feed during the day time, the bees all stay at home, and the honey that might otherwise have been gathered is lost. I have several times fed stocks during the fall to build them up; and although they were induced to take many pounds of honey or syrup, they would be in no better condition than others that had not been fed at all, for they "loafed" and fussed with their feeder, while the rest were doing very fair days' works. Again, I once gave a particular colony all the cappings during extracting time; the honey they got out of them amounted to 3 or 4 lbs. per day, but this was getting only about half as much as we were from them before, and we soon became satisfied that the honey in the cappings was even worse than thrown away, for it had induced the bees to stay at home, when they would otherwise have gathered a much larger quantity from the fields. This result has followed feeding so many times, that we are loth to resort to it, when it can be avoided. Feeding sugar, especially the cheap sugars, is less liable to disturb their work in the fields, than honey, for they will desert the sugar as soon as honey is to be obtained, even in small quantities.

FEEDING UP FOR WINTER.

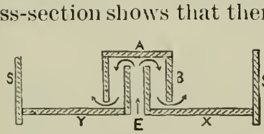
While the small feeders before described and illustrated may be used for feeding up colonies for winter, yet, on account of the necessity of frequently filling them in order to get the requisite amount of stores in the hive, and, as a matter of course, entailing considerable extra labor, I much prefer to give the bees all the necessary stores they need, *at one feed.* It is just as easy to give a colony 25 or 30 lbs. of syrup in a large feeder as to give them only a single pound in a small one. In the latter case the apiarist would have to visit the hives thirty times, and be in constant danger of robbing all this time. In the other case, the syrup would be given at one time, and the bees would take it down, or nearly all down, in one night. The feeder can be removed, and the hive be prepared for winter. We have used a great many styles of feeders. We formerly used



THE MILLER FEEDER.

a large tea-kettle inverted, the bees taking the syrup through perforated metal, on the principle of a pepper-box. During the last year or so we have found something very much superior to any thing else we have ever tried. It is Dr. C. C. Miller's feeder, with Warner's improvement.

The first cut shows the feeder adapted for an eight-frame Langstroth hive, and its capacity is 25 lbs. of syrup. The accompanying cross-section shows that there are two



feed-reservoirs. On the principle that liquids always seek their level, the syrup passes under the raised partition B; and the bees, to get access to the syrup, start from the arrow E, and take the feed from the inner chambers under the cover-board A. With most feeders of the kind, bees are obliged to pass through the two ends or the outside; and sometimes in cool weather, refusing to leave the center of the brood-nest, they will fail to take the syrup. The great feature of the Miller feeder is the fact that the passageway to the feed is located directly *over the center* of the brood-nest, and the warmth of the cluster rising is confined in the passageways and chambers under A. This feature, coupled with the fact that it is made of wood, makes it possible to feed bees during quite cold freezing weather. In fact, we have fed under the chaff cushion after the snow had fallen, and the temperature was considerably below the freezing-point, and the bees of the colonies so fed came out in the spring in good condition.

Large or small amounts can be fed according as the circumstances require. The feeders we use hold 25 lbs. of syrup when filled within an inch of the top edge. If we discover that some colonies need 10 lbs. and others 5, and still others 25, to give them the requisite amount of winter stores, at the time of feeding we fill each feeder to the proportionate needs of the several colonies. Sometimes we fill only one of the reservoirs, which would make, when full, 12½ lbs. of syrup. For a 5-lb. feed, we pour in enough to make one reservoir a little less than half full. To expedite matters in feeding, just before giving the colony a final feed we go through the whole apiary, examine each brood-nest, and estimate* the amount of stores in pounds that each colony will need, marking the same on the slate, or with a piece of chalk on the cover-board of the hive. We afterward come around and distribute the feeders. Then toward evening, with a large feeding-can, we lift the hive-cover, pour in the amount of syrup as indicated upon the slate or cover, and close it up. Thus we do with all the colonies. The next morning we remove the feeders and pack the colonies in chaff, when they are ready for winter.

As a matter of economy, 12 or 15 of these large feeders will answer for an apiary of 100 colonies, though a larger number would be more convenient, and you could finish the job up all at once. After having fed the 25 colonies, or any number of colonies that corresponds with the number of feeders that you have, the next morning remove them and give the same to other colonies, and the following evening feed as before. In cold weather, if you have been so neglectful as

---

*A Langstroth comb, when filled and capped over with honey or sugar stores, holds on the average about 5 lbs. To get at the amount of stores in a colony, estimate the amount in each comb, and the sum will give the amount. This amount, subtracted from the amount required to be fed, will, of course, give the amount to be fed. Some weigh each comb; but a very little practice will enable you to be accurate enough.

to leave the colonies until late, put the chaff cushion on top of the feeder after filling.

FEEDING FAST OR SLOWLY.

I have not been able to see that it makes any material difference whether we feed it all at once, or a little at a time for wintering purposes only; but for brood-rearing it is assuredly best to feed a little at a time, say a pint every night. I have, during severe droughts, reared queens, brood, and had beautiful comb built, by the latter plan.

FEEDING IN COLD WEATHER.

Although colonies have been wintered well when fed after cold or freezing weather, I think much the safer plan is to have it all done during warm dry weather, that they may have it all ripened and thoroughly sealed up. If the weather is not too cold you can feed with the Miller feeder as previously intimated. If you have been so careless as to have bees that are in need of stores, at the beginning of winter, I would advise frames of sealed honey if you can get them; and if you can not, use CANDY, which see. If the candy is covered up with warm chaff cushions or something equivalent, it may be fed at any time, although it does not seem to be as satisfactory under all circumstances as stores sealed up in their combs.

In feeding in cool or cold weather, you are very apt to uncover the cluster, or leave openings that will permit the warmth from the cluster to pass off. I have several times had colonies die in the spring after I commenced feeding, and I imagined it was from this cause alone. When they first commence raising brood in the spring, they need to be packed up closely and snugly; making a hole in the quilt or cushions above the cluster, and placing the feeder over this so as to close it completely, does very well, but is not, after all, as safe as giving the feed from below: for feeding in early spring, especially if the stock is weak, I would prefer the candy, or well-filled combs of sealed stores.

WHEN ROBBERS ARE BAD, FEEDING AT NIGHT.

During the early fall of 1887 we found our apiary almost on the verge of starvation, the previous summer having been very dry. Robbers were unusually vigilant, and it was almost impossible to perform almost any manipulation with the hives without getting a perfect storm of robbers in the brood-nest. Feeding during the day was out of the question, and yet the colonies must be fed in order to prepare them for winter. Accordingly, to circumvent the robbers we fed at night by the light of lanterns. Contrary to what we might expect, the bees gave us but very little trouble by flying against the lanterns. As the bees took up all the feed in the feeders during the night, and the robbers had had no opportunity to investigate during the feeding, every thing was comparatively quiet next morning, and during the following day. We fed successfully in this way some three or four barrels of sugar. Although I have recommended feeding *toward* night, in the preceding paragraphs, in the case above mentioned we fed from about 7 P. M. in some cases until 10:30 P. M. Perhaps I should also remark, that, if it is inconvenient to work at night, feed on the first rainy day. Put on your rubber hat, coat, and rubber boots. As long as it rains, bees will not bother you.

FEEDING BACK TO PRODUCE COMB HONEY IMPRACTICABLE.

You *could* feed white sugar so as to produce very nice-looking comb honey, but it would be sugar syrup in honey-comb, after all, as you would find to your sorrow if you should attempt to sell it as honey; and furthermore, it is doubtful if you could do it without losing money, were such not the case. Many are the attempts that have been made to produce honey by feeding sugar; but all have resulted in failures. Where you can purchase nice white extracted honey for 10c you may be able to feed it so as to make it pay, if you can get 20 or 25c for the honey in the comb. Several of our neighbors have fed out their extracted honey in this way, and they think it can be done profitably, with the aid of the foundation. This should all be done by a few colonies, because they must have quite a quantity, perhaps 25 lbs., before they are in shape to build comb. The feed should then be given as rapidly as possible, if we wish to get nice white honey; for the quicker we can get our comb honey out of the hive, the whiter and nicer will it be. Bees, when fed, are to some extent demoralized, and forget to be as particular as they usually are, about being neat and tidy. Sometimes they will scamper over the white honey with dirty feet, like a lot of children who have been fed sweetmeats to an injudicious extent, and this we wish to avoid. I am just now making some experiments in this direction, and have found that a common milk-pan, placed in a third story on a Simplicity hive, answers the purpose excellently. The first story contains the brood-combs; the second, the section boxes supplied with foundation as usual, while the third contains only the feeder of honey. The Miller feeder will be by all odds the best for the purpose. If you do not have this, fill a milk-pan with the diluted honey, and lay upon the surface of the latter a piece of cheese-cloth to prevent drowning.

For the purpose of more accurately testing the exact amount of loss incurred in feeding extracted honey, in order to get it into comb honey in the sections, I have had a platform scale made with a dial, that the weight of the hive and all the apparatus may be seen at a glance. A Simplicity hive, 3-story, with section boxes in the second story, was placed thereon; and when the combs in the sections were partly filled, the colony was fed with the milk-pan, as mentioned above, about 50 lbs. I then watched, with great interest, the hand on the dial, to see how many pounds they lost in weight, while the combs were being capped over. To my great surprise, I found that the honey weighed just about as much in the combs as it did in the pan; even after the combs were all nicely capped over, there had been a loss of only about one pound in ten, of the honey fed. As the extracted honey was bought of a neighbor for 10 cts., and the filled sections were readily sold for 25 cts., the investment was a paying one, without question.

There is one point that should not be lost sight of, however; that is, before the honey will be stored in sections, the brood-combs will be filled to repletion, and a large amount of brood will be started. Perhaps 25 lbs. will be used in this way before they will commence to store in the sections, in real earnest. On this account the brood-apartment should be contracted, and all combs removed except those actually needed for the brood.[86]

CAUTION IN REGARD TO FEEDING.

Before closing, I would most earnestly caution the inexperienced to beware of getting the bees robbing. I have advised feeding only toward night to avoid danger; for attempting to feed in the middle of the day will sometimes result in the robbing and destruction of strong colonies. Where food comes in such quantities, and in such an unnatural way, they seem to forget to post sentinels as usual; and before they have time to recover, bees will pour in from all the hives in the apiary. I do not know who is to be pitied most at such a time, the bees, their helpless owner, or the innocent neighbors and passers-by. *Sometimes*, all that can be done is to let your colony slide, and wish for it to get dark that the greedy "elves" may be obliged to go home. Now when you commence feeding, remember that my last words on the matter were, "LOOK OUT!"

For open-air feeding, see WATER FOR BEES.

FERTILE WORKERS. These queer inmates, or rather occasional inmates, of the hive, are worker-bees that lay eggs. Aye, and the eggs they lay, hatch too; but they hatch only drones, and never worker-bees. The drones are rather smaller than the drones produced by a queen, but they are nevertheless drones, in every respect, so far as we can discover. It may be well to remark, that ordinary worker-bees are not neuters, as they are sometimes called: they are considered undeveloped females. Microscopic examination shows the undeveloped germ of nearly every organ found in the queen, and these organs may become, at any time, sufficiently developed to allow the bee to lay eggs, but never to allow of fertilization by meeting the drone as the queen does.

CAUSE OF FERTILE WORKERS.

It has been over and over again suggested, that bees capable of this egg-laying duty are those reared in the vicinity of queen-cells, and that by some means they have received a small portion of the royal jelly, necessary to their development as bee-mothers. This theory has, I believe, been entirely disproven by many experiments; and it is now pretty generally conceded that fertile workers may make their appearance in any colony or nucleus that has been for some days queenless, and without the means of rearing a queen. Not only may one bee take upon herself these duties, but there may be many of them; and wherever the bee-keeper has been so careless as to leave his bees destitute of either brood or queen, for ten days or two weeks, you may be pretty sure he will find evidences of their presence, in the shape of eggs scattered about promiscuously; sometimes one, but oftener half a dozen in a single cell. If the matter has been going on for some time, you will see now and then a drone-larva, and sometimes two or three crowding each other in their single cell; sometimes they start queen-cells over this drone larva: the poor motherless orphans, seeming to feel that something is wrong, are disposed, like a drowning man, to catch at any straw.

HOW TO GET RID OF FERTILE WORKERS.

I feel very much like saying again, that prevention is better than cure. If a colony, from any cause, becomes queenless, be sure they have unsealed brood of the proper age to raise another: and when this one is raised, be sure that she becomes fertile. It can never do any harm to give a queenless colony eggs and brood, and it may be the saving of it. But suppose you have been so careless as to allow a colony to become queenless, and get weak, what are you to do? If you attempt to give them a queen, and a fertile worker is present, she will be pretty sure to get stung; it is, in fact, often almost impossible to get them to accept even a queen-cell. The poor fellows get into a habit of accepting one of the egg-laying workers as a queen, and they will have none other, until she is removed; yet you can not find her, for she is just like any other bee; you may get hold of her, possibly, by carefully noticing the way in which the other bees deport themselves toward her, or you may catch her in the act of egg-laying; but even this often fails, for there may be several such in the hive at once. You may give them a small strip of comb containing eggs and brood, but they will seldom start a good queen-cell, if they start any at all; for, in the majority of cases, a colony having fertile workers seems perfectly demoralized, so far as getting them into regular work is concerned.

My friends, you have allowed them to get into this condition by being negligent in supplying brood when they were on the verge of ruin for the want of a single egg or young larva, and the remedy now is to give them a fresh invoice of bees, brood, and combs from some other hive; if you wish to make a sure thing, give them at least three good combs of brood and bees. This is almost starting a new colony, but it is the cheapest way, when they get so they will not receive a queen. If the stock has become *very* weak, it may be best to unite them with some other colony, for it certainly does not pay to have them killing queens, and tearing down queen-cells.

If the fertile workers are discovered when they first make their appearance, before you see any of the drone-larvæ scattered about, they will often accept a queen-cell, or a fertile queen, without difficulty. I have before advised giving all colonies or nuclei, some eggs and brood just before the young queen is old enough to take her flight: when this is done, there can be but little chance of fertile workers, for they will always have the means of rearing another queen, if their own is lost in taking her flight. Sometimes a fertile worker may be disposed of by moving the combs into an empty hive, placed at a little distance from the other; the bees will nearly all go into their old hive, but the queen, as she thinks herself to be, will remain on the combs. The returning bees will then accept a queen or queen-cell. After all is right the combs may be returned, and the fertile worker will be—well, I do not know just what does become of her, but I suspect she either attends to her legitimate business, or gets killed.

See that every hive contains, at all times, during the spring and summer months at least, brood suitable for rearing a queen, and you will never see a fertile worker.

HOW TO DETECT THE PRESENCE OF FERTILE WORKERS.

If you do not find any queen, and see eggs scattered around promiscuously, some in drone and some in worker cells, some attached to the side of the cell, instead of the center of the bottom, where the queen lays them, several in one cell, and none in the next, you may be pretty sure you have a fertile worker. Still later, you will see the worker-brood capped with the high convex cappings, indicating clearly that the brood will never hatch out worker-bees. Finding two or more eggs in a cell is never conclusive, for the queen often deposits them in a feeble colony where there are not bees enough to cover the brood. The eggs deposited by a fertile queen are in regular order, as one would plant a field of corn; but those from fertile workers, and usually from drone-laying queens, are irregularly scattered about.

FIGWORT (*Scrofularia Nodosa*). This plant is variously known as Square-Stalk, Heal-All, Carpenter's-Square, Rattle-Weed, etc., the name indicating some of its peculiarities, or real or supposed valuable medical properties. . t is also called the Simpson honey-plant, after J. A. Simpson, of Alexis, Ills., who first called attention to it.

The engraving presented will give a fair idea of it, and will enable any one to distinguish it at once, if it grows in his locality. The pretty little ball-shaped flower, with a lip somewhat like the Pitcher-plant, is usually found filled with honey, unless the bees are so numerous as to prevent its accumulation. This honey is, of course, thin, like that from clover or other plants, when first gathered, and is, in fact, rather sweetened water; but still it is crude honey, and the plant promises to furnish a larger quantity than any thing else I have met with. We have had one report from a single plant under cultivation, and, as might be expected, the quantity of honey yielded was very much increased, and the plant grew to a great height, continuing to bloom and yield honey for full four months. The little flower, when examined closely, is found to be very beautiful. The following is Mr. Simpson's description of the plant:

It is a large coarse grower from 4 to 8 feet in height, coarse leaf, and a branching top covered with innumerable little balls about the size of No. 1 shot. When in bloom there is just one little flower-leaf on each ball, which is dark purple, or violet, at the outer point, and lighter as it approaches the seed-ball. The ball has an opening in it at the base of the leaf, and is hollow. It is seldom seen in the forenoon without honey shining in it. Take a branch off and turn it down with a sharp shake, and the honey will fall in drops. It commences to bloom about the 15th of July, and remains until frost. Bees frequent it from morning till night. The honey is a little dark, but of very good quality. I think it would be best to sow in seed-bed, and transplant.

THE SIMPSON HONEY-PLANT.

It grows in its natural state among brush-heaps, in fence-corners, and amid hedges, to the height of from 3 to 6 feet. The seed is easily gathered in Sept. and Oct. As they vary much in size, it is likely that we could produce a variety with much larger balls, by cultivation, and by a careful selection of the seeds. In doing this we should be careful to select also such as produce much honey, and, if possible, much *good* honey. Bees, and plants too, are like wax in our hands, if we go to work understandingly.

In December, 1879, I had the plants under cultivation during the whole season. The following in regard to them is taken from the Aug. and Sept. GLEANINGS of 1879.

SIMPSON'S HONEY-PLANT.

In the spring I purchased about 200 plants of friend Simpson, and planted them on our honey-farm, setting them about as far apart as corn. Somewhat to my surprise, they are now, July 8th, commencing to bloom; and, sure enough, every little pitcher-shaped blossom has a shining drop of nectar in it. This nectar is very fair honey, although it has a sort of weedy flavor, which, I presume, the bees will readily remove. The amount of honey is what astonishes me. One of these little flowers contains, I should say, as much as a hundred basswood-blossoms. At present I know of no other plant that promises so well for cultivation for honey alone. A single plant in the garden, for curiosity, if nothing more, I think, would be well worth the trouble to every bee-keeper.

HOW BEES "MAKE" HONEY.

Four o'clock P. M., August 19, 1879.—The Simpson honey-plants are at the back part of the honey-farm, and, as it gives me a pretty fair walk, I usually go over there when tired of writing. Well, I have just been over, and the very great numbers of bees on so few plants aroused my curiosity; so, watch in hand (I *borrowed* the watch), I counted the number of bees that visited a certain flower in a certain length of time. To my surprise, they averaged just about a bee a minute. The flower might not be visited for two minutes, and then, again, it would be visited twice in one minute. I very soon discovered that the bees that came twice in a minute made much shorter stays than when an interval of two minutes elapsed. Was it possible that enough honey could collect in that tiny flower to make it profitable for the bees to visit it all day long, from daylight until dark? If so, I ought to be able to see it by looking sharply. I found a flower, in the right position to receive the direct rays of the sun, and, just after a bee had licked it out clean, I watched the nectaries to see how soon any more honey was visible. To my great astonishment, in just three-fourths of a minute I saw a little shining globule of honey begin to push its way up, right where the bee had licked it off. I watched it most intently — no mistake at all — this little globule was enlarging before my very eyes, and, before two minutes were up, it had spread over, like a little silver mirror, and run along the side of the pitcher-shaped petal of the flower. A bee now became anxious to push his way in, and I let him lick it out, and then saw the process enacted over and over again. To be sure that I was not mistaken, I called a friend, and he, too, saw the little "tableau" enacted over and over again.

Under WATER FOR BEES I speak of a way the bees seemed to have of reducing thin, watery honey to the proper consistency. Well, I secured a position where the bees would come between myself and the sun, and watched to see how many bees went toward the apiary loaded. To my surprise, I saw one and then another, while on the wing, humming from one flower to another, discharge this same watery fluid, and, when my eye had become accustomed to it, I saw all the bees at work expelling the water in this way, while on the wing. This, then, is the process by which they make clear, crystal honey from the sweetened water, as it were, that is exuding so constantly into the nectaries of these little flowers.[88]

May, 1884.—We can now report, after having raised figwort by the acre. On deep, rich soil, the plants will blossom and bear considerable honey for three or perhaps four years; but like strawberries and other small fruits, they will then begin to run down, and new plantations must be made. Unless the soil is rich and deep, the secretion of nectar will be meager. At present I do not believe it will pay to raise *any* plant for honey alone, and I am inclined to think our honey-farms will have to embrace, mostly, alsike, buckwheat, rape, including, perhaps, the stock-pea of the South, and such other plants as will pay for the crop they yield, aside from the honey. See ARTIFICIAL PASTURAGE.

FIXED FRAMES. By these are meant frames held at certain fixed and regular distances apart by some sort of spacing-device, forming either a part of the frame itself or a part of the hive. Under SPACING OF FRAMES, elsewhere, and under HIVE-MAKING, I have discussed the distances that frames should be put apart. Some prefer 1½ inches from center to center; but the great majority, supported by the best of reasons, prefer 1⅜ inches. Fixed frames, then, are those that, when put into the hive, are spaced automatically, either 1⅜ or 1½ inches from center to center. Loose frames differ from them, in that they have no spacing-device connected with them, and are, therefore, when placed in the hive, spaced by eye—or, as some have termed it, "guesswork." Such spacing results in more or less uneven combs; and beginners, as a rule, make very poor work of it. The advocates of fixed frames claim that they get beautiful perfect combs, no burr-combs, and that, without any guesswork, the combs are spaced accurately and equally distant from each other. Fixed frames are all ready for moving the hives, either to an out-yard, to and from the cellar, or for ordinary carrying around the apiary. Loose frames, on the contrary, while they are never spaced exactly, can not be hauled to an out-apiary, over rough roads, without having sticks put between them, or something to hold them together. It is contended by some, also, that fixed frames can be handled more rapidly. See FRAMES, MANIPULATING. On the other hand, the advocates of the loose frame urge, as an objection to the fixed frames, that they kill bees. In the summer of 1890, at his apiaries, we saw P. H. Elwood, the owner and successful manager of 1200 colonies, handle his closed-end frames easily and rapidly, and without killing bees. We witnessed Mr. Julius Hoffman, whose frame we will presently illustrate, handle his with equal facility. Some of the largest bee-keepers in the world are users of fixed frames. Capt. J. E. Hetherington, who runs successfully 3000 colonies, has them all on the Quinby closed-end frames. But, despite this fact, the majority of bee-keepers use the loose frame—not because they think it is better, but because we believe they did not in the first place fully understand the advantages and convenience of the fixed frame. There are many styles of fixed frames; but there are only two or three that are really good ones, and worthy of any serious consideration on the part of the practical bee-keeper. These are, the closed-end Quinby, the Hoffman, and the Van Deusen reversible (see REVERSING FRAMES; also FRAMES, MANIPULATING).

The closed-end Quinby is, as its name indicates, one whose end-bars are 1½ inches wide their entire length. The top and bottom bars are 1 inch wide. These closed uprights, or closed ends, when they come in contact, cause the combs which they contain to be spaced accurately from center to center. Fig. 1, A shows one such frame. Almost all closed-end frames are made to stand, and have very often been called "standing frames." Mr. Quinby, in order to keep such frames from toppling over, invented the strap-iron hook on one corner, as shown in the accompanying engraving, re-engraved from Cheshire. *h* is the hook that engages the strap iron *ip* in the bottom-board; *gr* is a groove to admit of the hook, and at the same time render it possible to catch under the strap iron.

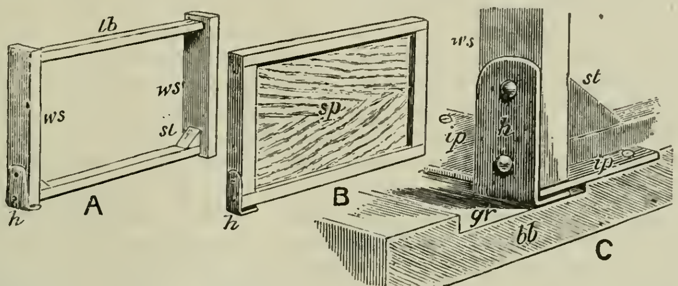


FIG. 1. HOW THE QUINBY FRAME HOOKS ON TO THE BOTTOM.

These hooks are on the outside of the hive proper, and hence they do not kill bees, nor are they filled with propolis as they would be if made on the inside of the hive. A and B are respectively the frame and the follower, although they are drawn somewhat out of proportion. With a panel on each side, a cover and a bottom-board, the Quinby-Hetherington hive is complete, the ends of the frames forming the ends of the hive; though, for additional protection in the spring, Mr. Elwood and Mr. Hetherington both use the outside case to set down over the whole. This makes a very cheap hive, and has many desirable features in it. For fuller details in regard to this frame, and its manner of construction, you are referred to "Quinby's New Bee-keeping." See Book Notices, also Frames, How to Manipulate, elsewhere.

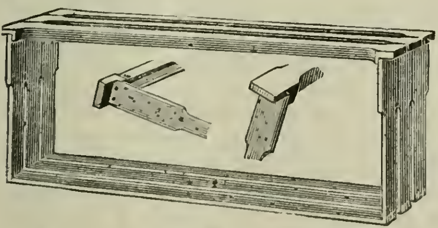


FIG. 2—THE HOFFMAN FIXED FRAME.

The great majority of bee-keepers prefer what is known as the "hanging frame." This has many very decided advantages over the standing frame; and there is no doubt that, for this reason, the loose frame is used so generally; but the hanging frame is also used as a fixed frame. The best style of hanging fixed frame is, without doubt, the Hoffman. Fig. 2 shows a trio of these frames.

You will observe that this frame can be used in an ordinary Langstroth hive (see Hive-making); and the end-bars are closed-end only within a couple of inches of the top. The rest of the frame, two-thirds of the way down, is narrowed down to ⅜ of an inch. The top bars are widened out at the ends, and are scored out in the middle to one inch wide.

It may not be clear why the top-bar should widen out near the ends. It is for covering up the wood rabbet entirely, so that the bees can have no occasion for chinking in propolis. We will suppose that the top-bar is $1\frac{1}{32}$ inches wide its *entire* length, and that the end-bars are as shown in the cut. As these are spaced frames, it is evident that the top-bars will rest in the rabbet exactly in the same place at all times. In a few months' time, if the frames be all lifted out, the places in the hive-rabbet not covered by top-bars will be thickened and stuck up with propolis, and those covered by the ends of the top-bars will be comparatively clean. In process of time, especially with hybrids, these exposed places in the hives will receive further accumulations of propolis, until the ends of the top-bars, so to speak, will rest between the notches of bee-glue. Now, the great "function," if I may borrow a term from Mr. Heddon, of the Hoffman frame, is a lateral sliding motion. With masses or notches of propolis placed at regular distances, this lateral motion is impracticable. "But," you say, "why is this not true with the ordinary loose frames?" For this reason: Loose frames are never put back exactly in the same place in the rabbet; and the result is, that the wooden rabbets are covered about equally with propolis from one end to the other. To avoid the regular masses of propolis, the inventor, Mr. Hoffman, had the top-bars enlarged at the ends, so that, when the frames are all in the hives, the rabbets will be covered up entirely. You may examine the wooden rabbets of hives that have had these frames for years, and you will find they are about as free and clean from propolis as they were when the hives were first made.

If you use tin rabbets you can get along very well with top-bars the same width throughout; but those of you who have had hybrids to any extent, know that they will sometimes fill tin rabbets nearly full of propolis, and then you have to go and dig it out again. By Mr. Hoffman's plan, the worst propolizing bees known are circumvented in the worst propolizing localities. If you use Italians and tin rabbets, you will never have any trouble about the rabbets being filled with propolis, and you could use the Hoffman frames with straight top-bars.

So much for the construction of the top-bar. There is no need of discussing the feature of having a wide end-bar near the top. Its office in preventing the bottom-bars from knocking together during moving or otherwise rough handling, is too evident to need discussion. As these frames are wholly inside of the hive, and the end-bars are a bee-space from the ends of the hive, the bees can propolize both sides of the end-bars coming in contact. So we have as little come in contact as possible.

For details as to its construction, see HIVE-MAKING; and the details as to its manipulation, see FRAMES, HOW TO MANIPULATE.

Not all bee-keepers will be suited with any one style of frame. Some would not tolerate either the Hoffman or the Quinby closed-end; and they have even gone so far as to urge the insurmountable objection that they are "unbearable" and "intolerable" by reason of the propolis and bee killing. The propolis question may be a serious one in a few localities, and so each bee keeper should decide what frame is best suited for him; but as to being "bee killers," that is almost altogether because of improper handling; or rather, I should say, a lack of the proper understanding of their manipulation. Fixed frames are used almost all over the United States, to a greater or lesser extent. It is said, and I think truly, that they would be intolerable in Cuba and in certain parts of our Southern States, because of propolis; but in a great majority of places they can be used, and not be "intolerable."

Now, in a word, what are their advantages? They give beautiful and regular combs; are practically free from burr-combs; can be hauled without any special preparation over the roughest roads, turned upside down, and rolled over without disturbing the combs. They permit, to a very great extent, of the possible handling of hives instead of frames. Under FRAMES, MANIPULATING, is shown how they can be handled in pairs and trios—in fact, half a hive at a time. They can also be inverted, thus causing the combs to be built out solidly to the bottom-bar; and, when once completed, they can be restored to their normal upright condition. They can be handled as rapidly as the loose frame. Indeed, Mr. Julius Hoffman, of Canajoharie, N. Y., the owner of some 600 colonies on Hoffman frames, says he can work nearly double the number of colonies with his frame that he can with any frame that is not spaced or close-fitting, and he has used both styles of frames. But not every one will be able to do this; and very likely some people would handle them very much slower than they would loose frames. In spite of all the advantages of fixed frames you will need a few to decide for yourself what you like, and whether you had best adopt them or not.

FOLLOWER—See DIVISION-BOARD.

FOUL BROOD. I know of nothing in bee culture so much to be feared as foul brood; and I believe it is pretty generally agreed that all other bee diseases together, and we might almost say all other drawbacks, are as nothing compared to it. It is not a disease of the bees, but of the *brood*.

Microscopic investigation has revealed the fact, that foul brood is a species of minute microbes, which, when once started growing, increases with astonishing rapidity, and only ceases to extend when the supply of material that it feeds on gives out, or the temperature is raised to such a point (boiling point) that the vegetation is killed. It is on this account that honey from diseased hives is rendered perfectly wholesome for feeding bees by being scalded, as this is fatal to the seeds of all such microscopic life. Severe freezing does not produce the same result. The name of the microscopic plant is *Bacillus Alvei;* you know we always feel a great deal better, to know just what a thing *is*.

SYMPTOMS OF FOUL BROOD.

Before I proceed further I am going to presuppose that you have found in your apiary something which you are afraid may be foul brood. The first thing you want to know is the symptoms. Having had to treat nearly one-half of our own apiary on account of this dreaded disease, I believe I am competent to tell you almost exactly the symptoms which you should expect. The disease does not, as you might suppose from the name, have a foul odor. The smell, when present, is not unlike that from a cabinet-maker's common glue-pot, and you may or may not be able to detect it. It will depend somewhat on how far the disease has advanced. You must not, therefore, depend too much on the smell. Before you may expect any odor, you are to examine carefully the young larvæ in all the cells, whether sealed or not. Foul brood is generally confined to *sealed* brood; but I have found, in many instances, cells of unsealed brood that were diseased.

About the first symptom which you will notice in a diseased colony (and which will be your first intimation of trouble) will be now and then a cell or two of capped brood, the capping of which is sunken, and perforated by a small hole. You must not always expect to find the capping sunk, however, neither must you expect to find the minute hole in the center of the cap, even when the colony is diseased. The point is, if you *do* find the capping sunk, and the little hole in the center, you can set it down that you *probably* have foul brood, and that it is well advanced. Sometimes even the capped brood will have a perfectly natural appearance.[90] At this point, however, it probably has not made much headway. The only true way, then, to ascertain the true condition of the brood in such cases is to open the cells with a toothpick. Whether you use the toothpick or not, in the early stages of the disease you may expect that now and then the young larvæ in the cells will have a light-brown appearance. As the disease advances, the brown turns to a little darker color—something like the color of the coffee which you drink when a little milk is added. The color will keep on turning darker until of the color of the roasted coffee-berry. The dead larva is then dried and shrunken, and at the bottom or side of the cell. At this stage of development you will be almost sure to notice the cappings of sealed brood a little sunken, with the characteristic small hole in the center, and you will probably be able to detect the foul-brood odor as described above. To further satisfy yourself that you have the real malignant foul brood, take a toothpick, poke it into the maturated mess of a diseased cell, draw it slowly out, and you will notice that the matter will adhere to the end of the pick in the form of a thread, something as you might expect from spittle. If you continue to stretch this thread till it breaks, the two ends thus formed will fly back to the points of attachment. In other words, the diseased matter from the foul-broody cells is tenacious, and by some writers it is not inaptly described as being "ropy." While you are looking for these symptoms, be sure that no bees are flying. If your neighbors want to take a look at it, don't open up the colony expressly to gratify them. Handle it as little as possible after you are satisfied that it is diseased.

If you notice any one of the symptoms which I have described above, you may begin to suspect that you have foul brood; and if you notice them all, you may be very *sure* that you have nothing more nor less than the most malignant disease that affects bees, and that, unless you proceed at once to treat the colonies in the manner I shall describe, you will find you have an "elephant" on your hands. In fact, the very spread of the disease from one colony to another is an infallible test that you have malignant foul brood; but you should not wait to see whether it spreads or not.

HOW TO TELL WHETHER FOUL BROOD HAS BEEN PRESENT IN OLD COMBS.

Mr. R. L. Taylor, at the Michigan State Bee-keepers' Association in 1890, told how it is possible to ascertain whether foul brood has ever been in combs. He said, "The dead brood is entirely dried up—mere scales, almost of the color of the comb itself, lying fast to the lower sides of the cell, and drawn back more or less from the opening." And further on, in telling how to see them to the best advantage in a suspected colony, he adds: "Take out three or four combs, one by one, from near the center of the brood-nest, and hold each with the bottom-bar from you in different directions, until the light strikes well into the *lower sides* of the cells, when, if affected, the scales I have described are very evident." It is evident, that the foul-brood matter had dried and afterward scaled up; and the bees, being very loth to have any thing to do with the diseased, soiled cells, leave them untouched. Such combs, if they should happen to get in with other combs, can be separated, melted up, or burned up, as the case may be.

WHAT TO DO WHEN YOU HAVE DISCOVERED FOUL BROOD IN YOUR APIARY.

I will assume, that, from the symptoms described above, you are no longer in doubt as to whether you have foul brood. The thing you now want to know is, what to do. First, you are to see to it that there shall be no delay nor carelessness on your part. *Under no consideration* are you to let robbers gain access to your diseased colony. The disease is propagated, in the generality of cases, from one colony to another by robbers entering affected hives and carrying back foul-brood honey in their sacs to their own combs. You must bear in mind, that the disease foul brood resides in the *honey*; and that said honey, when given to larvæ, kills them. Having now given you the proper caution, I believe you can more intelligently and more carefully carry out my directions.

HOW TO CURE FOUL BROOD.

There are several ways of treating diseased colonies. The first, surest, and, perhaps I had better add, the most expensive way to cure a foul-broody colony is to burn it—hives, frames, bees, brood, honey, and every thing. If you are situated so that you can gain access to a boiler-furnace,* the best and most expeditious way of burning a colony is to carry the hive after dark, or when no bees are flying, and all the inmates of the diseased colony are in their hives, to the boiler-furnace and dump it into a *hot* fire. If the hive is too large to go into the furnace at one "dump," pick up the cover and throw it in; next the quilt or cloth covering; then throw in successively the brood-frames covered with bees, after which knock the hive to pieces and throw it in. I recommend burning the hive in a boiler-furnace, because you can get a hotter fire than if you simply build up a big bonfire, and consign the hive in question to the flames. I hardly need add, that in burning the colony you should be very careful that not *a single bee* is allowed to escape. If you are so careless as to let a few diseased bees get away from you and go to their own location, they will, on finding their own hive gone, enter several other hives neighboring and adjacent to their old location. Every bee having the disease will be liable to communicate it to the other hives.

I have said, the fire treatment is expensive, and so it is; but under certain circumstances it will be the cheapest in the end. If you have good reason to believe that there is *only one* diseased colony in the apiary, your best and surest way is to burn it without any further hesitation. If, on the contrary, you are so careless as to let the disease get the start of you, and, as an inevitable consequence, you have foul brood in half your colonies, the treatment of complete extermination by fire would be rather expensive, and the following method would be the one I would recommend.

THE STARVATION PLAN.

Near the location of the colony to be treated, put a hive containing frames with only starters of foundation. At night, move the affected hive three or four feet from its location and put the clean new hive in its place. Open the former, take out the frames one by one, and shake from them the bees into the clean new hive containing the empty frames and starters. After all the bees are shaken out, carry the infected hive and combs away so that all the flying bees may return to their old location and enter the new hive now on the old stand. You are next to burn up the frames* of honey and brood, after which boil† the hive in water, to destroy all traces of the disease. The hive is now ready for use again, and you can put into it some clean frames of foundation ready for your next one. In the meantime, the bees which you shook from the diseased colony, and which are now in the new hive, are to be deprived of all food for about 48 hours, during which time the entrance must be closed. You are to make them consume all the honey in their sacs, and use the same in drawing out the foundation. At the expiration of the "starvation period," as we call it, you can with some degree of safety give them syrup. It is said, however, that the bees under certain circumstances will retain the diseased honey in their sacs for a period of four or five days; but if you compel them to go without food for 48 hours, at the same time forcing them to *build comb*, I don't believe there will be very much danger. In this way you are to treat the colonies one by one.

There is one difficulty in treating colonies by the starvation plan. In shaking off the bees into clean hives, there is danger that a few, on entering the new hive on the old

*If such is not convenient, brimstone the bees to death, so that not one shall escape and get into another hive, and then burn completely the whole thing in a bonfire.

* D. A. Jones, of Beeton, Ontario, Can., recommends extracting the honey, trying out the wax and boiling the frames, the latter to be used again. The wax is to be made into foundation, for further use. While this can and has been done, the expense of so doing would be greater, in my mind, than buying clean new frames and foundation; besides, it would be much safer. The operation of extracting, trying out combs, and "cleaning things up," might give robber-bees a sip of the virulent honey, and then —!

† Boiling heat will always kill the germs of foul brood, but freezing will not.

stand, and, finding its inside condition materially altered, will conclude that they have got into the wrong hive, and, as a consequence, go to others. By this means the disease is spread to the hives visited by the new comers. It has been recommended by some to close the entrance and so shut the bees into the hive. This can be done, but I have found it practically impossible to get every bee into the hive in shaking off. To shut them up entirely only aggravates the difficulty. The few stray bees outside, which did not get in, if unable to get into the new hive on its old stand will spread the disease by going elsewhere, where they can gain entrance.

During the summer of 1887 we used carbolic acid as an antiseptic, diluted 500 times in water.* This we sprayed upon the bees after they had been shaken out into clean hives, with what is called a spray-diffuser. These latter can be obtained of dealers in bee-supplies. We found that this *prevented* the *spread* of the disease from the colony under treatment to other colonies. The object, then, is not to cure the colony, but to prevent the bees from carrying the contagion into other parts of the apiary. When we did not administer the spraying, those colonies neighboring on the one diseased were pretty apt, sooner or later, to show that they had foul brood—indicating that diseased bees had gone originally from the parent stand to the neighboring hives.

OTHER REMEDIES.

Besides the two methods of complete extermination by fire, and the starvation plan just described, various acid treatments have been recommended. During the summer of 1887, while the disease was raging in our apiary we concluded to test almost every method given. We accordingly tried several of the acid treatments—not exactly according to the formula recommended by the originators, but near enough for all practical purposes. We first tried salicylic acid. Upon repeated attempts we found that it would drive out all traces of the disease as long as the acid was administered, after which foul brood would appear in from one to two or three months. In no case were we able to make the salicylic acid effect a permanent cure. As carbolic acid, or phenol, was recommended by some of the English friends, we gave it a most thorough test. Like the salicylic acid, it would for the time suppress the disease; but it was a long slow job, and at best very unsatisfactory in its results. We *could* make bees clean things up after a while, and finally could get clean-looking brood. But in every case this brood, sooner or later, again showed the real disease, showing that the acid had only a temporary effect, and, in our case at least, it would not effect a permanent cure.

A good deal has been said about the acid methods of treatment, but I believe my A B C scholars had better have little or nothing to do with them. I have carefully read all the reports in the bee-journals, both foreign and American. I have seen a score of reported failures with the acid treatments to one where a successful cure was accomplished. In the hands of a few experts they may effect a cure, but the novice will hardly have success. In 1887 and '8 the bee-keepers of Australia tried the carbolic-acid method most thoroughly; and, as nearly as I can judge from the reports received, they have, every one of them, given it up as unsatisfactory.

CAUTION.

I must enter just a few words more of caution, to more clearly impress upon your minds some things which you need to be careful about in treating foul brood. First, in your efforts to eradicate the disease, do all the necessary work after dark, or, at least, when no bees are flying. Second, in carrying a colony to a boiler-furnace be sure that no bees escape, else they will enter other colonies, and scatter the disease. Third, under no circumstances get the bees to robbing any colony, either diseased or healthy. If your bees get a notion of pilfering, and you have foul brood in your apiary, your efforts to counteract the disease will be almost fruitless for the season. Fourth, do not exchange combs in the apiary. In appearance a comb may be perfectly healthy, and yet at the bottom the cells may have the diseased honey. Fifth, if you have extracted any honey do not feed any of it back, no matter if you feel sure that the honey is perfectly good. If, however, you heat it to 212° F. it will be perfectly safe to feed back. Sixth, after handling a foul-broody colony, wash the hands thoroughly before touching a healthy colony. Seventh, a great deal more depends upon your being careful at the *start* in ridding your apiary of foul brood than all the care and all the treatments put together which you may be able to give *later*.

*To make the solution, get a bottle of *pure* carbolic-acid crystals. These will be white. Melt (125° F. is sufficient) about an ounce of this, and mix it thoroughly with 500 ounces of pure soft hot water.

CAUSE OF THE DISEASE.

Many reasons have been given for the appearance of foul brood, and it has been sometimes claimed that the disease might be generated by the decomposition of considerable quantities of chilled brood, if left in the hive. I can not but think that this is a mistake, and I also think that a great many cases are called foul brood that are nothing like it. If we admit it to be a fungoid growth, as the best authorities tell us, I do not know how it can originate without the germs or spores being brought by some means, from some locality where it prevails, like smallpox, and other diseases of like nature. The theory of spontaneous generation of either plant or animal life has for ages, over and over again, fallen to the ground, where the experiments were made with sufficient care. Does corn ever grow, where no corn has been planted?

FRAMES, HOW TO MANIPULATE. Under FIXED FRAMES I showed that there are two kinds in use—the fixed and the loose frame; and as the latter is more generally used, I will describe this first. In the first place, I assume that you have a smoker; and if you are a beginner, or are timid, a bee-veil. See that your smoker is well going. Approach the hive that you are to open, and blow a little smoke into the entrance. If there is no enamel cloth under the cover, you will then, of course, pry it loose with a knife or screwdriver, as it will be fastened down with propolis. Just the moment the cover is loosened, blow the smoke through the crack; and while you lift the cover off, blow more smoke over the top of the frames. Do not use too much smoke—enough to quiet the bees. If they are hybrids you will have to use more than for pure Italians, as a matter of course. The moment the cover is off turn it up edgewise, and sit down on it, milk-stool fashion, as shown in the accompanying cut.

FIG. 1—HOW TO SIT ON HIVE-COVER.*

To get at the center frame, crowd the frames, one at a time, adjacent to it, toward the sides of the hive. This will give room to lift out the frame you want. Beginners are pretty apt to pull the frame out without spacing the frames apart. This rolls the bees over and over, enrages and kills them, besides running a pretty good chance of killing the queen. Lift the frame out carefully, and be careful not to knock

* For further description of this cut, see VEILS.

the end-bars against the sides of the hive. If it is your first experience you may be a little nervous, and do things a little hurriedly. As a reward, the bees will quite likely sting you and make you still more nervous. To avoid this, proceed very cautiously and make your movements deliberate. Having removed the frame, hold it up before you, as shown in the accompanying engraving, which we will call the first position.

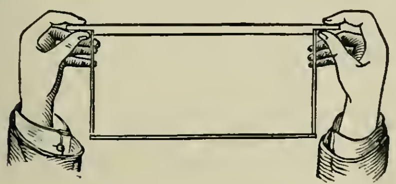


FIG. 2 FIRST POSITION.

You don't see the queen on this, and so you wish to turn it over and see the other side. If the comb is heavy with honey, you can turn it right over with the bottom-bar resting horizontally. But a better way and a good habit to fall into, and one that good bee-keepers usually adopt, is this: Raise your right hand until the top-bar is perpendicular, as shown in the accompanying engraving.

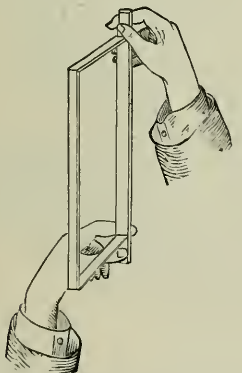


FIG. 3. SECOND AND THIRD POSITIONS.

Now revolve the frame like a swinging door, or the leaf of a book, so that the opposite side is exposed to view. There is a little knack about it; and to become familiar, take a frame without any bees on it, and try a few times until you become familiar with this mode of handling.

Having examined this frame, lean it against the side of the hive, and remove one of the frames next to the one already removed. Examine this in like manner. Lean this also against one corner of the hive, or return it to the hive; lift out another, and so on until you have examined the whole number. Now, may be you have not found your queen yet. Look your frames all over again, and be careful to look around the bottom edge of the combs. If you have not found her yet, examine the frames the third time and set them in another hive-body. Then look carefully down around the sides and ends of the hive, especially on the bottom-board. You will very likely find her there. But we will suppose you have not found her even yet. You have seen eggs and larvæ in all stages of growth, and you have not seen any queen-cells started. You know she must be there somewhere. Put the frames all back; close it up, and visit it again in about an hour. By this time you need not be surprised if you find her on the first frame.

I have told you above how to find the queen; but you must not imagine that it is going to be as difficult as this every time. You will be most likely to find her on the center frames, as a general thing; and especially with Italians, you will be apt to find her on the first or second frame.

The directions above given have reference to hives without any follower. Under HIVE-MAKING we recommend making the hive wide enough so as to admit the use of a follower or division-board (see DIVISION-BOARDS), so as to take the follower out instead of a frame, and leaning it against the hive. Now, then, when you come to examine the hive, remove the follower and crowd the outside frame into the space it occupied. You will then not be obliged to lean a frame against the hive. Almost all practical bee-keepers now prefer to have a hive wide enough to take in division-boards. When put on the north side of the hive it makes it warmer, and certainly it is a very great convenience in manipulating frames. Indeed, for fixed frames it is a *necessity*.

Now when you put back loose frames, space each one carefully, as nearly as you can, 1⅜ inches from center to center. You can not do it exactly, but do it the best you can. With loose frames you will be obliged to space each frame in position individually. If you do not space your frames carefully you will have some combs bulged, and some thinned down; and, again, between others bees will be likely to build spurs of comb. All this nuisance may be avoided by the use of fixed frames or the Hoffman, which I will now tell you how to manipulate next.

HOW TO MANIPULATE HOFFMAN FRAMES.

One of the conveniences, and almost necessities, is a small screwdriver. This, or a good strong knife, is something that almost every apiarist uses nowadays. With a screwdriver or wedge I pry loose the flat board cover of the Dovetailed hive, having previously blown a little smoke in at the entrance.

The cover removed, I place the same under me, and sit down on it, milk-stool fashion (as in cut), and as illustrated on a previous page in the consideration of the loose frame. You will observe that the cover is a seat on which we can lean backward and forward. This I find a great convenience, in that the body can be leaned toward or from the hive; and, the elbows resting on the knees, they can support quite a heavy weight, in the way of two or three Hoffman hive opposite to where we are sitting (see cut). With a screwdriver or the wedge, we pry apart the first pair or trio of frames, if the frames are not too heavy, and lean them against one corner of the hive as shown below. Don't you see we pretty nearly handle the brood-nest in halves and quarters?

You will notice that these frames will hang together by propolis, and that the bees on the two inside surfaces are not disturbed at all. The loose frames, when out of the hive, have got to be leaned against one or two corners of the hives, against each other—in fact, be scattered all around for the depredations of robbers; and, be-

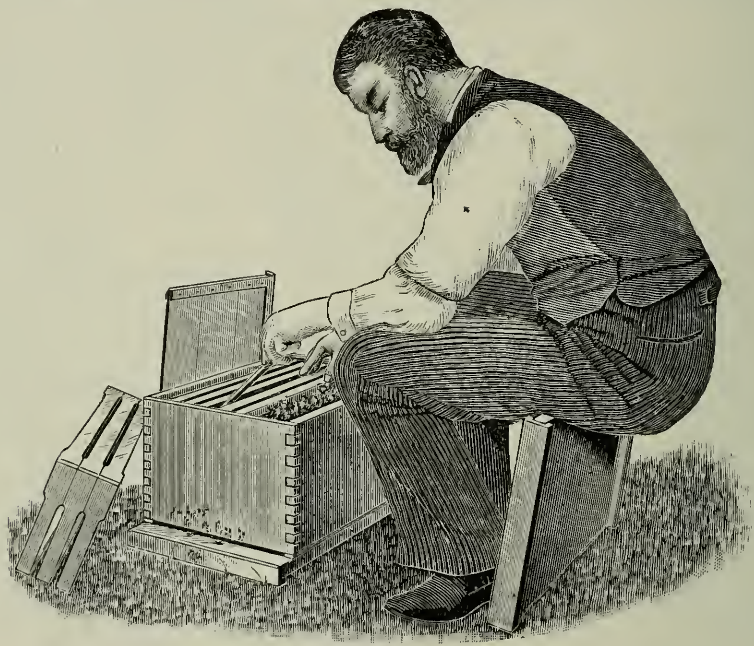


FIG. 4. HANDLING HOFFMAN FRAMES.

frames. You may argue that you would not sit down on the narrow edge of a ⅜ board for anybody or for any money. I will say, in reply, that, in handling Hoffman frames, so short a time is occupied in examining the hive that no inconvenience will be experienced; and, besides, there is no law to compel you to sit in any one attitude over every hive. Comfort as well as convenience sometimes suggests a standing as well as a kneeling posture, though usually I prefer to sit down on a cover. Well, to return.

A little smoke is blown over the top of the frames. The wedge that holds the follower, or spacing-board, against the frames, is next removed; and while the wedge is in the hands, the follower is leaned against the sides all that, the liability of killing bees or the queen is much greater. This is a big point in favor of the Hoffman frames. If we do not find the queen on the frame in hive, pry off the outside frame of a trio leaning against the corner of the hive. If she does not appear on that one, pry off the next one, and so on.

If frames are heavy with honey, we may lift out only one frame. Having seen the surfaces of two or three combs, the practiced eye will get a pretty fair idea of the condition of the colony and what the queen is doing. If we see eggs and larvæ in all stages, as well as sealed brood, we do not usually bother to hunt up the queen; so we put back the second pair removed, and finally return the trio, as shown in Figs. 4 and 5. We do not generally crowd these frames together at once. We blow a little smoke down between each of the end-bars, and then with a quick shove we close them all up again.

There is no cut-and-try spacing as with loose frames—no big and little fingers to get the distances at wide and narrow spaces. There is no continually instructing the beginner on just how far to space combs, and there is no finding the apiary afterward, with the combs spaced so far apart that spurs of comb are built where they ought not to be. No, with the Hoffman frames the spaces have got to be exact, and the combs will have a fixed and definite thickness; and I do not hesitate to say that you can alternate them just as well, and even better, than you can many of the loose frames. Let me explain. Space the loose frame during the honey-harvest, anywhere from 1⅜ to 1½ or even 1⅝ inches from center to center, and then, after the honey harvest, try to alternate it with other frames placed a little closer, and see where you are. You may say you can space frames near enough right. Although I have visited many large apiaries, I never saw a loose-frame apiary spaced near enough right, unless it was Mr. Manum's home apiary. He is one of those precise men who are bound to have every thing just so.

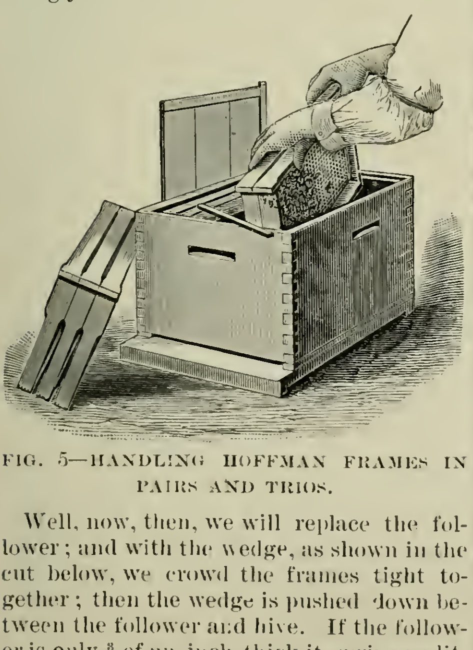


FIG. 5—HANDLING HOFFMAN FRAMES IN PAIRS AND TRIOS.

Well, now, then, we will replace the follower; and with the wedge, as shown in the cut below, we crowd the frames tight together; then the wedge is pushed down between the follower and hive. If the follower is only ⅜ of an inch thick it springs a little, and this will take up any unequal swelling or shrinking in the Hoffman frames (if there should be any) through changes of atmosphere, from extreme wet to extreme dry. If there are any bees on the tops of the frames, a whiff of smoke will usually drive them down, and then the cover is replaced with a sliding motion, which I have already explained.

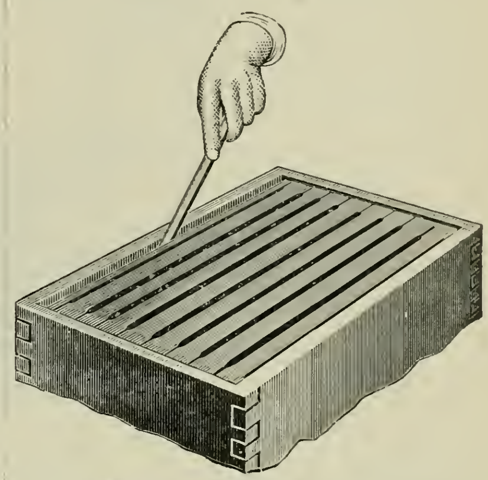


FIG. 6—MANNER OF CROWDING HOFFMAN FRAMES TOGETHER.

Perhaps from my description about manipulating the hive with Hoffman frames, it may appear like a very long operation; but I can assure you that it is a very short one. Mr. Hoffman says he can handle nearly double the number of colonies on his frame that he could on any loose frame; and I will add right here, that he used loose frames for years, until necessity, the mother of invention, caused him to bring out this style.

There is another big point; namely, by removing two or three frames in a trio, the rest of the frames in the hive need not be lifted out at all. They can be slipped back and forth, and each surface examined; but if the rabbet is covered with pieces of propolis, this lateral sliding is not easily accomplished.

HOW TO MANIPULATE QUINBY FRAMES.

Remove the outside case, after which pry loose the honey-board or quilt. With a jack-knife or screwdriver pry apart a couple of the frames, and then draw them apart as shown in the accompanying engraving.

Sometimes the queen may be found on the first frame, as shown in Fig. 7. If not, pry loose one of the others, and slide it along and take a glance at the others, and so on. If necessary, unhook the frame or frames from the bottom-board, and set them to one side, to make room for the others that you may wish to examine. When you have found your queen, or satisfied yourself as to the condition of the hive, hook the frames into place. Now, to avoid killing bees the frames should not be pushed laterally against each other; but by a little side sliding the bees may be brushed off from the surfaces of the end-bars that are to come in contact.

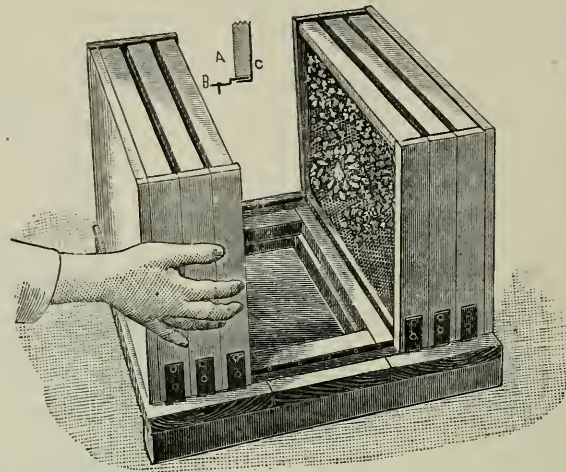


FIG. 7 QUINBY CLOSED-END FRAMES MANIPULATED.

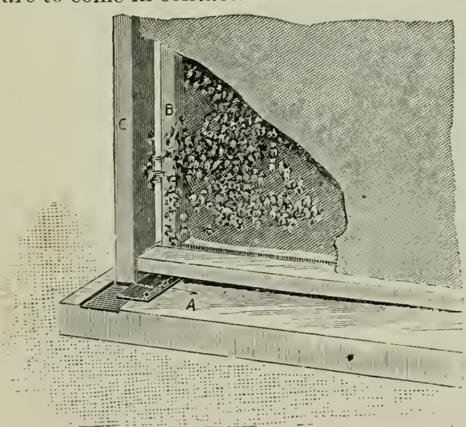


FIG. 8. HOW THE QUINBY FRAME AVOIDS KILLING BEES.

Let *a* be a bottom-board, and *c* and *b* respectively end-bars covered with bees. *c* slides in the direction of the arrow *a*, and brushes the bees off from the end-bar *b*. If there happen to be no bees on the end-bars, the frames can be shoved laterally together, of course.

By referring to the first figure, closed end Quinby frames offer facility in looking in, not only over the top, but between the open sides; and these open sides admit of light entering, so as to give a good clear distinct view.

In point of exact spacing, convenience in moving over rough roads, absence of burr-combs, etc., these have nearly all the advantages of the Hoffman frames; but they are used by only a few bee-keepers, comparatively; and those who would like to adopt the Hetherington-Quinby system could not very well do so in toto without discarding their hanging-frame hives; and as the Hoffman frame has the very desirable feature of the *hanging* frames as well as fixed distances, I would recommend it in preference to any other fixed frame, to those who would like to adopt the fixed spacing.

FRUIT-BLOSSOMS. Although the honey obtained from this source is not equal, either in quality or quantity, to that from clover, basswood, and some other sources, yet coming, as it does, just when the bees have, usually, nearly exhausted their old stores, it is a crop of great moment to the apiarist.[93] I do not know of a prettier sight to the bee-keeper than the yellow-banded Italians at work on fruit-blossoms, nor a pleasanter sound than their merry hum of rejoicing. One would suppose the honey from choice early cherry-trees must be unusually fine; but I believe those who have tried it, all agree that it is any thing but delicious. It seems to have a strong rank taste, much resembling the taste noticeable in chewing cherry-tree bark, or the buds. The honey from apple-bloom is much the same. It is excellent for starting brood-rearing, but it is of little or no value for table use. I once extracted about 10 lbs. of honey from fruit-blossoms, by putting two fair colonies together early in the spring, thus giving about the working force of a colony in June.

Although it will not be advisable to try to get surplus honey from the fruit-bloom, it is sometimes an excellent idea to put a frame or two of sections in the lower story, that they may get the fdn. nicely built out ready for the clover season. If they should store some of the dark honey in the sections, it will all be removed, in all probability, during the interval between the fruit-bloom and clover.

July, 1883.—The above statement in regard to apple-tree honey has appeared in print unchallenged, so far as I recollect, since the A B C book was first published, in 1877. During the present spring, however, several have reported apple-tree honey as being fully equal to any: and friend Sanford, of Unionville, Ct., has taken the trouble to send me a tumbler of nice honey from this source, which all declare, who have tasted it, to be equal to any honey furnished from any source. The flavor is distinctly apple-bloom; that is, one who had ever chewed apple-blossoms would have no difficulty in deciding at once as to its source. The flavor is not only beautiful, but the honey is very thick and remarkably clear. Whether this result is peculiar to this season, or whether the honey that I extracted and bottled in former years was mixed with honey from the dandelion, hickory, or other sources, I am unable now to say; but this I *do* know, that apple-tree honey is, at least sometimes, equal to any.

DO BEES INJURE THE FRUIT BY TAKING THE HONEY FROM THE BLOSSOMS?

This is an idea that has been advanced over and over again, and will probably be many times more, by those who take only a casual view. If I am not mistaken, the matter was carried so far in a town in Mass., that an ordinance was passed obliging a bee-keeper to remove his bees to another locality. After a year or two had passed, the fruit-growers decided that they would rather have the bees brought back, because so little fruit was set on the trees, in proportion to the amount of blossoms appearing. As it was a fruit-growing district, it was a matter of considerable moment, and the bees were brought back. Of course, with the bees came fruit in abundance, for many kinds of fruit absolutely depend on the agency of bees in fertilizing the flowers, to enable them to produce fruit at all. It seems that the small drop of honey which nature has placed in the flower is for the express purpose of attracting bees and other insects, that the blossoms may be surely and properly fertilized. It has been stated, that unless we have a few hours of sunshine when early cherries are in bloom, we shall have no cherries at all; and occasionally we have a season when cold rain storms so prevent the bees from getting out, that not a cherry is produced.

It is well worth while, I believe, for an apiarist to locate near extensive orchards, even if he should not think of planting fruit-trees, with the especial end in view, of having his bees benefited thereby. A large yield of honey from fruit-bloom is pretty sure to lay the foundation of a good honey season.

The very best time to transfer bees is when the honey just begins to come in from this source, for they are then all busy and happy, and but little honey is in the way to run down and hinder the work. I have looked at populous colonies during fruit-bloom, that had not a dozen cells full of honey in the hive, in the morning, but by night the hive would seem very well supplied; the next day would show the same aspect of affairs, indicating how rapidly they consume stores when rearing brood largely.[94] Should a stormy day intervene, stocks in this condition will be injured very much, if they do not starve, by being obliged to put the unsealed brood on such short allowance. A friend once came to me, in May, to have me come and take a look at his bees; he said they were sick. It was a box hive; and as I turned it over, I agreed with him that they *were* sick, and no mistake. I called for a bowl of sugar; and after stirring in some water, I sprinkled it all over the bees and combs. In less than an hour they were all perfectly well, and he paid quite a tribute to my skill in compounding medicines for sick bees. My friends, be sure that your bees do not get "*sick*" during fruit-blossoming time, nor afterward either.

G.

GILL-OVER-THE-GROUND. (*Nepeta Glechoma.*) Some 50 or 60 years ago, when this county was mostly woods, my father and mother commenced life on a little farm near where I am now living. Woman like, my mother wanted some flowers around the log house that they called home; and going to a neighbor's a few miles away, she took up various roots and plants. It was just about the time, or a little before fruit-trees bloom, and amid the shrubbery she found a little blue flower growing on a vine. As blue has always been my favorite color, I can readily excuse her for wanting to take home a root of this humble-looking little vine. The vine grew and throve "mightily;" so much so, that when my father moved back to the old

GILL-OVER-THE-GROUND.

farm after a dozen years' absence, he found my mother's blue flower all over, everywhere, and giving fair promise of being able to choke all the grass and almost everything else out entirely. When "we boys" commenced trying to make a garden, we scolded so about this "pesky weed" that my father said it must be thoroughly "dug out," before it went any further. After some feeble and ineffectual attempts at getting it out, he finally offered a younger brother a fine colt if he would rid the farm of the weed. I do not know how hard he tried, but I believe he never got the colt.

It transpired in later years, that this plant yielded a great deal of honey; and in some localities favorable to its growth, such as the beds of streams where there is plenty of rich vegetable mold, it has furnished so much honey that it has been extracted in considerable quantities. Coming in, as it does, between fruit-blossoms and clover, I think it might well be given a place on our honey-farm, even if it does hold so tenaciously to the soil when it once gets a start. That you all may recognize it, I give you a cut of roots, branches, leaves, and flower.

The honey is rather dark, and I believe a little strong; but if it is allowed to become perfectly ripened, I think it will pass very well. Perhaps the greatest benefit to be derived from it, however, will be to keep the bees uninterruptedly rearing brood, until clover and locust begin to furnish a supply.

This plant is a near relative of the catnip, which it closely resembles in the shape of the leaf. Both were originally from Nepeta, in Germany, hence the Latin names, *Nepeta Cataria*, and *Nepeta Glechoma.* I presume it would be an easy matter to raise this plant from the seed, but I would hesitate some in sending out such seed. It spreads much more rapidly than the catnip, because it catches in the soil like strawberry plants, from the little rootlets shown in the engraving.

GOLDENROD. (*Solidago*). This, in some localities, furnishes the bulk of the great yield of fall honey. It grows almost all over the U. S., and there are so many different varieties that it would be almost out of the question to try to give you a picture of it at all; the botany describes 53 different varieties, and it is common to find a half-dozen growing within a few rods. Its name describes it, so that almost any one should be able to identify it. If you see autumn flowers as yellow as gold, growing on the top of tall rods, you may be pretty sure they belong to this family. The flowers are very small, but grow in great masses, sometimes in long racemes, and again in dense bunches. The general characteristics are such that, after a little practice, you can readily identify any one of the family; but to assist you, we give the cuts.

Bees are almost incessantly humming over the flowers in some localities; in others, they seem to pass them entirely unnoticed. I have passed it in localities where bee-keepers say they have never seen a bee on it at all. Bees are seen on it, occasionally, in our locality, but I do not think they get enough honey from it, in ordinary seasons, to make it perceptible in the hive.

The honey is usually very thick, and of a rich golden color, much like the blossoms. When first gathered, it has, like the honey of most other fall flowers, a rather rank weedy smell and taste; but after it has thoroughly ripened, it is rich and pleasant. On getting the first taste of goldenrod honey, one might think he would never like any other; but like many other kinds, one soon tires of the peculiar aromatic flavor, and goes back to the clover honey as the great universal staple to be used with bread and butter. A patch of goldenrod might have a place on our honey-farm, and perhaps, with cultivation, it might do better and give a surer crop in all localities; but as it is only a common weed on our farms, I would hardly favor a general distribution of the seed.

THREE VARIETIES OF GOLDENROD.

H.

HAULING BEES. See Moving Bees.

HIVE-MAKING. Unless you are so situated that freights are high, and unless, also, you are a mechanic, or a natural genius in "making things," you had better let hive-making alone. Hives can be bought, usually, with freight added, for a great deal less than the average bee-keeper can make them himself, if we consider spoiled lumber, sawed fingers, and the expense of buzz-saws; and, besides, hives made in the large factories, where they are turned out by the thousands, by special machinery run by skilled workmen, are much more accurately cut, as a general thing. But there is lots of fun in making things, even if they are not so well made; and there are some rainy or wintry days in the year, when, if you are a farmer, for instance, you can as well as not, and at little or no expense for time, make a few hives and other "fixin's." Again, if you live in a foreign country you may not be able to get the hives that I shall recommend.

REQUISITES OF A GOOD HIVE.

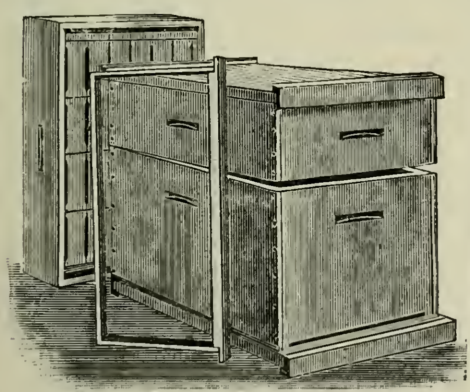
While it is very important to have good, well-made hives for the bees, I would by no means encourage the idea, that the hive is going to insure the crop of honey. I think, as Mr. Gallup used to say, that a good swarm of bees would store almost as much honey in a half-barrel or nail-keg, as in the most elaborate and expensive hive made, other things being equal. This is supposing we had a good swarm, in the height of the honey-season. If the swarm were small, it would do much better if put into a hive so small that the bees could nearly or quite fill it, thus economizing the animal heat, that they might keep up the temperature for brood-rearing, and the working of wax. Also, should the bees get their nail-keg full of honey, unless more room were given them at just the right moment, a considerable loss of honey would be the result. The thin walls of the nail-keg would hardly be the best economy for a wintering hive, nor for a summer hive either, unless it were well shaded from the direct rays of the sun.

P. H. Elwood, of Starkville, N. Y., who owns over 1300 colonies, said in *Gleanings in Bee Culture*, April 15, 1891, "A good hive must fill two requirements reasonably well to be worthy of that name. 1. It must be a good home for the bees; 2. It must in addition be so constructed as to be convenient to perform the various operations required by modern bee-keeping. The first of these requirements is filled very well by a good box or straw hive. Bees will store as much honey in these hives as in any. and in the North they will winter and spring as well in a straw hive as in any other. They do not, however, fill the second requirement; and to meet this, the movable-frame hive was invented."

SIZE OF FRAME AND HIVE.

Although there are a great many styles of hives, there are only a few really good ones for bee-keepers, and these are all of the movable-frame type. Well, then, if we are to agree on movable-frame hives, what size of hive or size of frame shall we adopt? If you are a beginner, I would by all means advise you to follow in the well-beaten track. The L. frame, 17⅝ long by 9⅛ deep, has obtained all but universal acceptance in the United States and Canada, and it may now be safely regarded as the standard. If the statement is true, that bees will produce as much honey in one style of hive as in another, it will be equally true that they will produce as much in one *size of frame* as in another; therefore when we decide upon the size, we should select, as a matter of course, the standard L. It is generally conceded that it is the best for comb honey, because it is so shallow as to bring the brood up close to the surplus; and few will deny that it is just as good for the production of extracted. It seems to be a compromise between the very shallow and very deep frames; and any beginner who adopts any thing else will be almost sure to regret it. The user of an odd-sized hive. besides being out of the beaten track, is obliged to pay anywhere from 10 to 25 per cent more for supplies, and then run the risk of having his supply-dealer make mistakes in not making the pieces the size ordered. Then, again, if he wishes to advertise and sell his bees they will have to go at a discount if at all. I believe two-thirds of those who are using any thing besides the regular L. size would be glad to change to the standard if they could without so much expense. Still further, if you should ever undertake to sell hives and supplies, you would not find a big sale for your odd-sized goods. If they are of the standard sizes, you will always find a decent market for them.

As to the size of hive, the *eight*-frame L. hive is now generally conceded to be the best working size; and it is plenty large for general purposes. The queen will seldom lay in more than eight frames in the brood-nest. If her brooding capacity extends beyond this, unless she is restrained she will go into the top story. In the *ten*-frame hive, Italians especially will fill eight frames with brood, and the two outside ones with honey; and this quantity of stores in the brood-nest is apt to make them quite loth to enter the super. If the lower eight frames are filled with brood just at the beginning of the harvest, and there are no more frames below, just as soon as the flow of nectar begins, the bees are obliged to put it where we want it—that is, in the upper story or super.

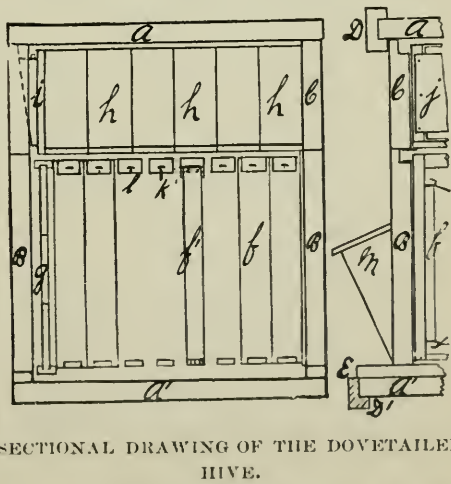


AN 8-FRAME LANGSTROTH HIVE.

Now, then, I will assume, Mr. Hivemaker, that you have decided on the regular eight-frame L. hive. The accompanying cut shows one of the most approved forms, showing the bottom-board, body (or brood-nest), super (or surplus receptacle), and cover. When the hives are made in quantity by supply-dealers, they are dovetailed at the corners. This makes an extra-strong corner. The manner of doing this will be explained further on, when we are making hives by steam power. But as you want to make only a few hives, for your own use and for your neighbors, you had better content yourself with what is called the halved corner, as shown in the accompanying engraving. While this is not nearly so strong as the dovetailed or lock-joint corner, it will answer your purpose.

HOW TO MAKE THE 8-FRAME LANGSTROTH HIVE.

Now, before I describe minutely how to make the hive I will here give briefly the sizes. The body is $9\frac{1}{2}$ in. deep; $13\frac{3}{4}$ in. wide; 20 in. long, outside measure. The super is the same width and length, with just half the depth, less the thickness of a thin saw-cut. The bottom-board and cover-board, without the cleat, are $20\frac{3}{4}$ in. long, and $13\frac{3}{4}$ in. wide. To prevent warping, the ends are let into the ends of grooved cleats $13\frac{3}{4}$ in. long, by $1\frac{3}{4}$ in. wide. As the hive is all made of $\frac{7}{8}$ lumber, the groove in the cleat is plump $\frac{7}{8}$ wide and $\frac{5}{16}$ deep. Both supers and body have the bee-space on top; that is, there is $\frac{1}{4}$ in. space between the top of the brood-frames and top of the sections and the next part of the hive above. There is practically no space under the frames; but to leave the usual $\frac{3}{8}$ space under them we nail a couple of cleats on each side of the bottom-board, as shown in the cut. This raises the brood nest up $\frac{3}{8}$ of an inch from the bottom, and also provides for an entrance, as shown. The accompanying diagram, cross and longitudinal sections, illustrates the matter a little more perfectly.



SECTIONAL DRAWING OF THE DOVETAILED HIVE.

Both supers and body have the bee-space on top; that is, there is a $\frac{1}{4}$-inch space between the top of the brood-frames and the top of the sections and the next part of the hive above.

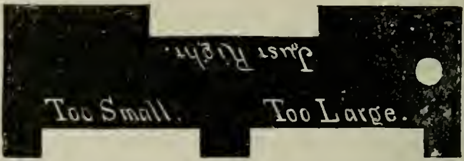
Having given you the general details pertaining to the hive, we will now proceed to the next subject; namely,

LUMBER FOR HIVES.

Get white pine. If you can not get it, you would better use whitewood. If you can not get that either, get the best lumber that they have for house-building, in your locality. For the body of the hive, you want boards just ten inches wide. For the cover and bottom-boards, which are one and the same thing, you want boards not less than 14 inches wide. You can get barn boards that will answer the purpose for about \$20 per thousand feet. As soon as you get your lumber home, have it nicely "sticked up." I say nicely, for I do not believe I ever had a boy that would put up lumber safely, unless he was told a great many times. Your lumber would better be 16 feet long, for this length works with less waste than any that is shorter. Now, before you stick it up, you are to prepare a level place for the first board; or, rather, you are to have the first board lie straight and flat. If it is to be left out of doors, it should have slant enough to carry off the water. If you have shop room, you can put it in doors. Do not lay the first board on the floor, but have some sticks under it. These sticks for sticking up lumber should be of an exact thickness, and I think it will pay to provide some that are just right. If you are making many hives, you will have refuse sticks that will come very handy for this purpose. The sticks should be about 1⅝ inches wide, exactly ⅞ thick, and 15 or 20 inches long. A stick should be placed at each end of the boards, and two more between them, so as to make the spaces about equal. Put the sticks exactly over each other, or you will, if you have a large pile, have the boards bent or warped by the weight of those above. When they are all piled up square and true, you can feel safe in regard to them.

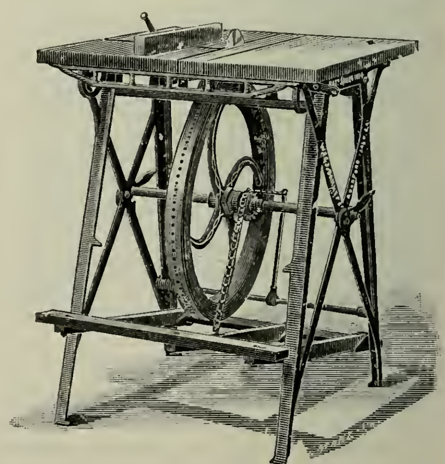
If you are going to make accurate work, you must have your lumber all of an exact thickness; and as it is much easier to talk and write about having it exactly ⅞ than it is to make it so, I will explain to you a kind of gauge that I had to give the planing-mill men, before we planed our own lumber. Below is a picture of it, full size.

When you carry them the lumber, tell them if it is planed so that the "too large" notch just fits it, it will have to be planed over again; and that, if it goes into the "too



GAUGE FOR PLANING LUMBER.

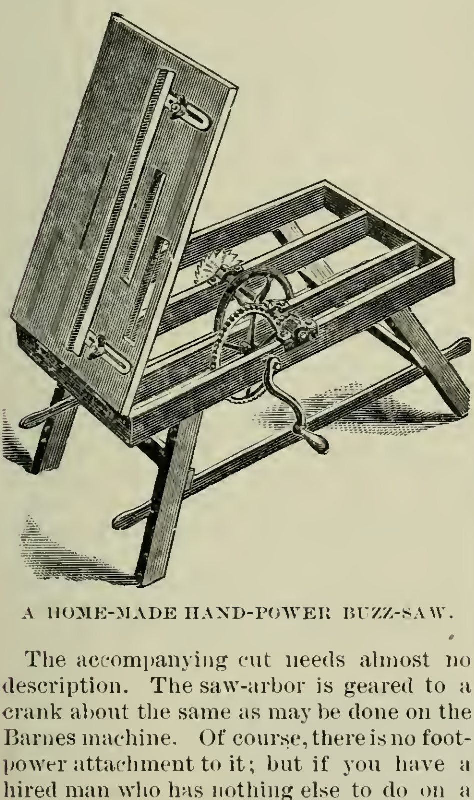
small" notch, it is spoiled. This will soon get them into the habit of having it "just right," every time. Their planers must also be so adjusted that both edges of the board are *just right*. As the 18-inch Gem planer costs only \$90, if you have much work to do it is by far the most profitable way to have a planer of your own. Then you can set it just as accurately as you choose, and it will pay for itself, where there is work to do, in a few weeks. The usual price for planing is \$1.00 per M., and you can do that amount without trouble per hour, with a 4-horse-power engine. If the lumber is not well seasoned it may be well to have it planed to the too-large gauge; but this is a very bad way of doing, on many accounts. Get your lumber seasoned as well as it possibly can be, before you commence work, and, if you are *obliged* to use that which is not well seasoned, cut your stuff to the exact length, then stick it up, and leave it until the very last moment, before you take it to the exact width you wish it. This is, perhaps, one of the surest ways, especially when the work is not all to be sent off immediately. We



NEW BARNES SAW.

frequently leave covers in this way, and only bring them to the finishing width the very day they are to be shipped. It is especially needful that the covers be well seasoned, for a season-check would let in water, and endanger the life of the colony.

A great many Barnes foot-power saws are in use; therefore I shall give my directions for them. They can be obtained of W. F. & J. Barnes, Rockford, Ill. The price without the scroll-saw is \$35.00. These, for foot-power saws, do very well for light work; but when you wish to do heavy sawing or ripping, you will have to use the crank arrangement, shown on the side; and, of course, you will then require an assistant.



A HOME-MADE HAND-POWER BUZZ-SAW.

The accompanying cut needs almost no description. The saw-arbor is geared to a crank about the same as may be done on the Barnes machine. Of course, there is no foot-power attachment to it; but if you have a hired man who has nothing else to do on a rainy day, you can set him to turning the crank while you do the ripping or cross-cutting, as the case may be. This home-made machine is very effective, and will do very good work, as we know by experience with machines of that class. Even though two men, with a couple of good sharp carpenter saws, might do nearly as much work in cutting and ripping, they could not possibly do as accurate work. With the above machine, rigged with the gauges described, a couple of boys would do the amount of work that men would, and it would be more accurate than an expensive carpenter with try-square and smooth-plane could possibly make it. I have no doubt but that the boys would cut up double the firewood they could with the ordinary hand-saw.

HOW TO SAW UP THE BOARDS FOR THE HIVES.

We will first talk about making the body of the hive. Your pile of ten-inch boards is to be cut up in lengths of 34 inches. Remember, just two inches less than a yard. To avoid making mistakes, you can cut a stick of just that length. If you have quite a pile of stuff, a gauge that you can push the boards against will be very handy. Always commence at the best end of the boards. If the end is checked or bad, allow a little for waste. Cut off 5 lengths, and leave the surplus of half a foot or more on the last piece; that is, do not cut it off. Pile these last pieces by themselves. You will need an assistant to do this; and if you have a boy ten or fifteen years old, he can help "papa" a "big lot," in making hives.

As we desire to make the machine rip boards $9\frac{5}{8}$, as described below, we will set the gauge to the proper place. After your boards are all cut up, you will proceed to bring them to an *exact* width and straighten one side. As we want the boards to finish $9\frac{1}{2}$, we will trim them, the first time, to about $9\frac{5}{8}$; those that will not hold out this width, can be saved to make frames of. To bring one side straight, you must set the parallel bar at the left of the saw, at just the right distance from it, and then push the boards through, holding closely up to the gauge. Very likely when you start, your saw may "run," as it is termed; this may result from either of two causes. If the teeth are filed longer on one side than on the other, and insufficiently set, the saw will be very likely to run either into or out of the lumber. This will not do at all, for we can never have an accurate hive unless we get a straight edge, in the first place, to work from. Give the saw set enough to make it run clear, as explained at the close of this subject, HIVE-MAKING, and have the teeth so that the cut ahead of the saw shows as in the diagram below.

IMPROPERLY FILED. PROPERLY FILED.

A second cause of trouble may sometimes be found in your parallel bar, which must be just parallel, or you can not have a true straight cut. The diagram will show you the consequences of having this bar improperly set.

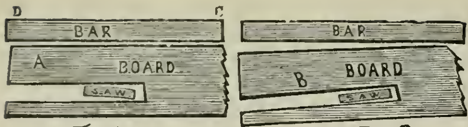


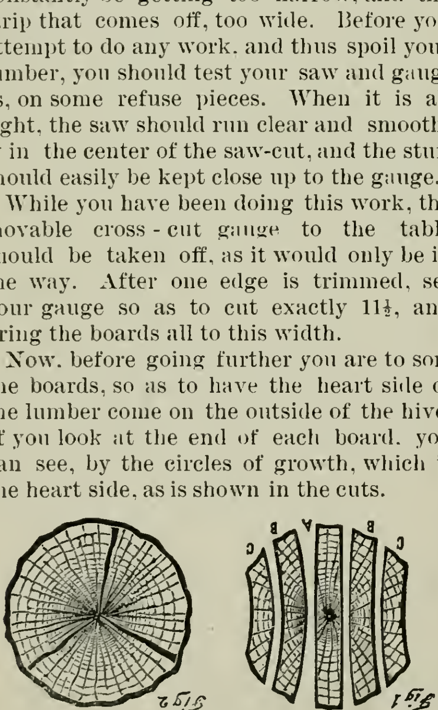
Fig 1 *Fig 2*

SETTING THE PARALLEL BAR.

In fig. 1, the bar is set so that the board between the saw and the gauge wedges, as it were; and, when this is the trouble, you will see the surface, at A, shows as if it had been planed; this is done by the face of the saw, which rubs or burnishes the wood, as it squeezes past. The remedy is plain; move the end, D, away from the saw a little, or the other end nearer to it, as may be necessary to preserve the proper distance. In fig. 2 we see the opposite extreme; and when this is the trouble, you will find it almost impossible to keep your board up against the gauge, for the saw is all the time crowding it off. The piece B will constantly be getting too narrow, and the strip that comes off, too wide. Before you attempt to do any work, and thus spoil your lumber, you should test your saw and gauges, on some refuse pieces. When it is all right, the saw should run clear and smoothly in the center of the saw-cut, and the stuff should easily be kept close up to the gauge.

While you have been doing this work, the movable cross-cut gauge to the table should be taken off, as it would only be in the way. After one edge is trimmed, set your gauge so as to cut exactly 11½, and bring the boards all to this width.

Now, before going further you are to sort the boards, so as to have the heart side of the lumber come on the outside of the hive. If you look at the end of each board, you can see, by the circles of growth, which is the heart side, as is shown in the cuts.



WHY BOARDS WARP.

At B, you see a board cut off just at one side of the heart of the tree; at C, near the bark; at A, the heart is in the center of the board. You all know, almost without being told, that boards always warp like C; that is, the heart side becomes convex. The reason is connected with the shrinkage of boards in seasoning. When a log lies until it is perfectly seasoned, it often checks, as in fig. 2. You will observe that the wood shortens in the direction of the circles, and but very little, if any, along the lines that run from the bark to the center. To allow this shrinkage in one direction, the log splits or checks in the direction shown. Now, to go back to our boards, you will see that B shrinks more than A, because A has the heart of the tree in its center; that C will shrink, in seasoning, much more on the bark side than on the heart side; that this can not fail to bring the board out of a level; and that the heart side will always be convex. You have all seen bee-hives, probably, with the corners separated and gaping open, while the middle of the boards was tight up in place. The reason was, that the mechanic had put the boards on wrong side out.* If the heart side had been outward, the corners of the hive would have curled inwardly, and, if the middle had been nailed securely, the whole hive would have been likely to have close, tight joints, even if exposed to sun, wind, and rain. This matter is especially important in making covers to hives. If your boards are all sorted with the heart side downward, we are ready to proceed. I say heart side downward, for you want them placed just as they are to be used on the saw. I have seen boys that would turn every board over, just as they picked it up to put on the saw table, instead of piling the whole just as they were to be used. I have seen others that would carry each one of several hundred boards 6 or 8 ft. to the saw, when the whole pile might have been put almost within one foot of the place where it was to be used. It is very awkward and extravagant to do work in this way.

We have thus far been using the rip-saw in edging up stuff. Our next business is to cut boards across the grain, and we therefore change our rip saw to a cross-cut.

I think we would better "oil up" at about this stage of proceeding. I do not know why it is, but I scarcely ever take hold of a foot-power saw when it would not be greatly improved by giving it a thorough oiling. It is really a saving of time, as well as of strength, to oil your machinery often. Much time is also saved, in changing saws, by having your saws and wrench close at hand. A ten-cent monkey-wrench is sold which is just right for Barnes saw-mandrel,

* If the hives have the dovetailed, or, as it is sometimes called, the lock-joint corner, this gaping is impossible.

and we used to keep one tied, by a stout cord, to the frame of the machine, that it might be always in readiness. To be obliged to stop your work, and hunt for tools when you are in a hurry, is "awful." You would better fix some kind of a drawer in your saw-table, to keep your saws, or they may get down among the rubbish, and be lost. I *have* known people to lose their cut-off saw, and be obliged to stop and hunt for it; and I should not be surprised, if they scolded somebody who was not to blame at all. I have spoken of having one of the children help by handing you the boards, etc.; if they do, be sure that you make the work pleasant for them. If you lose your tools and scold, you certainly will not make good hives.

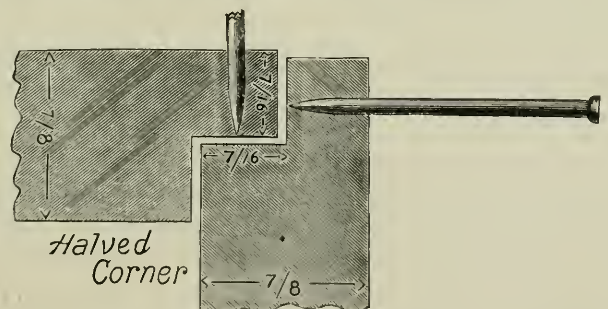
You probably have not made any mistakes, thus far; but now, before you commence cutting off the pieces to the exact size, be careful.

To provide against mistakes I would have a gauge like that shown in the accompanying cut; and it is the same thing that is used

GAUGE FOR FRAME-MAKING.

further on in frame-making, where it will be described a little more minutely. One of the brass stops should be set at such a point that it just measures the length of one of the sides of the hives, so that, when the board has been cut off on your foot-power buzz-saw, it will just slip between the two points. On the reverse side of the gauge, the brass stop should be so set that it will just take in one of the end-pieces of the hive. I think it will be well to have two sets of gauges—one for frame-making and one for hive-making; because experience has shown that it is not wise to depend too much on measuring with rules and squares, for the eye can not measure exactly when the stuff is the right length, according to the graduations on the square. Such measured stuff may vary all the way from plump to scant measure, and this is something that we can not tolerate in making hives. If you attempt to measure with a square, you will get it wrong side up or something, and get your gauges set wrong. It was not long since that one of the men cut up a whole pile of boards to the wrong length, because he looked on the wrong side of the square. For fear he would do something of the kind, he was given a board just right, for a sample; but some one else wanted it, and so he took the dimensions, and it turned out as I have said.

As I have already stated, our hives are just 20 in. long by $13\frac{7}{8}$ in., outside measure. Now, the length of the side and end pieces will depend upon what method you adopt for nailing the hives together at the corners. If you "halve" the corners, either the ends or the sides should be $\frac{7}{8}$ shorter than the outside width or the length of the hive, as the case may be. If you miter the corners, cut both sides and ends to the exact length of the side and end of the hive. If you use what is called the box-lap corner—that is, one straight piece nailed on to the end of another, either the side or end pieces should be $1\frac{3}{4}$ inches shorter than the length or width of the hive, as the case may be. But the box-lap joint does not permit of cross-nailing; and if you propose using the miter corners, you will have to have iron gauge-frames, or something to hold the pieces up together while nailing; otherwise it will be very difficult to nail the hive together; and I would therefore advise you to use what is called the halved corner. What is meant by this, is illustrated in the accompanying

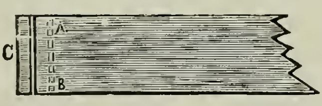


cross-section. Out of both sides and ends, a rabbet, $\frac{7}{16}$ deep and $\frac{7}{16}$ wide, is cut. As either the sides or ends will have to be cut $\frac{7}{8}$ inch shorter than the length or width of the hive, I would recommend that it be taken out of the end-pieces. The sides, therefore, when cut up into lengths, should be exactly 20 in. long, and the ends will be $13\frac{7}{8}$

wide, less $\frac{7}{8}$ in. for the halving of the corners; viz., 13 in. exactly. Therefore, if you propose to adopt the halved corner (and I would advise it in preference to the other two mentioned), set your brass stops on the gauge already spoken of, so that one side will measure exactly 20 in., and the other side exactly 13. Now, if you cut out the rabbet $\frac{7}{16}$ deep and wide, out of each end of the side and end pieces, your hive, when nailed together, will have the required dimensions—13$\frac{7}{8}$x20 inches.

Now, then, before you begin cutting off any considerable number of pieces, you want to look sharp to your gauges, and determine whether your buzz-saw runs true. When you get nicely to going, try your gauge occasionally to see whether your stuff does not vary.

The sliding cross-cut device has a bar bolted to *its* top, for a square cut-off gauge; this gauge was, in all probability, set accurately when it left the factory. It should be so set, that, when you cut off a board held closely against it, it will be exactly square across the end. You can test this with a good square, but I think I should prefer to take a board with true straight sides; cut off a little, say a half-inch; now turn it over, and cut off again; if the strip cut off is of exactly the same width at each end, your gauge is set true. For fear you may not get the idea, I give you a picture.



HOW TO SET THE CROSS-CUT BAR.

If your gauge is set right, the slices, C, will be exactly straight; i. e., not wedge-shaped, even if you turn the board over so as to cut from the opposite edge at every cut you make. When you are satisfied with this, set your parallel bar so as to cut the side-pieces of the hive to just go into the iron frame lengthwise, and the end-pieces to just go in crosswise. The 34-inch boards will just make one of each, after squaring up.

Now, take one of these boards, 34 inches long, and cut off enough to square the board up. Set your gauge on the table so that it will be just 13 inches from the saw. Slide the board along, and saw it off. Take your steel gauge, and see whether the board is exactly 13 inches. If so, you can go ahead and cut in two your other boards, until you have cut up the whole lot; but remember to "edge up" the end of every board before cutting. You now have one pile just exactly 13 inches long, and all squared up. You also have another pile of boards that are something over 20 inches, one end of which has been edged up—that is, been made square with the cross-cut saw. Set your gauge again so as to cut the board exactly 20 inches long; and be sure to cut off that end of the board that has not yet been edged up. This done, your sides and ends are all done except the halving of the ends.

While you are cutting up the boards you will find that you will occasionally run into knots. It is desirable to avoid these as far as possible; and this you can do by reversing the end of the board; and this will make the knot come in the center of one of the side-pieces. We want to so manage as not to be obliged to work the knots.

You may remember, when you were cutting up your boards in lengths of 34 inches, you had some shorter pieces left. Some of these will make two ends, and some one side only. These you are to work up as you can to the best advantage; at any rate, manage so the ends and sides will be of equal height when piled up on the floor.

HOW TO HALVE OUT THE BOARDS.

On the under side of the Barnes saw-table you will find a lever by which you can raise or lower the table. Raise the table up until the saw will cut just $\frac{7}{16}$ deep. Next set your ripping-gauge so that it will be just $\frac{7}{16}$ from the saw. Take one of your boards and pass the end of it over the saw. The edge of the cut should be now just $\frac{7}{16}$ in. from the end of the board, and just exactly $\frac{7}{16}$ deep. Be sure you make no mistake here. Then go ahead and make saw-cuts on each end of the side and end boards. You now want to take off your cross-cut and put on your rip-saw. Leave the ripping-gauge on, as it will be just right, probably. Now turn the board on end and pass it over the top of the saw so as to meet the other saw-cut. If you have made no mistakes, and have done every thing right, you will have a rabbet cut just $\frac{7}{16}$ deep and $\frac{7}{16}$ wide across the grain. To make sure you are right, measure. As a further precaution, rabbet out a pair of sides and a pair of ends; and now put them together to see whether your hive measures, outside dimensions, 20 x 13$\frac{7}{8}$. If so, you are safe in going ahead in cutting out the rabbets.

CUTTING OUT THE FRAME-RABBETS.

The operation of cutting out the frame-rabbets is very similar. But in this case, instead of being *across* the grain, it is *with* the grain; so, therefore you want to leave on your rip saw. Screw up your table until the saw cuts ⅜ deep. Bear in mind that only the *end-pieces* are to be rabbeted out on the upper inside edge. This rabbet is to be $\frac{5}{16}$ wide by ⅝ deep, exactly. Set your ripping-gauge ⅝ inch from the saw, and pass your boards over the saw. You should now have a saw-cut $\frac{5}{16}$ deep and ⅝ from the top edge of the end-board. Having made sure of this, cut out saw-cuts in all the end-pieces on one side only. You next let down the table so your saw projects ⅝, and you are to move the ripping-gauge up to within $\frac{5}{16}$ inch of the saw. Now pass one of the end-pieces perpendicular over the saw in such a way as to make this saw-cut hit the other one. Measure again, to see that this rabbet is $\frac{5}{16}$ wide by ⅝ deep, and then go ahead and rabbet out all your end-boards. See sectional drawing. The reason why we make the rabbet ⅝ deep is because the ends of the top-bars of the frames are ⅜ thick, and we want to leave exactly ¼ inch bee-space on top of the frame; therefore the hive-rabbet should be ⅝ deep. As our hive is just 9½ inches deep, and the frames are 9⅛ deep, and the rabbet ⅝ deep, and the top-bars ⅜ thick, this will leave just exactly ⅛ inch under the frames. This is convenient, so that, when you set the hive on a flat surface, full of frames, the frames do not quite hit the surface so as to push them up. Our next step is

CUTTING OUT HAND-HOLES.

The body of our hive is nearly all done, except the handles, or, rather, hand - holes, that you lift them by; these are made with a wabbling saw. Sometimes our saws have a fashion of "wabbling," just when we would rather they wouldn't, and it would seem to be quite an easy matter to make one wabble: so it is. The way in which we make saw wabble, ordinarily, is by a pair of wooden washers like this cut. The saw should be securely clamped between the two wooden washers; that is, clamped so it can not really slip round, or out of true. I mean by out of true, so that the teeth are just as long on one side as on the other. Unless you have it so, the cavity will be deeper at one side than at the other. You will also need both the parallel and cross - cut gauge for this business, and they are to be so set that, when the boards of the hive are carefully and slowly dropped down on the saw, one end at a time, a nice cavity for the fingers will be cut. To smooth out the bottom of the cut, you have only to move your board slightly sidewise just before you lift it off the saw. This trims off the strings, as it were, left between the saw-teeth. I would have these handles made in the sides, as well as the ends, for it is often convenient to lift a hive, when the ends, one or both, are not convenient to get at; for you must remember that our hives can be placed tight up against each other, as there is nothing in the way of so doing. Of course, hand-holes should be cut in the supers or half-depth bodies. They are not heavy, like full bodies, it is true, but we need something to lift them by. I omitted to say, that the depth of the hand-holes should be ¾ inch deep, and ⅞ wide. If you make them narrower and shallower, it will not be as easy to lift the hives, for sometimes a body may weigh a hundred pounds, and you need all the grip you can have. Some prefer cleats nailed all around the hives. While they are a little handier to get hold of, they are in the way, and add to the expense, as well as interfere in closely packing the hives together for moving.

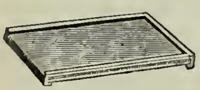
HOW TO MAKE THE COVERS.

If you have followed carefully the directions already given, and consulted the sectional drawings, you will know, almost at a glance, how to make the cover. Most bee-keepers prefer a flat board, and a whole board at that. If you use narrow boards tongued and grooved together they will be almost sure to leak, sooner or later, from shrinkage; therefore, for covers and bottoms we want to get them out so that they are 13⅞ wide, and 20⅞ long. You are to proceed the same as you did with the sides and ends; viz., cut boards 42½ long, edge them up, and then cut them in two. To prevent the covers from warping we let the ends into grooved cleats. These cleats are 1⅝ wide, 13⅞ long, and ⅞ inch thick. A longitudinal groove $\frac{5}{16}$ deep, and plump ⅞ wide, is to be cut into one side of the cleat with the wabble-saw, already described. As the hand-holes are ⅞ inch wide, your wabble will be just right. To make this groove exactly in the center, set your ripping-gauge ⅜ in. from the wabble, and then pass your cleats over this. But be very careful that you do not let the cleats slip out of your fingers, or, worse still, let your hand fall on to the wabble. If you do, you will maim it fearfully.

In cutting small pieces where we work near the saw, we always use what we call "push-sticks." These are simply curved sticks about 8 or 10 inches long, one end of which is shaped something like the handle of a pistol, and the other end is notched in such a way as to make a shoulder crowding against the stuff that goes against the saw. If the work slips from the saw, or any thing happens, all the harm done is, that the push-stick has been "chawed" into by the saw, and not your hand. And I might remark here in passing, that it is always better to use the push-stick where you can. Of course, where you are sawing up boards, and your hand is four or five inches away from the saw, the push-stick is unnecessary.

When your cover boards are cut out, and the cleats are made, the cover is complete with the exception that they are to be driven on to the ends. We want only sound boards for covers. Boards having dead knots in them, or those that are in any way checked or knotty, will answer just as well for bottom-boards; so all you have to do is to cut up the lumber into boards and covers, and afterward assort them out according to quality. If you buy the right kind of lumber you will be able to manage it so there will be about an equal number of bottom and cover boards.

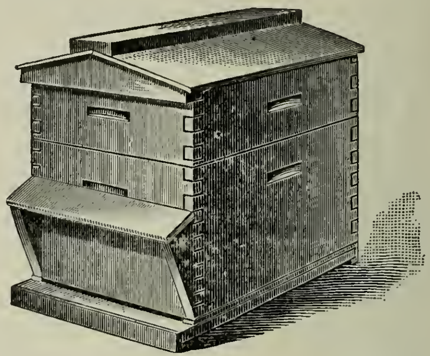
The bottom differs from the cover, in that it uses only one of the grooved cleats. This is nailed on to the rear end. The following engraving shows one.



Now, we can not use the same cleat on the other end, because that would close up the entrance, or, at least, interfere with the bees passing in and out. So the front cleat is simply a piece of wood 13¾ in. long, ⅞ thick, and 1¼ wide. On the wide side the rabbet is taken out 5/16 deep and ⅞ wide. This is nailed on to the front end of the board, as shown, to keep that end from warping. Now, as I have said, the bee-space is put on top of the frames. You must therefore make some provision for raising the hive up a bee-space, or, better, a little more, above the bottom-board. We therefore cut strips of wood from the refuse lumber or edgings, ⅞ wide, ⅜ thick, and 19¼ long. These are nailed on the two sides, as shown in the accompanying cut. We now have a bottom-board with raised edges on three sides—the fourth, or front side, being open. When a hive-body is set on top of this it is raised ⅜ in. from the bottom-board, and thus provision is made for the entrance without any slotting-out of the front hive-board.

SUPERS—HOW TO MAKE.

We have so far constructed the body of the hive, bottom-board, and cover. If we wish to produce comb honey, we shall need half-depth bodies, or supers. These are made from sides or ends of a full-depth body ripped in two longitudinally through the middle, with a thin saw, and they are therefore just half the depth of a full body, less the thickness of a saw-cut. As it is sometimes desirable to use two supers together for one body, we rabbet out both ends the same as we do in full-depth bodies for frames to hang in.



EIGHT-FRAME HIVE, WITH GABLE COVER AND PORTICO FRONT.

There are a good many who do not like a flat cover and plain hive; and to suit your trade you may be obliged to make some slight modification. The cut below shows a form of an eight-frame hive with a gable cover and portico. This cover is made after one illustrated and described in Quinby's "Mysteries of Bee-keeping," edition of 1866; and I do not know of any thing better for any one who wants such a cover. The ridge board is made just the same as that shown under CHAFF HIVES, further on. It is 21¼ in. long, and 4 wide. The other two boards forming the cover are ⅜ thick, and 7½ wide by 21¼ long. The gable ends are 14 in. long, ⅞ thick, and 2⅝ inches wide at the widest part, and ⅝ inch wide at the two ends. To put together, the two ends are laid together upon the bench, and the two ⅜ boards are nailed as shown in the cut. The ridge-board is then laid flat on the bench, and the cover is reversed and set down in the V, and nailed from the *inside*. There are no side pieces to the cover, but they can be put on if thought necessary; but, for reasons which encroach too much upon our space, they are better left off. To keep the boards from warping, the outside edges of the gable should be nailed with wire nails, and clinched or screwed down; else, when somebody sits down upon the cover he will be liable to pry the covers off from the gable-end pieces.

Under such a cover there should be used either enamel cloth, quilting, or something to prevent the bees from building comb in the empty spaces. We prefer a plain board, $\frac{3}{16}$ in., tin lined on the ends, to prevent warping. This, in my opinion, is better than quilts or enamel sheets. This thin board will rest on the top edges of the hive, and yet leave the regulation ¼-inch space above the frame.

Now, very few people prefer what is called a portico, and I can not but regard it as a nuisance. It is a harbor for spiders and cobwebs, and an excellent loafing-place for bees to cluster on during the summer days when they ought to be at work in the fields, or when they should be building comb. Still, there are those who will have it. To accommodate those, and go to as little expense as possible, take a couple of the three-cornered entrance-blocks described under ENTRANCES. These we nail (the longest side) on the hive. On top of these is then nailed a sort of water-table, $\frac{3}{16}$ thick, 13¾ long, and 3½ wide. The whole portico is simply and cheaply made; and if you get disgusted with them, as I feel sure you will, you can at any time yank them off. It may be said, however, that they add a little to the architectural appearance of the hive; but with most of us it is not ornament but the bread-and-butter side of a hive we are after.

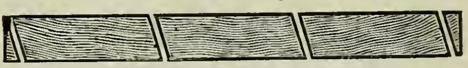
BEVELED OR SQUARE EDGES FOR HIVES.

You will observe, that thus far the directions imply hives with square edges. In a former edition of this work I recommended what was called the Simplicity hive. This had what is called beveled edges—that is, the opposing surfaces of the hive that came in contact were beveled at an angle of 45,° so as to shed water; but as bees will propolize the two sections of a hive together, it is often difficult to separate them by reason of the propolis. For that reason there seems to be a universal agreement among all practical bee-keepers, that the edges of the hive should be square, so that; when they are gummed together, as the bees will surely do, they can be readily pried apart with a screwdriver, or with the blade of a large knife. Aside from this, it is easier to make the square edges. It requires less mechanical skill to make all parts come together true. Theoretically, the water would seep into these cracks and rot the edges of the hives. But such has not been found to be the case in practice. Besides that, the bees gum the cracks together so that neither water nor cold air can enter. Therefore these plain square edges are just as warm as those that have the telescope principle. Another thing, by sliding the cover or edges of the body above, the bees can, to a very great extent, be brushed off, and so prevent maiming and killing bees. Any form of telescope cover is quite liable to smash a lot of bees unless a smoker and brush are used pretty vigorously to brush off each bee; and it is not many apiarists who will take all this precaution. They will claim that their time is more valuable than the few bees killed each day.

HOW TO MAKE THE CHAFF HIVE.

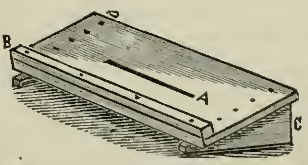
This hive is all, except the corner posts, made of cull lumber, which can be bought at any lumber-yard; we get it for $10 per M. Get it long enough beforehand to have it piled up and seasoned, if you possibly can; if you can not, you must manage to have the stuff piled up so as to season after it is got out; it will season very quickly in these thin narrow strips, and so we often cut it up, unseasoned, when we are behind on orders. Fix your table, as before directed, and cut your whole pile of boards, before being planed, into pieces two feet long. If you do not cut them all so exact, it will not matter a great deal for this hive, as you will presently see.

After your boards are all cut up, put on your rip-saw, and split them up three inches wide; but instead of cutting them square, cut them on about the angle shown below.



HOW TO CUT THE STUFF FOR SIDING.

If you find any bad knots or shakes, do not split them, but pile them up nicely at one side, to be used as rough bottom-boards. This ripping can be done either on the foot-power saw or with the hand-ripper; we used the latter, and I think it does the work more rapidly. To cut the pieces on the bevel, you are to screw a bevel-shaped piece on the saw-table.



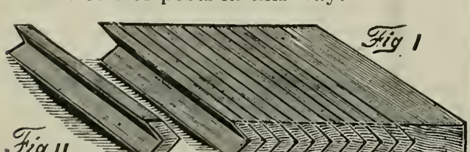
PLATFORM FOR GIVING THE SIDING THE PROPER BEVEL.

Two wedge-shaped pieces, of which only one is shown at C, are used to give the board the proper inclination; the other one is supposed to be where you see the nail-holes, at D. A is where the saw comes up through, and B is a square bar that the edge of the rough lumber is rested against. It is fastened to the table by screws put through the table-top from the under side into these pieces C. With the hand-ripper, we screw the two pieces fast to the two light wooden bars that constitute the only wood about the machine.

A B C

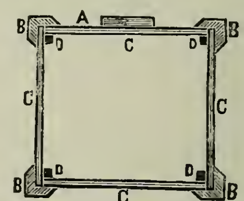
The first piece that comes off will be like A: turn it over, and run it through again, and it will be like B; the next operation is to split each piece, like C. This you will have to do with the hand ripper, for the foot-power saw would not reach through so far. If you do not split the pieces exactly in the middle it does not matter, and a very thick one occasionally will be all the better, to give the hive strength without any extra expense. You can plane this siding by hand very cheaply, or it may be done on the cigar-box planer; if on the latter, you will be obliged to reduce them to a uniform thickness unless you choose to save out the thickest pieces, and plane them afterward with the planer a little higher. Plane only the one side just left by the saw. If you are not going to use this siding at once, pile it up crosswise, as coopers do their staves, until it is thoroughly seasoned and straight.

Our chaff hive is built by nailing these pieces of siding to corner-posts, with planed side outward, of course. As nails have a fashion of drawing out when exposed to the sun (some carpenters say the sun pulls them out), we will drive them all from the inside, and then if "Old Sol" tries to pull them out by the feet he will have a tough job, and will only draw the heads up tighter. The corner-posts that we use are made of solid wood, and are cut from 3-inch plank. The plank should be so clear from knots and shakes that there will be no danger of the pieces breaking while nailing into them. Cut your plank, which should be as wide as you can get it, into pieces 22 inches long. Now with the beveling platform that I showed you in hive-making, you are to cut out the corner-posts in this way:



HOW TO MAKE THE CORNER-POSTS.

You will observe that the saw goes in at each side until the cuts meet, so as to take out pieces like Fig. II. After you get them all out, you are ready to nail up the outside of the hive. Lay two of your corner-posts, as shown above, on your work-bench, and have them 2 feet and 2½ inches apart. To get these dimensions without measuring, I would nail a couple of strips to the bench just the right distance apart; also a third across the end, that we may always have the hive square and true. The chaff hive is not quite square; it is ⅞ inch narrower on the entrance-side and the back; therefore when you are nailing the back and front, you are to slip a strip of wood ⅞ inch wide between one of your posts and your stop. Our siding, you remember, is just 2 feet long; well, the pieces on both front and back go clear up into the corners of the corner-posts, and not the sides as shown in the cut. This will prevent the side strips from coming clear up by ½ inch, as shown below.



EXTERNAL SHELL, AND CORNER-POSTS OF CHAFF HIVE.

A is the entrance; B, B, B, B, the corner-posts, and C, C, C, C, the siding. Now, after we have got the siding nailed securely, with the beveled edges so arranged as to keep the rain out of the chaff, we will nail in each corner an inch strip, shown at D, D, D, D; these are put in with heavier nails, and lock the whole structure most securely.

As there is no need of uncovering the chaff part when we uncover the hive, we make the cover so as to extend over the interior only, and have a permanent cover over the space containing the chaff. This permanent cover is our next piece of work. Get out some long strips, just as you did the siding, only have them ⅜ inch wider, preserving just the same bevels on each side. Plane it on both sides down to ⅞, and then cut out a part as shown in the diagram.

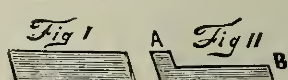
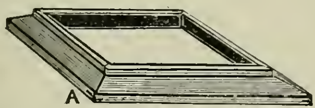


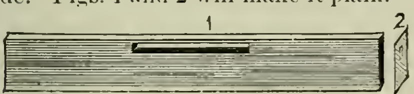
Fig. I. shows the piece before taking out the strip, and Fig. II. after it is done. You are to cut in ¼ inch at A on the same bevel as the sides, and then 2⅞ at B to meet the other cut. Now turn your cross-cut bar at an angle, just as if you were going to make a picture-frame, and make a picture-frame in reality, of the stuff shown at Fig. II. The inside dimensions of the frame must be just 19¼ by 20¼; you must be very exact about the 19¼, for the frames will not have the right play, otherwise; but that you may get the proper idea, I will give you a diagram of this frame.



RIM THAT HOLDS THE COVER.

To make the joint water-tight at the miters, a saw-cut is made in each end of each piece as shown at A; and after the frame is nailed at the corners, a strip of tin is pushed in. The outside of this frame will probably be a trifle large.

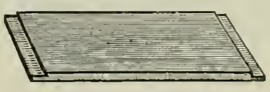
This rim, when nailed true and square, is to be fitted to the tops of the corner-posts; the posts can be given the proper bevel, with the circular saw, before the siding is nailed on. This bevel is the same as that of the siding. The top-pieces of siding are to be of pretty good thickness, that we may nail this rim securely to it, as well as to the posts. It may be well to state here, that the top-pieces of siding are nailed on first; 7 pieces, of the dimensions we have given, form the hive. Before nailing in the last piece, you are to mortise the entrance near the upper side. This entrance is to be 14½ in long by ⅜ wide. Figs. 1 and 2 will make it plain.



Having now completed the outer shell, we will see about the

INSIDE OF CHAFF HIVE.

This, as well as the outside, is all made of cheap cull lumber. I would by all means advise getting out your boards a little wide, and sticking them up until thoroughly seasoned, as I have mentioned before. Cut your stuff in two in the middle, so that you can handle it readily, and then, with the hand-ripper, rip the boards ¼ inch wider than you need, and cut them up to the exact length. When this is done, and your boards are all piled up square and true as before, you are ready to split them through the middle. It is not necessary that the boards be planed on more than one side, for the back side of all of them is next the chaff; and as the rough surface would tend to impede the circulation of currents of air, I do not know but that I would rather have them unplaned. Neither is it important to have the boards split exactly in the middle; in fact, one end I had in view, while inventing this chaff hive, was to avoid the necessity of having to be so exact as we must be with hives where both inside and outside are exposed to view. You see as we go along, that, while the inside dimensions of the hive are to "a dot," the boards constituting it may be of all sorts of thicknesses, and lengths too, or at least a part of them, for nearly all the joints are lap joints. As before remarked, it is very important that the back and front of the hive be at the right distance apart, and this proper distance is 18½ inches; to insure this every time, we make the side-boards with shoulders as shown below, ½ by ½.



ONE OF THE SIDES OF THE INSIDE OF THE CHAFF HIVE.

It will be observed, that four of these boards are used—two above and two below, 18½ inches from shoulder to shoulder.

The width of these boards, when finished, is to be just 9⅝ inches by about 19¼ long. We will cut the shoulders on the planed sides, of course, because they come inside of the hive. The ends are of unequal length, for the upper story contains a greater number of frames than the lower. The bottom ones are 14½ in. long, and the upper ones 20½ in.; both are 9 in. wide. In the Simplicity hive we were obliged to cut a rabbet into the upper edge of the end-boards; but with these, we simply nail the tin rabbet directly on their upper edges. The rim before mentioned forms the back to those in the upper story, and a strip, nailed on to connect the two stories, forms the back to those in the lower story. This inside work is all made of ½ or ⅜ inch stuff. The bottom of the lower story is also made of this same thin stuff; and in nailing it on it does not matter if the boards lap over and project at both the sides and ends too. The diagram given, a transverse sectional view of the chaff hive, will, I think, make it all plain.

Both the outside and inside are nailed up separately, and then they are put in place, and nailed together, the only points of attachment being the rim which rests on the top edge of the upper story, and the bottom of the lower story, which rests on a couple of strips that are attached to the siding on either side, and to which the bottom is nailed. Let A A represent the siding; B B B B the chaff, and C C C C the light boards that

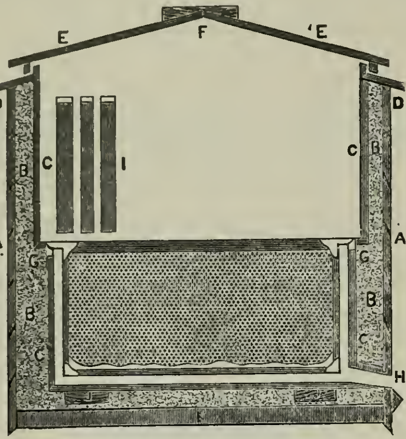


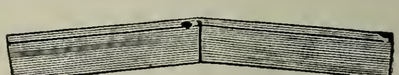
DIAGRAM SHOWING SECTIONAL VIEW OF CHAFF HIVE.

constitute the inner hive. D D is the rim that holds the cover, and E E the cover itself. F is the ridge-board that holds the siding of which the cover is made. G G are strips about 1¼ inches square, that support the upper story, and attach it securely to the lower one. The shelf, or ledge, formed by making the upper story broader than the lower one, is exactly on a level with the top-bar of the lower frames, and therefore the upper tier of frames must hang just ⅜ of an inch from these, to prevent, as much as possible, the building of combs between the two. H is the entrance, which is simply a covered passageway from the inside hive, through the chaff, to the outside.* A frame is shown in place in the lower story, and the ends of three of them in the upper story, hanging at right angles to those below. J J are two heavy pieces of rough unplaned stuff, that support the bottom of the inside hive. Just below these is the rough bottom of the hive, which is made of the knotty and shaky pieces that were rejected when we were getting out the siding. To keep out the dampness of the ground as much as possible, as well as to discourage mice from any attempt to get into the siding, we put a sheet of tarred building-paper just under J J, and between them and the rough bottom-boards.

* 1884.—The bottom-board piece that comes opposite the entrance is cut 9 inches wide and ⅜ thick; and from the outside of the inside shell to the inside of the outside shell it is beveled ¼ inch, leaving the end ⅛ thick, under which a cleat is nailed, to prevent checking, etc. The entrance as so made is shown at H, only the artist has left out the cleat. This prevents all possibility of severe storms beating into the hive.

These rough bottom-boards are the last thing put on; when the body of the hive is all finished, it is turned bottom upward and the chaff filling put in. The chaff may be either wheat or oats; it has been suggested that wheat would be less liable to get damp and settle down so as to be soggy and moldy, and our experience seems to indicate that this is so. The wheat chaff is probably the warmer of the two, because it is softer and more downy, like feathers. The chaff should be packed sufficiently to prevent it from ever settling so as to leave the upper portions of the hive vacant. When the chaff is all nicely filled into the sides, you are to put as much over the bottom as possible and have the tarred paper and rough bottom-boards go in, and then the whole is to be securely nailed, both down into the strips, J, and through from the siding, into the ends of these bottom-boards. Now we are ready for the cover.

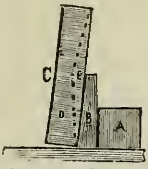
To contrive a light, cheap cover that would be absolutely water-proof, that would allow of being readily lifted with one hand, and still afford a flat place on the top for setting a case of section boxes, or any other article used in the apiary, caused me more hard study and experiment than all the rest of the hive put together. There are a great many different pieces to the chaff hive, it is true; but these pieces are all made of cheap lumber, and one kind of pieces is made to answer a great variety of different purposes. For instance, the roof-boards of the cover are all sorted out of the same siding that is used for the body of the hive. Before piling this siding away, you are to select all of the poorest and knottiest pieces for these covers. For the sake of lightness we will plane these down to ⅜, or a little less. Where we get hold of very thick stuff among our pile of culls we can often make 3 roof-boards of a piece, thus saving lumber, and time in dressing it down. Now these boards or strips are to be bent in the middle, to get the slope to the roof; and to do this we will make a broad saw-cut nearly through each of them, as shown below.



ROOF-BOARD TO CHAFF HIVE.

Make the cut so nearly through, that the board will bend along the line, without trouble. To keep them bent just right, and to make a solid ridge-board with the flat place on top, we will get out a piece of ⅞ stuff, 23½ inches long, and 5 inches wide.

Fix a beveled piece against the parallel bar on your saw-table, so that you can cut out this board thus:

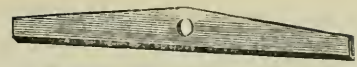


Let A represent the parallel bar; B, the beveled piece screwed to it; C, the ridge-board we are making, and D the dotted lines where we wish to have the saw-cut. After going through on one side, the board is to be turned over, so that the piece E is taken entirely out at the second cut.

To make these cheap roof-boards waterproof, we will cover them with tin. Get 12 x 24 roofing tin, which will cost, at present prices, about $7.00 per box. Two sheets are required for a cover. Notch out two of the corners to each sheet, ⅜ x ⅜; fold three sides of the sheet at right angles, ⅜ of an inch, and it is then just right to put on the covers, if the covers are as they should be. The tin is nailed fast only in the edges of the eaves and along the gable-ends, no nails being on the top side of the cover. In our picture of the cover, the ridge-board is represented in place, but it is not to be put on until after the sheets of tin. It is put on the last thing, and held by nails from the inside, none of them being allowed to come up through. This tin cover is to be painted like the rest of the hive, and, so long as it is kept painted, the tin will last unimpaired.

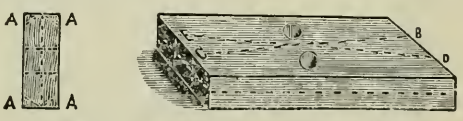
As the rim that holds the cover is on a bevel, we wish the strip that goes under the eaves, as well as the gable-end piece with the ventilating-hole in it, to be beveled at their lower edges also; the former we make of thick pieces of siding, by splitting them in two on the proper bevel. As these are to hold the nails along the eaves, they should be at least ⅜ thick. For the gable-ends, we adopt a little different line of management, and, as the principle is a very important one, I will take a little space to explain it.

Much time is occupied in handling all these little bits of lumber; and to employ a strong man to handle little bits of pine, and turn them end for end, when he could, without fatigue, handle a dozen or a hundred just as well, is something that should be avoided as much as possible. The same idea is brought out very strongly in making section boxes; but to make irregular forms is a little more difficult. Even if we can accomplish no more than to have two of the pieces attached, so that the workman can perform two operations on them, while the stuff is right in his hands, it is quite a saving. This gable-end piece, you see above.



GABLE END TO CHAFF-HIVE COVER.

You will notice, that each piece has a tapering cut at each end; that it has a bevel at the lower edge; and that it has a hole bored through it. To pick it up and lay it down for each of the four operations, especially if you are one of the awkward kind that have to turn around and stoop over every time they lay a piece down and pick another up, requires a good deal of time. If we should take a piece of 3-inch plank, we could cut the tapers and bore the holes in at least *six* pieces at once, for they need not be over ⅜, and then we could saw off the pieces after all was done. But 3-inch plank is pretty expensive, because there is so little demand for it. If we can buy 2-inch plank at a low figure, it may do to use this; but even if we do, after boring the holes and cutting the tapers, we would better cut them in two in the middle first, so as to have about inch pieces, as you will see. Very likely it will be best to use your culls, so we will get out a piece of inch stuff planed as thick as it will work, 5 inches wide by 22½ long. This piece will make 4 gable ends, by running your saw through the dotted lines, as shown below.



HOW TO MAKE THE GABLE ENDS.

First we take off the corners, A A; then bore the holes; next we cut from B to C and from D to E; lastly, split them through the middle, and they are finished all but planing. The ventilating-hole should be about 1½ inches in diameter, and should be covered with wire cloth, on the inside. It is never safe to omit these; for the bees in a strong colony will exhale so much moisture as to cause drops of water to hang on the roof-boards, and large icicles to form in the winter. I have wintered bees in the chaff hives, without the ventilating-holes, but was obliged to open them occasionally during very severe weather, to let the roof and cushions dry out.

OUTSIDE WINTER CASES.

In 1890 and '91 there was an effort looking toward something cheaper than the chaff hive, in the shape of an outside protection that can be readily adapted to single-walled hives already in use. The discussion revealed the fact that a good many bee-keepers were using single-walled hives in an outside removable winter case, the same being two or three inches wider, longer, and deeper, than the inside hive. These cases being large enough to be set down over the hive, and leave space all around, of an inch or two, can be packed or not as desired. They are usually made of lumber not more than ⅝ in. thick, and they may have a permanent cover, or one that can be taken off at pleasure. The former, of course, would then simply be a cap, to set down over the hive. This, of course, can not be easily packed. When it is desired to pack these hives the cover should be removable. Some sort of bridge is necessary to make an entrance-way from the outside to the inside of the hive, and to prevent the packing, wherever it may be used, from closing the entrance up.

Their chief advantage lies in the fact that they are cheap, and can be readily removed when warm weather approaches. Another thing, when it is desired to move an outapiary, the winter cases can be moved in a large hay-rack wagon, separately from the hive containing the bees; and as the bee-business is resolving itself into out-apiaries, which see, there has been a demand for something lighter and more portable than the chaff hive. Not more than eight or ten of these can be put on a wagon at a time; whereas twenty or thirty of the single-walled eight-frame hives can be loaded in the same space that the eight or ten large chaff hives take. Again, most bee-keepers have single-walled hives already, and they can hardly afford to throw these away; but by buying these outside winter cases, at a cost of 25 or 30 cts. each, they can very quickly convert their single-walled hives into double-walled or winter hives.

We have tried these outside winter cases during a couple of winters back, with success; but as I am not certain just what form is best, I will not describe any in particular, any further than that I would make the cases of ⅝ lumber, about 3 inches deeper, wider, and longer, than the outside dimensions of the single-walled hive. I should then have a plain top to telescope over the outside case. This may be either flat, or of the gable form. To prepare the hive for winter, take one of these cases and set it over the hive, having first removed the cover of the single-walled hive. Pour chaff, planer shavings, or other packing material around the sides. Spread a sheet of burlap on top of the frames, with a Hill device or something of the sort, under. Cover with a chaff cushion, or pour loose chaff on top, and, last of all, put the cover on. Winter cases of this style, when put over a single-walled hive, make virtually a double-walled hive, and have all the advantages of these hives, with others peculiar to themselves.

I have now described how to make a complete hive, both single and double walled. It will now be necessary to describe how to make the inside furniture. We will, therefore, first take up

FRAMES FOR HIVES.

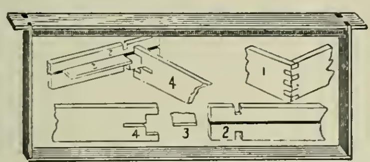
The frames to fit the hives I have described, are 17⅝ by 9⅛. I took these dimensions from a frame Mr. L. sent me several years ago, in answer to an application to him for a frame of the dimensions he would prefer. Although some of the frames in common use, called the L. frame, differ somewhat from these dimensions, yet the frame will fit the greater number of hives in common use, known as the L. hive.

It is a very important thing to have all our frames, as well as our hives, exact in size; and to insure this, we have gauges made for each separate part. We formerly used wooden gauges; but after long use, we find there is danger of inaccuracy from the shrinking and swelling by changes of weather, or loosening of joints by use, and we have, therefore, decided on steel gauges, which we make of a cheap carpenters' square, such as are to be had at almost any hardware store. The stops are made of brass, and are put on with rivets, as there is always more danger of a solder joint giving way than of a riveted one. The drawing below will make it all plain, I think.

GAUGE FOR FRAME-MAKING.

The plate on the end is put on that end of the square that reads one inch, thus enabling us to read the dimensions in inches, at the same time that we are trying a piece of board to see if the length is right. One side of the square gauges the top-bar, and the other side the bottom-bar. The notch in the side gives the length of the end-bars. For frames, we use box lumber that costs about $30.00 per M. A cheaper quality would answer, and we might work cull lumber to quite an advantage, were it not that there would be great danger of bad pieces getting in, and we really need the very best straight-grained pine for our frames, both brood and section, that we can get. Square the end of your board with the cut-off bar, and then set the parallel bar at such a distance that the pieces cut off will be of such length as to just push in between the stops on your gauge. Do not say, when you have it nearly right, "That is near enough," but have it just as nice a fit as it can be; then you can go on cutting up your boards, without any fear of inaccuracy.

If you wish to make a cheap frame, and do not care any thing about the sagging of the top bars and the building of burr-combs in between the upper and lower set of frames, or between the brood frames and sections, you can not get up any thing cheaper than the one shown in the accompanying engraving.



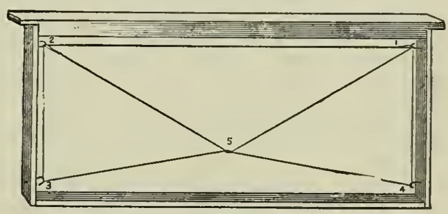
A CHEAP FRAME.

Figs. 2, 3, 4, 5, show almost at a glance how it is made, and put together. The end-bars and bottom-bars are $\frac{7}{8}$ wide and $\frac{1}{4}$ thick. The end-bars are $9\frac{1}{8}$ inches long, and the bottom-bar is $17\frac{5}{8}$ inches long. The top-bar is $\frac{3}{8}$ thick, $\frac{7}{8}$ wide, and $18\frac{5}{8}$ long, leaving a $\frac{1}{2}$-inch projection at each end beyond the end-bars. On the under side of the top-bar there is a groove in which to insert the comb-guide 3; and the end-bars, before being ripped up into $\frac{1}{4}$-inch strips, are grooved on one end, as shown in Fig. 1, and slotted out on the other end as in Fig. 4. The widest part of the mortise is $\frac{7}{16}$ wide and $\frac{3}{8}$ deep. The saw-cut in the center is $\frac{7}{32}$ of an inch deep. The mortise and saw-cut in the end bars is made by placing a grooving-saw $6\frac{3}{4}$ inches in diameter, and two 6-inch $\frac{3}{16}$ saws together, one on each side of the groover, so that the whole end is finished at once, as seen at 4. The top-bar is notched out at each end, as shown at 2. These notches are made in the bar before the boards are ripped up into $\frac{3}{8}$ strips, and are $\frac{1}{4}$ inch wide by $\frac{7}{32}$ deep, on each side.

A frame of this description can be driven together and will hold tolerably well without nails; but, of course, to make it secure they should be nailed.

THICK-TOP-BAR FRAMES.

On account of the aforesaid inconvenience of the sagging of top-bars, and the unnecessary building of burr-combs between the upper and lower set of frames when extracting, in 1889 and '90 an effort was made to get rid of these undesirable features; and the discussions in GLEANINGS IN BEE CULTURE which followed during those years, showed quite conclusively that a top-bar a full inch wide, and $\frac{5}{8}$ or $\frac{7}{8}$ thick, having a bee-space in the hive to allow $\frac{1}{4}$ inch, and also having the separate frames spaced from each other $1\frac{3}{8}$ from center to center, would be virtually proof against the building of burr-combs. The L. frame is what is called a "long" one; that is, the top-bar is rather longer than the other sizes of frames; and to prevent its sagging, and so preserve the proper bee-space, experience has shown that it can not be much less than $\frac{7}{8}$ inch. Top-bars $\frac{1}{2}$ inch have been known to sag a trifle; so, to be on the safe side, it is best to add at least $\frac{1}{8}$ more. Experience has shown that, for "loose" frames (for the definition of which see FIXED FRAMES), it may be desirable to use even $\frac{5}{8}$ inch; and this will be more convenient for reasons to be presently given. The following cut shows what we call a thick-top-bar frame. It is made a little different from the one already described, as you will see by referring to the cut.

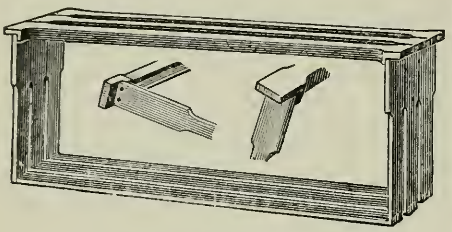


THICK-TOP-BAR FRAME.

As I have said, a $\frac{5}{8}$-inch thickness might do for loose frames; but as you probably will not be able to get lumber of that thickness without paying for a great deal of waste, I would advise you to make your top-bars $\frac{7}{8}$ thick. They had better be a little too thick than not thick enough.

HOW TO MAKE THICK-TOP-BAR FRAMES.

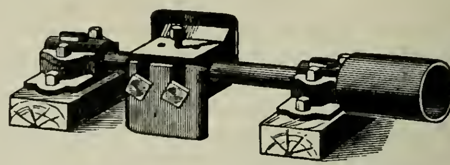
Take $\frac{7}{8}$ boards, and cut them up into lengths of $18\frac{5}{8}$ inches, and then square them up as already described under the making of hives. Now, on each end of these boards cut a rabbet $\frac{5}{8}$ inch into the end of the grain, by $\frac{1}{2}$ inch deep across the grain. You are then to rip them up into lengths of $1\frac{1}{32}$ inches wide. The next step will be to cut the comb-guide groove. Put on a thick grooving-saw, and cut on the under side of the top-bar longitudinally, in the center, a groove $\frac{3}{16}$ deep. The bottom-bars are made just the same as those of the frames previously described. The end-bars are made just the same, only the top end is cut off square, and the length is ⅜ shorter; namely, 8¾ inches long. Into the end of this make a saw-cut, with the same grooving-saw that you used for cutting out the comb-guide groove in the top-bar, ½-inch deep. The comb-guide is 17⅝ inches long, the thickness of a thick grooving-saw, and ⅜ wide. Your pieces are now all cut out and ready to be put together, as shown in the engraving. In the cut, the frame above is wired on the Keeney plan. For directions in regard to it, see COMB FOUNDATION.



HOFFMAN FRAMES.

Before I describe these I will ask you to refer to FIXED DISTANCES. I may say at the outset, that these frames will be a little difficult to make on a foot-power saw, although they are perfectly easy to make in an establishment where steam power is used, and a proper set of cutter-knives is made for the purpose. If you purpose making sections, however, you will need a cutter-head for cutting out the insets of the sections, as explained further on under SECTION-MAKING.

You will need to purchase plank 1½ inches thick; and you will save money by getting clear first quality of lumber. This plank you are to take to a planing-mill and have them plane it to 1⅜ thick. Out of this you are to make the end-bars and top-bars. Cut the plank up into lengths 18⅝ inches for top-bars, and into shorter lengths, $17\frac{9}{16}$ inches, for end-bars. So far all is easy and plain sailing. Now, the next operation is somewhat difficult as well as dangerous on a foot-power saw. We will first commence with top-bars. By referring to the engraving you will see that the end of the top-bar is paddle-shaped. Seven-eighths of an inch from the end of the top-bar the frame begins to narrow down to $1\frac{1}{32}$ inches wide, and continues this width to within ⅞ of an inch of the other end, when it enlarges to 1⅜ inches wide again. Where it changes in width it rounds off (see cut). If you have the right kind of cutter-knives for cutting out sections, you can slide the plank over and cut out a groove 4 inches wide across the grain. The following cut shows the cutter-knives on the mandrel. They will be explained under SECTION-MAKING. The first groove should be cut ⅞ inch from the end.



CUTTER-HEAD FOR HOFFMAN FRAMES.

But as this cut is not wide enough, you will have to pass the plank over the saw several times, each time cutting out a score, as you would over a lawn with a lawn-mower, until the required width is obtained. To do this you will need to set your gauge at several different points, and to run all the planks over the table at each setting of the gauge. Proceed thus until you have scored out both sides. This done, slice the plank into strips ⅝ inch thick. Your next step is to cut out the rabbets on the under side of the top-bar (see engraving). Without special machinery you will be obliged to rabbet each top bar, one at a time. This rabbet in a frame should be ¼ inch deep by ⅜ inch into the end of the grain (see cut). The top-bar is now complete, with the exception of the comb-guide groove, which you are to cut out the same as has already been described under thick-top-bar frames.

The end bars (see engraving) are 1⅜ inches wide, for 2¼ inches, from which point it narrows down to ⅞ inch wide. As each end-bar is to be 8¾ inches long, we cut our plank in the first place, as already stated, twice this length, plus the thickness of a saw-cut; viz., $17\frac{9}{16}$, allowing the saw-cut to be $\frac{1}{16}$ thick. The next thing is to cut out the comb-guide saw-cut in each end, and this is ½ inch in depth. We now score out each side of this plank in such a way that, 2¼ inches from each end of the plank, it is left its original thickness (1⅜ inch), the space between these points being made ⅞ inch wide by the cutter-knives. In order to do this you will have to use the cutter-head which we use for cutting out the bee-ways in sections; and to make it wide enough you will have to change the gauge as you did for the top-bars, as already explained. The next step is to cut this plank in two in the middle. We now have two planks just long enough to make end-bars when cut up into strips ¼ inch thick. But before we do this, groove the narrow ends and then slice them up into ¼-inch strips.

THE UPPER STORY, OR SURPLUS APARTMENT.

We can run this either for comb honey or extracted. As the Simplicity body is interchangeable it can be used for the lower or upper story. This, filled with the frames I have described on the previous page, the same filled with foundation or comb, according to circumstances, and placed on the lower hive, is ready for the storage of extracted honey, and is really the surplus apartment when so used. No other fixture is necessary for extracted honey, unless it be the honey-board.

For the storage of *comb* honey, the necessary fixtures are more varied, and somewhat more complicated. As honey in this form is now universally put into section honey-boxes, we need to describe how to make appliances for holding sections already mentioned under COMB HONEY. A few years ago the old double-tier wide frame—that is, a frame the same size as that used in the brood-nest—only two inches wide or less—was the only thing in use, and they held eight sections. But in later years, comb-honey producers prefer single-tier wide frames, or cases or crates, for holding one tier of sections only. A single-tier wide frame is shown under COMB HONEY. But the arrangement that is best suited for the 8-frame hive described, as well as the one that is used by some of the largest honey-producers in the world, is what I shall here call a section-holder, also shown under COMB HONEY.

The end blocks are just ½ inch thick by 1⅞ wide. The bottom piece is 18⅛ inches long, ¼ inch thick and 1⅞ inches wide, and is scored out to correspond with the entrances to the sections. The manner of doing this will be shown under SECTIONS. These section-holders are just right to go inside of the supers previously described, leaving a ¼ inch bee-space above the sections. We recommend this arrangement for the 8-frame hive we have described.

T SUPERS.

The T super is another very popular arrangement. But a regular half-depth 8-frame body will hardly answer for it, so you will have to make a separate case, or super, expressly for it, an inch shorter, and only 4½ deep; or, in other words, the super will be 13⅞ inches wide, 19 long, and 4½ deep, outside measure, and it is made out of ⅞ lumber. Through the middle, sections are supported by three T tins. These are simply folded strips of tin, in length equal to the inside width of the super, after deducting a certain amount of play room. By special machinery they are folded in the form of an inverted T, as shown in the engraving under COMB HONEY, Fig. 1.

THE MOORE CRATE.

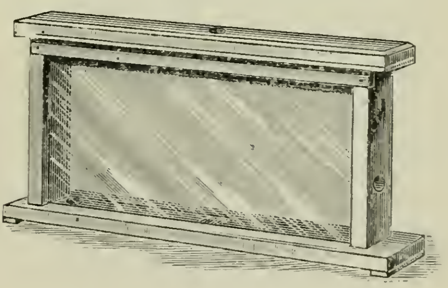
This is preferred by some; but the great objection to it is, that separators can not be used with it. It is of the same size as an ordinary half-depth Dovetailed body, except in depth, which would be ¼ inch less. The sides are grooved on the inside, 4¼ in. apart, so as to take three transverse partitions, these being ⅜ inch thick. Strips of tin are nailed to the bottom inside edge of the ends of the crate, as also on the bottoms of the transverse partitions; and these project far enough to support the sections. See COMB HONEY.

HONEY-BOARDS.

If you use thick-top frames, no honey-boards are necessary; but some bee-keepers seem to be troubled by queens going up into sections, and they therefore use what is called the perforated zinc honey-board. For details in regard to their use, see CONTRACTION.

OBSERVATORY-HIVES.

Before closing the subject of hive-making it may be well to speak of what is called the observatory-hive, used more as a curiosity, or study, than for any practical purpose.



GLASS OBSERVATORY-HIVE.

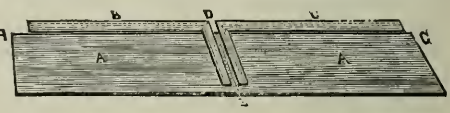
The picture will almost make it plain of itself. If I am correct, the idea of an observing-hive was first invented by Mr. Langstroth, and mine was made after the dimensions given in his book, which I here copy as follows, giving all dimensions in inches:

Base-board, 24⅝ x 4¼ x ⅞. An entrance-hole, ⅝, is bored 3½ inches deep into the end, and two holes are bored in its center, ⅞ in diameter and 1⅛ from center to center, the wood being cut out between them. Bottom of hive, 2¼ x 18⅝ x ⅞. Make a rabbet at both upper corners, ⅜ on x 7/16 deep. Start a ⅝ hole, 1 in. from the end, and bore slanting, to meet entrance-hole, and make a hole in the center to match entrance-hole, for a ventilator, and cover with wire gauze on the inside. Front and rear of hive, ⅞ x 2¼ x 9⅞. Rabbet the inner corners, up and down, ¼ x ⅜; make a ventilator in each piece like the bottom; ⅝ from the upper ends, cut in ⅞; and ⅞ from the lower end, cut in ¼. Side-strips, ⅜ x 1 x 20¼. On one corner of each, rabbet on ¼, and in ⅛ for the glass. Movable cover, 21⅝ x 4¼ x ⅞. Holes may be made in this cover, over which glass receptacles for honey may be placed. Glass, two panes, 9¼ x 19. The clamps on base-board, 4¼ x 2 x ½. Clamps on cover, and ledges on hive, 4 pieces, 4¼ x ⅞ x ½.

You see, it is simply a one-comb hive, made so as to hold a single L. frame. The two sheets of glass are just 1½ in. apart, and, with a nice frame of comb built out on wired fdn., it makes a pretty sight to set in the window. With a moderate number of bees in the hive, the queen is always to be seen, either on one side of the comb or the other. To put the hives in place, raise the window enough to let the bottom-board catch over the window-sill; then let it down, placing a strip of wood on each side, so as to close the openings. The way to get bees into it is to take a frame of hatching bees from any hive, with all the adhering bees and queen. If you choose, you can let them rear their own queen; but it works a little nicer, and they stay better, to take the queen with them. The hole in the cover is to place a feeder over. When they get their comb so full of honey and brood that it will hold no more, you will have to exchange it for an empty comb, or for a frame of wired fdn., or they will swarm out. Mr. Langstroth speaks of having two in one window—one having a laying queen, and the other a queen-cell in process of construction. I hardly need say, these one-comb glass hives succeed only during warm weather. One reason why these hives have not been much used of late, is that our simple hives with metal corners make it so easy to open any hive, and take out a frame, without disturbing the queen in her duties, that each hive is itself almost an observatory-hive.

CONCLUDING REMARKS ABOUT HIVES.

Work carefully, and avoid mistakes and blunders by carefully measuring, trying, and testing every thing, as you go along. Do not get a lot of hives nailed up, and then discover that the frames will not go in them properly, but have a frame right at hand, and, before you drive a nail, put the frame in place and see if it is right. More than this, be sure that your *frame* is just right. Many bad blunders have resulted from picking up a frame *supposed* to be right, but which was found to be a little too large or too small, in some of its dimensions, after a lot of hives were made to match it. Have a good steel square, and keep it carefully, that it may not get out of true, or get rusty or injured in any way. To test its exactness, lay it on a broad straight-edged board, and draw a fine line along the blade of the square, with a keen-pointed knife; then reverse it, and see if the knife-point runs in the same track. The drawing shown below will show you how.



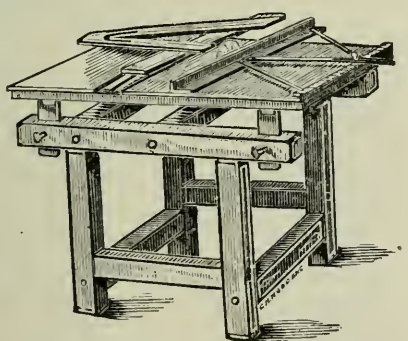
HOW TO TEST A SQUARE.

Let A A represent the board with the straight edge. Do not say, "This edge is straight enough," until you have made it as exact as you can. Lay the square on as at B, and draw the line, D E, with your knife-point; now turn it over as at C, and draw a line in the same place, or so near it that you can readily see if the two are exactly parallel. You can take your board to the hardware store, and pick out a square that is right, or you can get the one that is nearest right, and then make it right by filing. Another point: you will find squares with the marks on one side not exactly agreeing with those on the opposite side. This is a very bad fault indeed. Our blacksmith and foreman once had quite a dispute on some iron gauge-frames, and, when the matter was investigated, it was found the square given the blacksmith varied a 32d of an inch in the way I have mentioned. Further investigation showed we had but one square on the premises that exactly agreed on both sides. Now, when you go to buy a square, *look out.*

When you get a square that you know you can "put your trust in," go ahead, but work carefully. Say over and over to yourself, when starting out, "Suppose I should find, after I get these done, that they are all wrong;" and so measure and try your work, at every step. It is just as easy to cut boards in the right place, as it is to cut them in the wrong one; and it is just as easy to have all the different parts of your work nice and accurate, as it is to waste your time by careless bungling, and then trying to patch up the consequences of your own awkwardness. I know, for I have made a great many awkward mistakes in my life, and I also know, by experience, that one so awkward and careless that he, at times, almost feels as if there were no use in trying to be a mechanic, or hardly any thing else, for that matter, *can* learn to be careful, and to do nice work. I also know the thrill of pleasure that rewards one after he has successfully fought these besetting sins, and come out triumphant. Once more, be careful; work slowly, until you know your work is all right; have your tools all nice and sharp; keep every thing piled up in neat order; look pleasant, *be* pleasant, and thank God every day for being a great deal kinder to you than you deserve, while you ask him to help you overcome these besetting sins.

MAKING HIVES BY STEAM POWER.

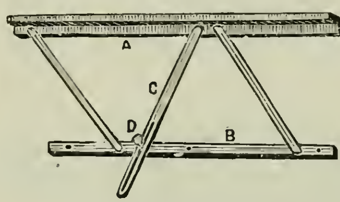
While a foot-power saw does very well for making, say one hundred or even more hives a year for one's own use in his own apiary, when it comes to making hives for his neighbors, or, perhaps, to ship off to distant customers, almost every one soon finds it too laborious to be pleasant. It is true, he can hire help; but I believe it is generally a pretty hard matter to find help with the necessary enthusiasm to be willing to tread a buzz-saw many hours in the day. The owner of the bees will do it, I know, and thrive on it, for that matter, especially when fighting his way to making a start in the world; but most people during this present age will very soon want to bring in the aid of steam, or something else, to do the work of bone and muscle.



BUZZ-SAW TABLE FOR HIVE-MAKING BY POWER.

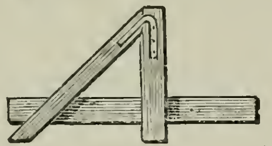
Now, it is almost always suggested by a new hand, that steam or other power be applied to the foot or hand power machine. This can be done, it is true; but as a rule it does not in the end prove satisfactory, for the reason that all foot-power machines are of necessity made just as light and easy running as they can be consistently, and are therefore not calculated for much more strain than the power of a man. If you put on a horse-power or two they will quickly wear out, or break down. What you want to stand a horse or steam-engine, is something like the cut shown.

The table is made of 4x4 hard-wood scantling, say maple or ash. The sticks are sized, and the "wind" taken out of them, and then the whole is put together with mortise and tenon, and drawn up tight with lag screws ⅝ in. in diameter, by 6 in. long. The table is 48 in. wide, and 42 in. long. It is made of hard-wood boards securely screwed fast to four bars of hard wood about 2x2. A bar is placed at each end, and the other two at equal distances under the middle. The table-top is hung on hinges at the further end as it stands in the cut; and at the end nearest us, in the picture, it rests on hinged strips, resting in mortises, as shown. Set-screws fasten the table at any desired height. Strips of iron should be let into the wood where the points of the set-screws strike, or the wood will soon be injured and mashed up. In the drawings, two gauges are shown. We term these the "figure four" and the "parallel" bar. The former is for cutting off stuff, and the latter for ripping.



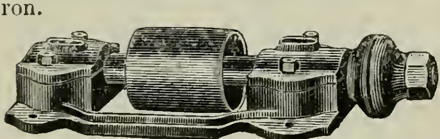
"PARALLEL BAR" GAUGE.

This is to be made of the best piece of seasoned maple or cherry you can get. It needs about a 3x4 scantling, one foot longer than the table-top. Rabbet out a piece as shown, to make a bearing for the bars of iron that it swings on. These bars are iron, 1x¼, pivoted at each end with heavy screws. They allow the bar to swing clear up against the saw and back away from it, far enough to cut off the cover of a Simplicity hive, which is in length 20¼ inches. To fasten this parallel bar securely at any point, a third iron bar, C, is placed between these two. Instead of being screwed fast to the parallel bar A, it is simply slipped over a steel pin driven into A. There are, in fact, two of these pins, at a distance of perhaps a foot apart. This is to keep the adjusting-bar always at pretty nearly a right angle to the parallel bar. Now, this strip of iron has a long slot in it, and a thumb-screw D goes into the slot. By this arrangement it will be noticed that the parallel bar can not swing or move, unless the thumb-screw lets the slotted bar slide under it. By tightening the screw, the parallel bar is a fixture at any point, and it is always parallel to the saw, when once adjusted.



THE "FIGURE FOUR" GAUGE.

This hardly needs explanation. That it may slide easily, and without shake, it runs on an iron track. This iron track is simply a straight bar, ½ inch square, screwed fast to each of the strips on the under side of the table-top. It is made of hard-wood stuff about ⅞ thick. The longest piece, which is grooved to run over the iron bar, is exactly the length of the table. The right-angled piece is two feet long. All are about 4 inches in width. This right-angled piece must be so adjusted as to cut boards off exactly square; and when right, it should be screwed down and braced with iron, as shown, so it can never get racked out of true. On the accuracy and fineness of this adjustment depends all your work. If one could afford it, it would be a fine thing to have the whole table-top, and all of these gauges, of planed iron.



SAW-MANDREL FOR SAW-TABLE.

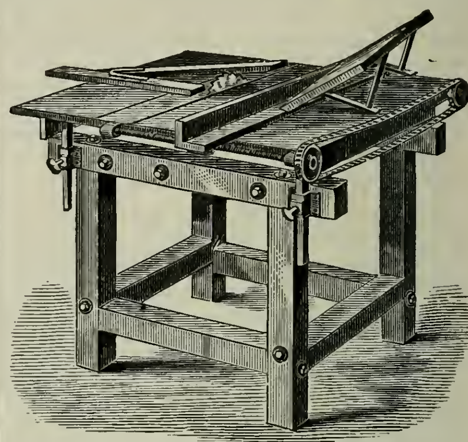
The mandrel used for these saw-tables is our $5.00 one, generally; but for a great deal of work I would advise the heavier one, costing about $7.50.

The parallel-bar gauge does very well for home-made work; but there is nothing equal for general ripping purposes, to Warner's ripping-gauge. This was devised by the superintendent of our hive-factory, and they are used all through our wood-working department.

The gauge is held at the right distance from the saw by means of a pair of screws, on the end of which are sprocket-wheels connected by a chain. Simply pulling the chain moves each screw at the same speed; and as the gauge is fastened to the screws by means of threaded lugs, it will travel parallel to the saw. The great feature of this is, that it holds the gauge perfectly solid, and at the same time permits of a very fine adjustment, which is a great convenience in sawing sections, which we mention further on.

HOW TO MAKE A CUT-OFF SAW-TABLE.

Where the bee-keeper has but little to do in the way of hive-making he may cut boards on the same table that he uses for ripping. But in order to work this way, he must have somebody to hold the end of the long boards while he cuts them up, or have some sort of a support on which they will slide over easily.

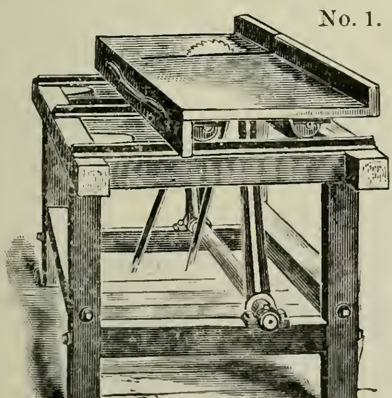


SAW-TABLE, WITH WARNER'S SCREW-AND-CHAIN ATTACHMENT.

When I used to make all my own hives with a single saw-table, and my saws were run by a windmill, as some of you may remember, I used to have the further end of the board slide on a smooth rest made of a piece of hard wood. With this I could take a 16-foot board, and, without any assistance, cut it up into pieces long enough for hives or covers, and have them so exact that, when piled up, no difference in the length could be told by passing the fingers over the ends. Now, while I could do this day after day, and really enjoy the work, I could not find any one who would do it for me. If I set a couple of boys at it, the one with the other end of the board would move it too fast or too slow, or by jerks, in such a way as to have the pieces, when cut off, of unequal lengths. Then we tried cutting the board up first into pieces long enough for two or three lengths for hives; and then as these pieces were short enough to handle, it was an easy matter to cut them up into exact lengths. This, of course, took a great deal more time; and even then the boards would not be cut squarely across. The reason was, that although the edge of the board might be held closely up against the figure four, unless at least one side of the board was perfectly straight, like a straight-edge, before being cut up, we found trouble after we got through.

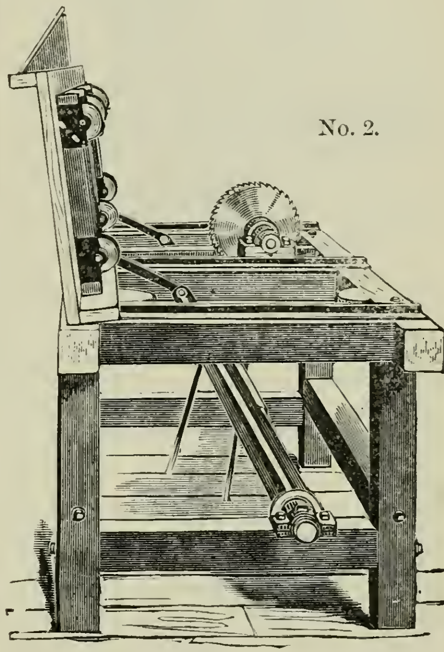
There is a way, however, in which a board can be cut up into accurate lengths, even if its sides are not straight. Fix a straight-edge of steel (nice hard wood may do) back of the saw just far enough away to get the length of board wanted. Hold it hard up against your figure 4 and cut off just enough to make it square across. This done, hold the square cut hard up against the steel straight-edge. Now push the board along on the top of the table up against the saw, watching carefully to see that the end is a perfect fit against this steel straight-edge. In this way you can cut up a whole board and have the pieces exactly of the same length. But woe betide you if you are so careless as to leave a crack on either edge, even if it be not more than a hair in thickness. You see, we want the boards so accurate that where there are two stood up together on a smooth surface, neither eye nor finger can detect any difference in the length. In making frames for the hives, this is a most important matter; indeed, I have had nothing in the whole department of hive-making that has caused me so much trouble as this matter of getting hands who would cut stuff *perfectly accurate*. Many times I could have cried about it (if you will excuse a little exaggeration), had I thought it would do any good.

No. 1.



A SAW-TABLE FOR CUTTING OFF STUFF.

We are now ready to consider what may be done by the use of machinery, for enabling even unskillful hands, or, perhaps, hands who have never been shown the importance of accuracy in mechanical work, so that they may do work and be exact. When at the Exposition at Cincinnati, once, I saw some beautiful iron tables having a pair of saws. These saws could be adjusted at any required distance from each other; and to cut off the board it was pushed against the saws while moving on a carriage of iron. This, you will see, made it next to impossible to have boards cut either too short or too long; but the two cuts every time, made a small waste of lumber.



No. 2.

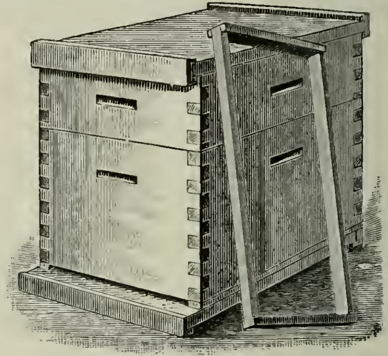
THE SAME WITH TOP RAISED.

We here give you some engravings of the cut-off tables we use in our own factory. I don't know whether exactly the same device has ever been used before or not.

No. 1 shows the table ready for work, and No. 2 the same with top elevated, which can readily be done to take off saws, etc. It occurs to me just now that our artist has made a mistake, and drawn a rip-saw where he should have shown a cut-off or cross-cut saw, as it is sometimes called. The table is made of 4x4 seasoned maple. On the top are placed three cast-iron V-shaped tracks. The sliding top runs on these tracks on 6 cast-iron wheels having a V-shaped groove in each. This, you will observe, makes the sliding top of the table so that it moves to and fro with great ease, yet without a bit of end shake. At a first glance one would almost think this sufficient; but if you were to lay a 16-foot plank on this sliding table-top, and take hold of the end, you would find it would have a considerable twist, or "wiggle," on its center. This twist would, of course, prevent cutting off the boards accurately. Now to make the table rigid where it stands, and still bear sliding to and fro, we have what is termed a rocking-shaft. This is a cast-iron shaft about 2 inches in diameter. Don't make it any smaller, thinking it will do. Better have it larger, if any thing. On this shaft is a pair of rigid cast-iron arms, as you see in the cut. At the top of each of these arms, short iron bars are bolted; and these bars are attached to the movable table-top. Now, providing these bolts all work closely, we have secured our table so that no twist is possible, unless the shaft should twist. But a 2-in. iron shaft can not be expected to do this very much. A handle is attached to the sliding top, as you will see in the cut, for drawing it back easily. We have two of these tables in use —one about 10 feet long, and the other about 8, and they are in use almost constantly. Of course, an iron gauge which can be adjusted at any required distance from the saw is a great help for cutting different lengths of lumber. And as before, your stuff *must be* held *tight up* to this gauge. Such a table, well made, ought to cost perhaps $45.00 for the short ones, or $50.00 for the long ones, as described above. If made as we have directed, it should, with a mandrel of proper size, be capable of carrying a 12 or 14 inch saw, and should cut up heavy planks used for chaff-hive corners, or such as will be required for slicing up wood into separators, or any similar work. Where inch boards are to be cut, or any thing thinner, we pile them up until we get as many as the saw will reach through. By this means we cut three or four, or even more, where the lumber is thin, at one cut, and one person handles it all easily.

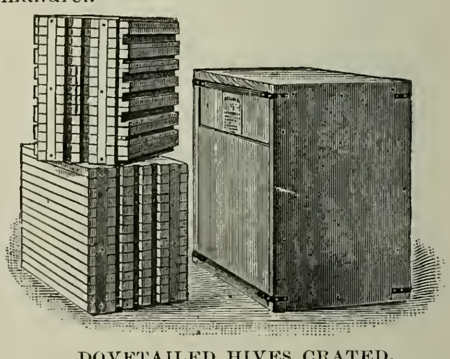
HOW TO MAKE DOVETAILED HIVES.

Under HIVE-MAKING BY FOOT-POWER I recommended the "halved corner" because this is the best one that can be made on light machinery; but if you have heavy machinery, driven by power, and propose to make hives in any quantity, you had better adopt the dovetailed joint. This sort of a corner has long been in use on section honey-boxes. It is only recently that it has been adapted on a large scale practically to hives. Such corners make the very strongest hives—so strong, indeed, that a weight of 100 pounds may be put on the diagonally opposite corners, and yet not affect the true square of the body. The dovetails are ⅜ in. wide, and it is done by a series of dadoe saws, spaced exactly ⅜ inch apart by metal collars, the whole strung upon one large heavy mandrel. The dadoe cutter is made up of one wabble-saw held by beveled collars between two heavy groovers. The groovers are simply to clean the edge of the cut, and the wabble is to do most of the cutting. To do the work nicely, a pile of boards should be put in an automatic machine, in such a way as to be securely clamped. These boards, *en masse*, are then passed over a series of dadoe saws by suitable riding table.



A DOVETAILED EIGHT-FRAME HIVE.

There is another and simpler way that the ends of the boards may be dovetailed, and that is, by shoving each board (on a line with the mandrel shaft) between a pair of stops on to the dadoe cutters one by one, until they reach a couple of stops in between the saws that regulate the depth of the cut. This cut will be a little rounding, to conform to the circumference of the saws; but the boards will bed together. I hardly need mention, that dovetailing takes considerable power; and you will need to use at least a four-inch belt to drive the mandrel.



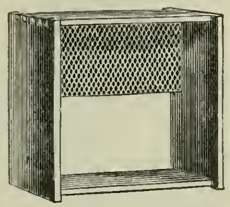
DOVETAILED HIVES CRATED.

This hive is made just the same as the eight-frame hive, explained under HIVE-MAKING, under FOOT-POWER, only it has the dovetailed, or lock-joint corner. There has been such a demand for these hives that they have been sold by the carload all over the country. They can be crated up very cheaply. The preceding cut shows 10 sides and ends with the other parts of the hive, including the inside furniture crated inside of the bottom-boards. Four square sticks, ⅝ square, are let into the dovetails of the sides and ends, and nailed with three wire nails. Four of these sticks will hold 10 (or 20) of these sides securely for shipment clear across the country.

SECTION HONEY-BOXES.

ALL ABOUT MAKING THEM.

In taking up this subject we will first consider how to make what is called the four-piece or dovetailed section.

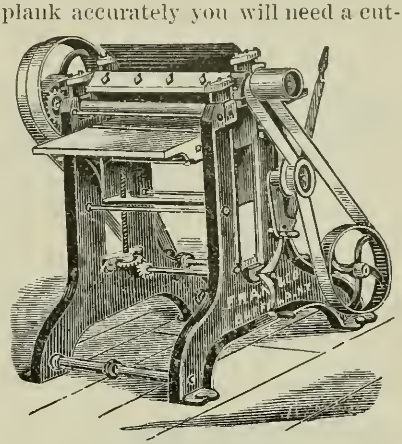


FOUR-PIECE SECTION BOX COMPLETE.

The best material which we can obtain in this locality for honey-boxes is nice, white, clear-grained basswood. It should be sawed into planks, about 2¼ in. thick, that it may be full 2 in. when seasoned. Such lumber is worth here, at present, $18.00 per M. After the lumber is seasoned it is ready to be planed so that the sides of the sections shall work full 1⅞ inches. As the tops and bottoms are $\frac{5}{16}$ less in width than the sides, they may easily be made from ordinary 2-in. stuff. The planer mentioned below is about right for these planks, and is shown in the following cut.

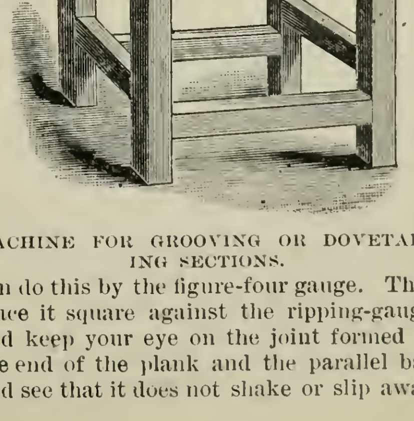
These small planers have astonished us by the beauty and accuracy with which they do their work, and the small amount of power with which they may be run. Our machinist said he did not think we could plane a 16-inch board with a 4½-horse-power engine; but with only 40 lbs. of steam, we cut a full ⅛ inch from the hardest and knottiest board we could find, and the planer did not even slack its motion. As the machine cost us, all belted and ready for work, only $90.00, we were very agreeably astonished. A two-horse-power engine would run the planer very well, if a light cut at a time were made.

After your planks are all planed, you are to cut them up into pieces for making the usual one-pound section boxes; these pieces are to be only 4¼ inches in length. To cut the plank accurately you will need a cut-off



18-INCH GEM PLANER.

saw-table, such as shown on a previous page —that is, if you do a very large business. If you are making them for your own use only, or, say, for the local trade near you, cut your plank in pieces three or four feet long, just as you would do for hive-making. If your pieces are longer than this they will be inconvenient to handle, and you will have irregular work. For instance, when you cut off a piece from the plank it must be just 4¼ inches long at each end of the piece—no more and no less. For this purpose we use the ripping-gauge. Have one end of your plank sawed straight and true. You

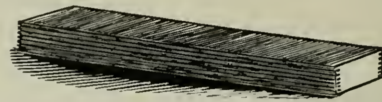


MACHINE FOR GROOVING OR DOVETAILING SECTIONS.

can do this by the figure-four gauge. Then place it square against the ripping-gauge, and keep your eye on the joint formed by the end of the plank and the parallel bar, and see that it does not shake or slip away, even the width of a hair, while it is being slid along over the smooth top of the saw-table. As you cut your pieces you can test their accuracy by standing them on end, and running your finger over the surface of the ends, as I told you in cutting up your hive-stuff. After they are all cut up you are ready for the grooving, or dovetailing. This is done by the machine shown on preceding page.

This is called the dovetailing machine, and it has a gang of 8 saws to cut the whole number at once. The saws we use are 6 inches in diameter, and about $\frac{1}{8}$ in. in thickness. They are run with steel washers between them, that gauge the tightness with which the sections fit together. If they are too loose, a washer of thin paper put between them will make them tighter. The saws are sharpened like a rip-saw, but they have no set. They are filed without removing from the mandrel, the file touching eight teeth at one stroke. A 4 or $4\frac{1}{2}$ inch belt will be required to run these saws, and the pulley should be not less than $4\frac{1}{2}$ inches in diameter. The shaft should be about 1 inch in diameter, and should run in broad strong boxes; it may be $\frac{3}{4}$ in., where the saws go on. As these saws must cut always the same width, exactly, it is best to run them without set. Such saws 5 or 6 in. in diameter are worth about $1.00 each; a steel washer, 35 c. more: and a suitable mandrel and boxes, $7.50. Therefore the whole outfit, with 8 saws, will cost about $20.00. The saws will run a week with proper filing, and be in use all the time.

After the slices from the plank are grooved they present about the appearance of the cut below.

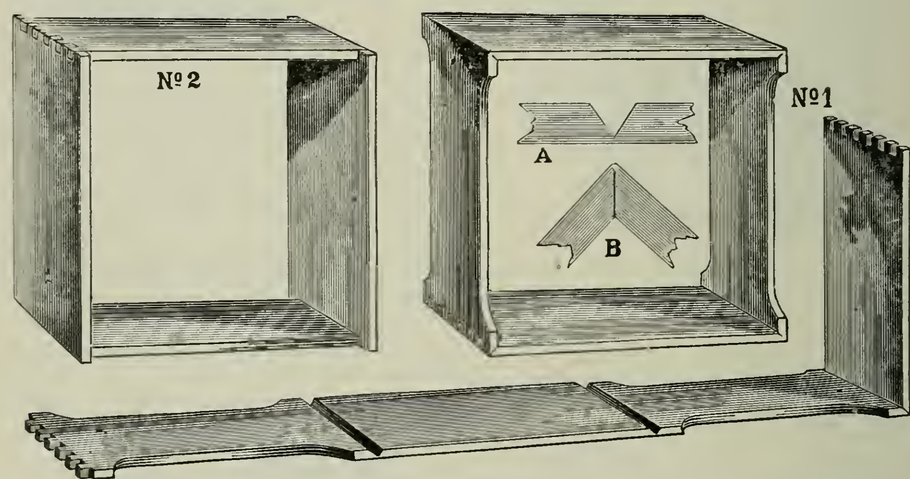


PIECE OF PLANK, GROOVED READY FOR SLICING UP INTO PIECES.

These bolts are next to be ripped up into strips $\frac{5}{32}$ of an inch thick with a saw without any set, as shown under PUTTING CIRCULAR SAWS IN ORDER, presently to be considered.

THE ONE-PIECE SECTION.

These are used by the great majority of bee-keepers. They are far more easily and rapidly put together. The only objection to them is that they have a tendency to assume the diamond shape. This does not appear to be a very serious objection.

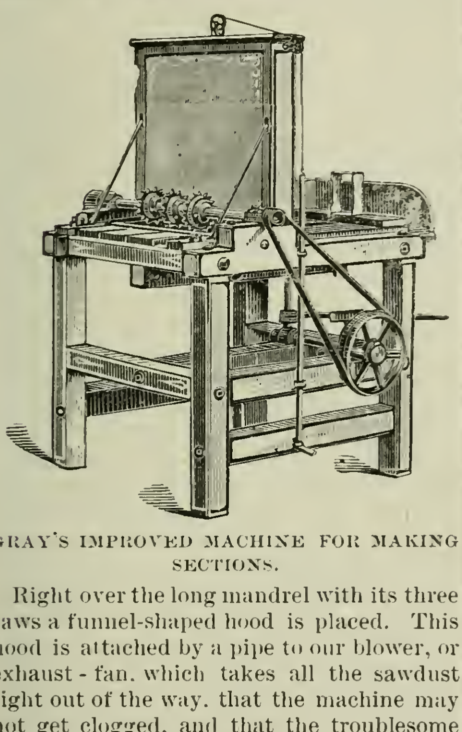


SECTION BOX, MADE ALL OF ONE PIECE OF WOOD.

In 1880 we succeeded in making machinery for turning out the one-piece section above, which is not only stronger and neater than any thing else yet devised, but, with the proper appliances, is the easier box to make. The engravings will make it plain, almost without explanation.

In our first machine the strips were shoved under the saws, which make the grooves for the folded corner, by means of a revolving drum with pins set in it, but in 1884 we made and perfected the machine which appears on next page.

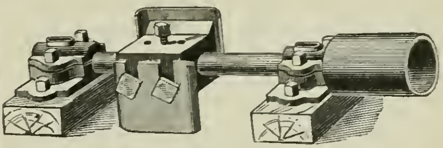
The upper part of the machine, as seen in the cut, is a sort of magazine, as it were, for holding the blanks for making the sections. Instead of the drum used in the old machine, a sliding table pushes the blanks under the saws, one at a time. The operator has only to keep the magazine full of blanks, and take the finished sections as they come out of the machine, and pack them in boxes holding 500 each. The rod shown in the foreground enables the operator, by means of the foot, to raise the weight that presses the blanks down when replenishing the magazine. The handle in the rear of the machine enables him to stop or start the sliding carriage. In practice, it is found that this carriage must be attached to the pitman by means of a *spring*, to avoid the effects of a shock occasioned by one section getting above another, or crosswise. The spring allows the machine to go on without any thing being broken or injured.



GRAY'S IMPROVED MACHINE FOR MAKING SECTIONS.

Right over the long mandrel with its three saws a funnel-shaped hood is placed. This hood is attached by a pipe to our blower, or exhaust-fan, which takes all the sawdust right out of the way, that the machine may not get clogged, and that the troublesome dust from the basswood may not render the air in the room unwholesome and disagreeable to the workmen. All of our saw-tables and planers are now arranged so as to have the dust and shavings all carried, automatically, right down into a brick room just before the boiler. From here there is another arrangement which carries the dust and shavings driven by the same blower directly into the furnace under the boiler and the same blast blows the fire.

To get out stuff for these sections, you want the best white clear basswood. The logs must be sawed into plank $2\frac{1}{8}$ in. thick. After the plank have been stuck up and seasoned, they are to be dressed on both sides until they are just $1\frac{7}{8}$ inches. After the plank is dressed, it is cut up into bolts just $16\frac{4}{5}$ in. With the cutter-head below to cut $3\frac{1}{2}$ in., wide cuts are now made in these bolts of plank,



CUTTER-HEAD, FOR MAKING THE ENTRANCES TO THE BOXES.

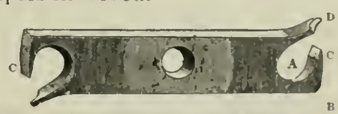
at the proper places to make the top and bottom pieces narrower, so as to let the bees pass through. These cuts are about $\frac{5}{32}$ in. deep. If you want closed-top sections, only one cut is made instead of two. The end of each bolt is now dovetailed with the gang of saws, precisely as in the old way, except that one end of the plank is made so as to match with the other end, that the section, when folded up, may exactly come together. This being done, the bolts are ready to be ripped into strips with saws without any set, as explained at the end of the subject of PUTTING CIRCULAR SAWS IN ORDER, next to be considered. They are now ready for the machine, after which the strips appear as seen in the cut opposite.

To fold them, you have only to draw together the two ends, and then with a small mallet drive the dovetailed corner together.

PUTTING CIRCULAR SAWS IN ORDER.

And now I am going to take a little space to talk to you about putting circular saws in order. It is no use to say you can not sharpen a saw, for you *must* do it, or you are not fit to be a bee-keeper. Perhaps I can help you a little.

We will take the cutter-head for an illustration, for it embodies nearly all the principles involved.



CUTTER-HEAD FOR GROOVING SECTION BOXES.

The point, or spur, D, is, of course, to cut a little ahead of the chisel-shaped cutter, C, and is to gauge the exact width of the groove, while C follows after, and takes out a shaving of wood. Now, suppose the tool be so carelessly ground that the heel, B, is higher, or, rather, further from the hole in the center than the cutting edge, C; it is very plain that the heel would only rub on the wood, get hot, and make things smoke, without doing any cutting at all. At about this stage, the operator of the foot-power saw is in danger of losing his temper—especially if he has tired himself out, and worked himself into a perspiration, without stopping to examine into the matter. To illustrate, I will give a letter that Barnes Bros. wrote us, after one of our customers had complained of his cutter-head.

> We mail you this day the cutter-head that Mr. ——— returns by our request, for our examination. He has ground it, or sharpened it, from the outside, and spoiled it of course. It should be ground or sharpened from the inner edge. Please put it on the saw and you will see that the edge is ground down so that the back part will not let it cut; hence the jumping he speaks of. You will also see that it has never been sharpened on the inner edge — the temper color has not been removed. We would as soon tell a man not to hitch to the tongue of a wagon, after selling him one, as tell him not to grind these cutters on the outer edge. You will find, on grinding back and allowing the edge to be the highest, as it was originally, that this same cutter will beat the best saw (especially when gauged), cutter, or groover you can get. We like fair play, especially when things are so plain as to need no explanation.
>
> If you have time, we would like you to write him, and, after grinding the cutter properly, return it to him to convince him. W. F. & JOHN BARNES.
>
> Rockford, Ill., Sept. 11, 1877.

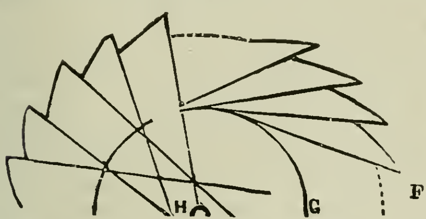
That the above is somewhat harsh, I am aware; but I have given it you to show that I think there is blame on both sides. Our friend was thoughtless, it is true; but had the cutter been sent him, ground just as it should be, at first, he would have succeeded and been pleased; and if it afterward got out of "rig," he would have known the fault was not in the construction of the implement. I have purchased much machinery, and, I am sorry to say, but little of it has been in really nice working trim when first received. The planer I have mentioned was a pleasant surprise in that respect, for it was almost as sharp and keen as a razor, and every part was as carefully in order as if the maker had fitted it up for his own use. If all kinds of machinery were sent out in just this shape, it would save ever and *ever* so much trouble and bother, and hard words and feelings all round. I know it costs money to do this, and I know it is hard to find a man who will take pride in having every thing just right, no matter what the cost may be; but it should be done. There will be no difficulty in getting a price to cover all expense, after the work has once earned a reputation.

The cutter-head was received, as it was stated. The blue on the steel showed that no file or stone had ever touched it on the inner edge at A, but our friend had ground the outside, in the manner stated. I took the tool to one of our hands who runs saws, explained the matter, and desired him to fix and try it. As it did not cut very well, I stopped it and looked, and, behold, *he* had not even taken the blue from the steel on the inside.

Friend Barnes, I fear there are a great many thick-headed people in this world, and I sometimes have reason to think *I* am "chiefest" among them. Then what shall we do? I think we shall have to make every thing *very plain*, and I think our tools would all better be sharpened *just right*, before they are sent out, and then purchasers will certainly know how they should be.

Messrs. Barnes Brothers have sent us a pair of their improved cutter-heads. They are of much nicer finish than their old ones, and there has been some grinding done on the points of the knives; but neither of them are ground as they should be to make the best speed in cutting. I think the gentlemen will excuse these criticisms, for I have always found them very ready to adopt any improvement or suggestion I may have made, if a good one. We owe them a vote of thanks already, for having made such great reductions on the prices of almost all kinds of foot-power machinery. The spurs on the cutters sent were too long, and they were of such shape that the block of wood was shaken while being grooved; when they are made so as to be thin sharp blades, cutting about the thickness of a sheet of paper into the wood, in advance of the chisels, with the steel ground back so as not to bump or rub against the sides of the finished groove, your block will stand as steady as if no cutting were being done, and your groove will be beautifully smooth and clean. Best of all, so little power will be required to do the work, that you will hardly know the tool is cutting. I know, for I have just stopped my writing an hour, to be sure I could make them go. As I have said before, we use saws instead of these cutters, because, with the constant work we have for them, they would require sharpening so often. A saw has 50 teeth or more, where these tools have but two, to do the work.

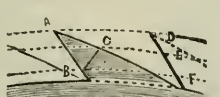
Remember, the extreme points of the teeth are to do the work, and no power can be spared in making the saw rub or squeeze through the lumber. No part of the saw should ever touch the lumber, except these extreme points, and they are to be of such shape, and so disposed, that they pare off just enough to let the saw through, and nothing more. If you stand a chisel straight up on a plank, and draw it across it, it may scratch the wood some, but it will not cut it smoothly. If you try pushing it forward at different angles, you will find there is a certain position in which it will make a smooth cut. This is about the angle we wish to give the teeth of a rip-saw. There is a rule for getting this pitch, which you will understand from the diagram below.



SAW IMPROPERLY FILED. PROPERLY FILED.

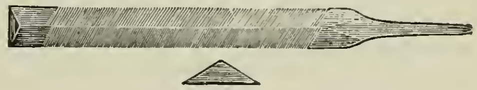
Let H represent the center of the saw, and F the circumference; G is a line drawn just midway between the center and circumference. Now, if a straight-edge is held against the under side of any tooth, it should lie on the line G. Hold your try-square on the under side of the tooth of your rip-saw, and you can soon see if the teeth are of the right pitch. On the left-hand side you will see some teeth with a wrong angle. Some of them would carry a line toward the center of the saw, and one of them would go past the center on the other side. You need not say no one ever did as bad work as that, for it is not many years since I complained to Mr. Washburn that my saw would not cut well, and he, with a straight-edge, showed me just how badly I had been doing. I had commenced in a hurry, and had filed the saw just to make it do a little for the time being; I had filed both top and front of the teeth to get them to a point "real quick."

Filing a saw on the top of the teeth is a great waste of time, files, and especially saws. Perhaps I can give you some faint idea of the matter from the cut below.



HOW SAWS ARE WASTED, BY IMPROPER FILING.

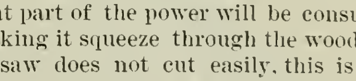
Let A be the point of the tooth when the saw is new; and C, the point where it would be after having been used for a certain amount of work, the filing having all been done on the under side of the tooth so as to leave the line A C just as it was when it was made; that is, it has been untouched by the file, and has only worn away, in actual cutting on the wood. The saw has been reduced in this way by this amount of work, exactly from D to E. Bear this in mind. Now suppose we have done the sharpening by filing the top of the tooth; in getting the same amount of cutting edge, we should file down from A to B. This would reduce the size of the saw from D to F, instead of from D to E. For filing these small saws from 6 to 10 inches in diameter, we need a file made at just the proper angle like this cut.



The broad side of the file is to be laid on the top of the tooth; it is never to be used for cutting downward, but only to preserve the shape and angles of the top of the tooth, while the cutting is to be done from the under side of each tooth, the top of the tooth being made while sharpening the one just after it.

So much for the shape of the tooth; our saw must be set, or it will not clear itself through the lumber; and for this purpose, we have found the Boynton saw-set as good as any thing for circular saws.

The diagram below will give you an idea of the purpose of setting saws.



THE PHILOSOPHY OF SETTING A SAW.

You will observe that we depend on the little points, A and B, to make a path along the dotted lines, for the blade. If these points get worn off, the saw will pinch, and a great part of the power will be consumed in making it squeeze through the wood. If your saw does not cut easily, this is very likely the trouble. If your lumber is unseasoned or tough, you will need much more set than if you have dry clear tender lumber. Of course, we wish to get along with as little set as we can consistently, for the more wood we cut out, the greater is the power required. Now, another consideration comes in. If we do not set the teeth all alike, and it is almost impossible to do this with any saw-set, on account of the tendency of some teeth to spring more than others, we shall have occasionally a tooth sticking out more than the rest; this causes much friction, and makes our lumber look bad with grooves plowed in it at intervals.

For large saws, a side-file is used; but for our work, I think we can level off the points very well with an oil-stone. Lay the stone on your saw table, against the side of the saw, and turn the saw backward by hand. Now be sure you do not trim the points too much, and that you do not hold your stone so as to make the points wedge-shaped. When done rightly, your saw should cut smoothly and easily, and the stuff should look almost as if it were planed.

In the drawing, I have given about the right angle for the face of the tooth. The point should be almost square, like the end of a chisel; but as the outside corner has by far the greatest amount of work to do, it should be kept a trifle higher. If you give the point of the tooth a very sharp bevel, the saw will leave a point in the wood like this, at A; and if the saw is crowded, the teeth will spring outward somewhat, as shown in the dark lines, making a great amount of friction, and rough and unsightly work. Have plenty of good files at hand, and touch up the teeth of your saws often, if you wish to accomplish the most, with the least amount of hard work.

The above directions are all for rip-saws. A crosscut saw is filed with a 3-cornered file, and needs but few directions different from those already given. As it is always used across the grain, it will work best to have it sharpened so as to leave the point A, as shown in the cut, for this will break off itself. The outer points of the teeth are to be kept very sharp, and are to be leveled up with the oil-stone, so they all cut in the same path. The saw must also be set enough to clear itself, in all kinds of lumber. If you wish to cut up boards that are not perfectly seasoned, you will need to set your saw accordingly. You can, with the Barnes saw, cut off a foot board at one clip, if every thing is all right. Ours is seldom in order to do this, I know; but if I were going to use it, I would keep it in just such order. The grooving-saws for section boxes are to be sharpened like the rip-saws.

SPEED OF CIRCULAR SAWS.

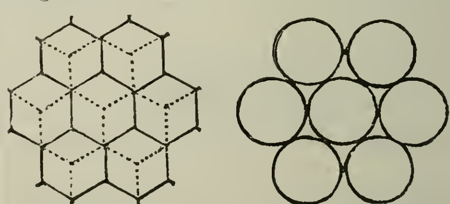
In regard to the speed of circular saws, much depends on the power to be applied, and the material to be cut. As a rule, we may say that the teeth should move at the rate of about 8000 feet per minute. By getting the diameter you can easily figure out the number of revolutions per minute.

HOW TO MAKE A SAW DO AS NICE WORK AS A PLANER.

In the year 1885 we discovered that a rip saw filed with sufficient sharpness and accuracy will cut well-seasoned basswood as smooth or smoother than the average planer or sandpapering machine will make it. The saw is used without any set at all. It must run absolutely true on the mandrel. The teeth must be filed exactly on the pitch given on page 171, and it may take an experienced saw-filer to do it so that the marks of the teeth will not show on the pieces of wood. The saw must have a high speed—not less than 4000. The stuff must be fed rather slowly, and by a man trained to run a saw without set. You can make the saw do a smooth nice job, my friends, I think, if you set right down to it and work the matter out. Learn to file your saws, and then learn to run them after they are filed. If you are unpracticed you will crowd the saw, or get the pieces thin at one end and thick at the other; but with practice you can do it every time, saving nearly half the lumber, and a great amount of time, over the old way of first sawing and then planing.

HIVE RECORDS. See RECORD-KEEPING OF HIVES.

HONEY-COMB. Everybody knows that the cells of the honey-comb are 6-sided, and I presume most people know why they are 6-sided. If they were square, the young bee would have a much more uncomfortable cradle in which to grow up, and it would take a much greater space to accommodate a given number of bees. This last would, of itself, be a fatal objection; for to have the greatest benefit of the accumulated animal heat of the brood, they must be closely packed together. This is not only the case with the unhatched bees, but with the bees of a whole colony in winter; when each bee is snugly ensconced in a cell, they occupy less room than they could by any other arrangement.[107]



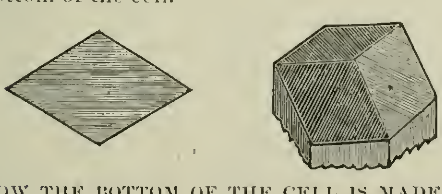
B A

WHY THE CELLS OF THE HONEY-COMB ARE MADE 6-SIDED.

If the cells were round, they could be grouped together much in the same way as they are now; viz., one in the center, and 6 all around it, equally distant from the central one, and from each other, like the cut, in the figure A; but even then, the circles will leave much waste room in the corners, that the bees would have to fill with wax.

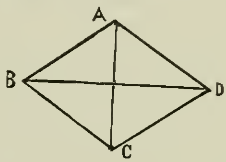
At B, we see the cells are nearly as comfortable for the young bee as a round one would be—of course, I mean from our point of view, for it is quite likely that the bees know just what they need a great deal better than we do—and, at the same time, they come together in such a way that *no* space is left to be filled up at all. The bees, therefore, can make the walls of their cells so thin that they are little more than a silky covering, as it were, that separates each one from its neighbor. It must also be remembered that a bee, when in his cell, is squeezed up, if we may so term it, so as to occupy much less space than he otherwise would; and this is why the combined animal heat of the cluster is so much better economized in winter, when the bees have a small circle of empty cells to cluster in, with sealed stores all around them.

But, my friends, this is not half of the ingenuity displayed about the cell of the bee. These hexagonal cells must have some kind of a wall or partition between the inmates of one series of cells, and those in the cells on the opposite side. If we had a plain partition running across the cells at right angles with the sides, the cells would have flat bottoms which would not fit the rounded body of the bee, besides leaving useless corners, just as there would have been if the cells had been made round or square. Well, this problem was solved in much the same way, by making the bottom of the cell of three little lozenge-shaped plates. In the figure below we give one of these little plates, and also show the manner in which three of them are put together to form the bottom of the cell.



HOW THE BOTTOM OF THE CELL IS MADE.

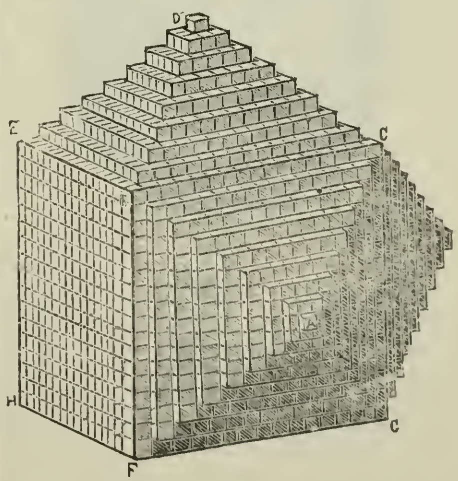
Now, if the little lozenge plates were square, we should have much the same arrangement, but the bottom would be too sharp-pointed, as it were, to use wax with the best economy, or to best accommodate the body of the infantile bee. Should we, on the contrary, make the lozenge a little longer, we should have the bottom of the cell too nearly flat, to use wax with most economy, or for the comfort of the young bee. Either extreme is bad, and there is an exact point, or rather a precise proportion that the width of this lozenge should bear to the length. This proportion has been long ago decided to be such that, if the width of the lozenge is equal to the side of a square, the length should be exactly equal to the diagonal of this same square. This has been proven by quite an intricate geometrical problem; but a short time ago, while getting out our machine for making the fdn., I discovered a much shorter way of working this beautiful problem.



In the figure above, let A B C D represent the lozenge at the bottom of the cell, and A C, the width, while B D is the length of said lozenge. Now, the point I wish to prove is, that A C bears the same proportion to B D that the side of a square does to the diagonal of the same square.

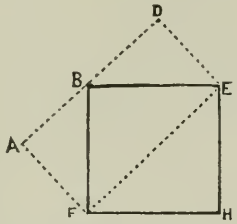
THE MATHEMATICS OF THE HONEY-COMB.

Suppose we have a cubical block, E B C G F, and that we pile small blocks on its sides as shown, so as to raise pyramids of such an inclination that a line from any apex to the next, as from A to D, will just touch the

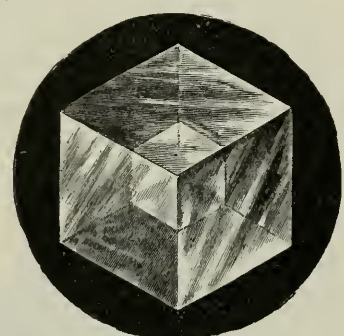


edge of the cube, B C. Now A C D B is the geometric lozenge we are seeking. Its width, B C, is equal to one side of the square, E B

F H, for it is one side of the cube. Now, to prove that A D is equal to the diagonal E F, we will use the diagram below.



Let E B F H represent the cube, and the dotted lines the pyramids. If the pyramids are so made that the line A D is a straight, continuous one, it is evident, by a little reflection, that the angles A and D will be right angles. If this is so, A D is exactly equal to E F, the point we were to prove. Now, referring to the former figure, if we should go on building these pyramids on all sides of the cube, we will have the beautiful geometrical figure called the rhombic dodecahedron; it is so called, because it is a solid figure having 12 equal sides, and each side is a rhomb, or lozenge, such as we have described. Where the obtuse angles of three of these rhombs meet, as at C, we shall have the exact figure of the bottom of a honey-comb cell. A picture of the geometrical solid we have mentioned is given below.



RHOMBIC DODECAHEDRON.

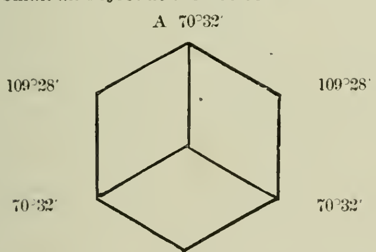
How does it come that the bees have solved so exactly this intricate problem, and know in just what form and shape their precious wax can be used, so as to hold the most honey, with the very least expenditure of labor and material? Some are content with saying that they do it by instinct, and let it drop there; but I believe God has given us something farther to do than to invent names for things, and then let them drop. By carefully studying the different hives in a large apiary, we see that not all of them build comb precisely alike, and not all colonies are equally skilled in working wax down to this wonderful thinness. Some bees will waste their precious moments—and wax—in making great, awkward lumps of wax; coarse, irregular cells; crooked, uneven comb, etc., with very bad economy either for the production of brood or for the storing of honey; while others will have all their work so even and true, and so little wax will be wasted, that it is wonderful to contemplate the regularity and system with which the little fellows have labored. Now, it does not require any great amount of wisdom to predict that the latter would, in a state of nature, stand a far better chance of wintering than the ones that were wasteful and irregular in their ways of doing things. If this be the case, those queens whose progeny were best laborers, most skillful wax-workers, as well as most energetic honey-gatherers, would be most sure to perpetuate themselves, while the others would, sooner or later, become extinct. I have found more of a tendency in bees to sport, or to show queer peculiarities, than in any other department of the animal or vegetable kingdom. They vary in color, in shape, in size, in disposition, in energy: and almost every colony, if studied closely, will be found to have some little fashion or way of doing things, different from all the rest in the apiary. Now, when we take into account the fact that many generations can be reared in a single summer, we see how rapidly, by fostering and encouraging any desirable trait or disposition, the bees may be molded to our will. The egg that is laid by a queen to-day may, by proper care, be made to produce a queen laying eggs of the same kind herself, in the short time of only 25 days, as I have explained heretofore. Well, if we should pick out a queen whose progeny made the thinnest comb, and rear others from her, doing the same thing for several generations, we should probably get bees whose combs would break down by the weight of the honey. In a state of nature this extreme would correct itself, as well as the other; but the point I wish you to see is right here: *Geometrical accuracy in the shape of the cells can never be overdone, and can be reached only by absolute perfection; and this absolute perfection, the bees have been constantly aiming at through endless ages.* Is it any thing strange, my friends, that the bees have got the honey-comb pretty nearly right by this time? I will give you a little story, and one which has been very interesting to me, from page 150, Vol. II., *American Bee Journal*.[108]

If a single cell be isolated, it will be seen that the sides rise from the outer edges of the three lozenges above mentioned, so that there are, of course, six sides, the transverse section of which gives a perfect hexagon. Many years ago, Maraldi, being struck with the fact that the lozenge-shaped plates always had the same angles, took the trouble to measure them, and found that in each lozenge the large angles measured 109°28′, and the smaller 70°32′, the two together making 180°, the equivalent of two right angles. He also noted the fact that the apex of the three-sided cup was formed by the union of three of the greater angles. The three united lozenges are seen in the figure below.

Some time afterward, Reaumur, thinking that this remarkable uniformity of angle might have some connection with the wonderful economy of space which is observed in the bee-comb, hit upon a very ingenious plan. Without mentioning his reasons for the question, he asked Kœnig, the mathematician, to make the following calculation: Given a hexagonal vessel terminated by three lozenge-shaped plates, what are the angles which would give the greatest amount of space with the least amount of material?

Kœnig made his calculations, and found that the angles were 109°26′ and 70°34′, almost precisely agreeing with the measurements of Maraldi. The reader is requested to remember these angles.

Reaumur, on receiving the answer, concluded that the bee had very nearly solved the difficult mathematical problem, the difference between the measurement and the calculation being so small as to be practically negative in the actual construction of so small an object as the bee-cell.



Mathematicians were naturally delighted with the result of the investigation, for it showed how beautifully practical science could be aided by theoretical knowledge; and the construction of the bee-cell became a famous problem in the economy of nature. In comparison with the honey which the cell is intended to contain, the wax is a rare and costly substance, secreted in very small quantities, and requiring much time and a large expenditure of honey for its production. It is, therefore, essential that the quantity of wax employed in making the comb should be as little, and that of the honey which could be stored in it as great, as possible.

For a long time these statements remained uncontroverted. Any one with the proper instruments could measure the angles for himself, and the calculations of a mathematician like Kœnig would hardly be questioned. However, Maclaurin, the well-known Scotch mathematician, was not satisfied. The two results very nearly tallied with each other, but not quite, and he felt that, in a mathematical question, precision was a necessity. So he tried the whole question himself, and found Maraldi's measurement correct—namely, 109°28′, and 70°32′.

He then set to work at the problem which was worked out by Kœnig, and found that the true theoretical angles were 109°28′ and 70°32′, precisely corresponding with the actual measurement of the bee-cell.

Another question now arose. How did this discrepancy occur? On investigation, it was found that no blame attached to Kœnig, but that the error lay in the book of Logarithms which he used. Thus a mistake in a mathematical work was accidentally discovered by measuring the angles of a bee-cell—*a mistake sufficiently great to have caused the loss of a ship whose captain happened to use a copy of the same Logarithmic tables for calculating his longitudes.*

DIFFERENT KINDS OF CELLS IN THE HONEY-COMB.

The bees build two distinct, regular sizes—drone and worker cells. The worker-comb measures very nearly five cells to the inch, on an average. Some specimens average a little larger, and some a little smaller; but when the comb is at all irregular, it is quite apt to be a little larger. The best specimens of true worker-comb generally contain 5 cells within the space of an inch, and therefore this measure has been adopted for the comb foundation.[109] If there are five cells to the inch, a square inch would give, on an average, about 25* cells, and 25 on the opposite side would make 50 young bees that would be hatched from every square inch of solid brood. As foundation is so much more regular than the natural comb, we get a great many more bees in a given surface of comb, and here, at least, we can fairly claim to have improved on nature.

The drone-comb measures just about 4 cells to the inch, but the bees seem less particular about the size of it than with the worker. They very often seem to make the cells of such size as to best fill out a given space: and we, accordingly, find them of all sizes, from worker size all the way up to considerably larger than ¼ of an inch in width. Drones are raised in these extra-large cells without trouble, and honey is also stored in them; but where they are very large, the bees are compelled to turn them up, or the honey would flow out. As the honey is kept in place by capillary attraction, if the cells exceed a certain size, the adhesion of the liquid to the wax walls is insufficient, of itself, to hold the honey in place. Where drones are to be reared in these very large cells, the bees contract the mouth, by a thick rim. As an experiment,

*The exact mathematical calculation make these numbers 29, 29 and 58, respectively, but ordinarily the numbers I have given in the context are more nearly correct.

I had some plates made for producing small sheets of fdn., having only 3½ cells to the inch. The bees worked on a few of these, with these same thick rims, but they evidently did not like the idea very well, for they tried to make worker-cells of some of it, and it proved so much of a complication for their little heads that they finally abandoned the whole piece of comb, apparently in disgust. Bees sometimes rear worker brood in drone-comb, where compelled to from want of room, and they always do it in the way I have mentioned, by contracting the mouth of the cells, and leaving the young bee a rather large berth in which to grow and develop. Drones are sometimes reared in worker-cells also, but they are so much cramped in growth that they seldom look like a fully developed insect.

DRONE-COMB. WORKER-COMB.

Several times it has been suggested that we enlarge the race of honey-bees by giving them larger cells; and some circumstances seem to indicate that something may be done in this direction, although I have little hope of any permanent enlargement in size, unless we combine with it the idea of selecting the largest bees to propagate from, as given a few pages back. By making the cells smaller than ordinarily, we can get small bees with very little trouble; and I have seen a whole nucleus of bees so small as to be really laughable, just because the comb they were hatched from was set at an angle so that one side was concave and the other convex. The small bees came from the concave side. Their light, active movements, as they sported in front of the hive, made them a pretty and amusing sight for those fond of curiosities. Worker-bees reared in drone cells are, if I am correct, sometimes extra large in size; but as to whether we can make them permanently larger by such a course, I am inclined to doubt. The difficulty, at present, seems to be the tendency to rearing a great quantity of useless drones. By having a hive furnished entirely with worker-comb, we can so nearly prevent the production of drones that it is safe enough to call it a complete remedy.

HOW THE BEES BUILD THE COMB.

In this day and age of bees and honey, it would seem that one should be able to tell how the bees build comb, with almost as much ease as they would tell how cows and horses eat grass; but for all that, we lack records of careful and close experiments, such as Darwin made many years ago. In our house-apiary, there are dozens of hives where the bees are building right up close to the glass, at this very minute; and all one has to do, in order to see how it is done, is to take a chair and sit down before them. But the little fellows have such a queer, sleight-of-hand way of doing the work, that I hardly know how they do accomplish it.

In a little work published by Prof. Agassiz, about the year 1867, the renowned naturalist speaks as follows about the way in which bees build honey-comb:

"The bees stand as close as they can together in their hive for economy of space, and each one deposits his wax around him, his own form and size being the mold for the cells, the regularity of which, when completed, excites so much wonder and admiration. The mathematical secret of the bee is to be found in his structure, not in his instinct."

Notwithstanding the promptness with which the folly of such a statement was at once shown up in the bee-journals, it seems it never came to the eyes of Prof. A., or, at least, he never deemed it worthy of notice; for, in 1873, he gave, substantially, the same thing in a lecture at Cambridge, Mass., and it was praised and published in the *Tribune* and other papers, and sent broadcast all over our land. I believe all the bee-journals at once protested against giving the people such "twaddle" (if I may be excused for using the term), as science; but for all that, I think the learned professor never recalled his blunder, or even so much as admitted that he had never seen the inside of a bee-hive at all, but only guessed at it, or repeated what he had been told by some one.

About two years afterward, the great scientist, Tyndall, by some means got an inkling of the way in which Agassiz had "put his foot in it," and, in the *Popular Science Monthly*, wisely admitted that the bees did not stand in the cells to build their comb, but fixed them in this wise: Says he, "The bees place themselves at equal distances apart upon the wax, and sweep and excavate—" etc. Now, if Tyndall is teaching us other things in the same way, i. e., delivering lectures on some subject on which he knows nothing, how much can we depend on any thing he says? Oh why could not he and Agassiz, before attempting to explain the matter to the people, take the time to get a hive of real live bees, as did Darwin, and not be obliged to take any thing at second hand? If they *two* were afraid of stings, any expert honey-raiser could afford them the facilities for a safe observation, and thus prevent their going into such folly, or falsehood, to call things by their right names, for they pretend to have knowledge where they have none. *Take the money and buy a hive of bees*, all ye that thirst for knowledge, and take it direct from God's own works, instead of receiving it second hand.

For particulars in regard to the North Pole, or as to whether the planet Jupiter is habitable, we may be obliged to listen to those who should know better than we do; but in our own industry no such necessity exists, for a swarm of bees is within the reach of all.

When distinguished persons have visited my apiary, I have almost invariably heard them mention the great discovery of Agassiz, in regard to the way in which bees build their comb; and when I explain that it was a great mistake, they usually think that so great a man as Agassiz, and one who always went to the ants and bees with his own eyes, must have been right, and that I had made a mistake somewhere.

I have occupied all this space, my friends, just to give you an illustration of how little *real work* some of the great scientists and lecturers are in the habit of doing, and of the importance of proving things for yourself, with your own eyes and hands.

If we examine the bees closely during the season of comb-building and honey-gathering, we shall find many of them with the wax scales protruding between the rings that form the body, and these scales are either picked from their bodies, or from the bottom of the hive or honey-boxes in which they are building. If a bee is obliged to carry one of these wax scales but a short distance, he takes it in his mandibles, and looks as business like with it thus as a carpenter with a board on his shoulder. If he has to carry it from the bottom of the honey-box, he takes it in a way that I can not explain any better than to say he slips it under his chin. When thus equipped, you would never know he was encumbered with any thing, unless it chanced to slip out, when he will very dextrously tuck it back with one of his fore feet. The little plate of wax is so warm from being kept under his chin, as to be quite soft when he gets back; and as he takes it out, and gives it a pinch against the comb where the building is going on, one would think he might stop a while, and put it into place; but. not he; for off he scampers and twists around so many different ways, you might think he was not one of the working kind at all. Another follows after him sooner or later, and gives the wax a pinch, or a little scraping and burnishing with his polished mandibles, then another, and so on, and the sum total of all these manœuvres is, that the comb seems almost to grow out of nothing; yet no bee ever makes a cell himself, and no comb-building is ever done by any bee while standing in a cell; neither do the bees ever stand in rows and "excavate," or any thing of the kind.

The finished comb is the result of the united efforts of the moving, restless mass; and the great mystery is, that any thing so wonderful can ever result at all from such a mixed-up, skipping-about way of working, as they seem to have. When the cells are built out only part way, they are filled with honey or eggs, and the length is increased when they feel disposed, or "get around to it," perhaps. It may be that they find it easier working with the shallow walls about the cells, for they can take care of the brood much easier, and put in the honey easier too, in all probability; and, as a thick rim is left around the upper edge of the cell, they have the material at hand to lengthen it at any time. This thick rim is also very necessary to give the bees a secure foothold, for the sides of the cells are so thin they would be very apt to break down with even the light weight of a bee. When honey is coming in rapidly, and the bees are crowded for room to store it, their eagerness is so plainly apparent, as they push the work along, that they fairly seem to quiver with excitement; but for all that, they skip about from one cell to another in the same way, no one bee working in the same spot to exceed a minute or two, at the very outside. Very frequently, after one has bent a piece of wax a certain way, the next tips it in the opposite direction, and so on until completion; but after all have given it a twist and a pull, it is found in pretty nearly the right spot. As nearly as I can discover, they moisten the thin ribbons of wax with some sort of fluid or saliva. As the bee always preserves the thick rib or rim of the comb he is working, the looker-on would suppose he was making the walls of a considerable thickness; but if we drive him away, and break this rim, we will find that his mandibles have come so nearly together that the wax between them, beyond the rim, is almost as thin as tissue paper. In building natural comb, of course the bottoms of the cells are thinned in the same way, as the work goes along, before any side walls are made at all; but the manner of thinning the bottoms of the cells in the foundation is quite another thing.

For the consideration of the thickness of combs and how far to space them apart see FIXED DISTANCES; also SPACING OF FRAMES.

HONEY-DEW. This, as its name implies, is a dew that falls during the night, and is sweet like honey; or, at least, a great many claim that it falls like dew in the night, and many have been the learned theories embodied in lengthy papers, to endeavor to account for such a very queer way of doing things, on the part of old dame Nature. It may be that sweet dew does fall from the atmosphere without the agency of aphides, or of any other kind of winged insect; but I, for one, am very much averse to accepting any such theory. Some writers explain it by saying that the leaves of some trees, and possibly the blades of grass, at certain times and seasons when the conditions are all right, distill the sweet matter from their foliage and blades. I like this explanation much better than the former; but, inasmuch as all cases that have come under my observation could be explained by the agency of the aphides (see APHIDES), I much prefer to give them the credit of the whole of this kind of honey. When the dew is found on the grass, in situations where no trees or bushes are near, which, it is said, is sometimes the case, I would suggest that it is exuded by some sort of an insect that, after feeding on green foliage, etc., takes a flight in swarms like mosquitoes, and ejects the sweet fluid in a sort of spray. It may be hard to prove this; but, nevertheless, I think the idea much more tenable than that the honey or saccharine matter evaporates from the flowers, and then falls like dew. Some of the advocates of the latter theory urge that, in boiling the maple sap, a part of the sugar, at least, is evaporated, for it is plainly discernible by the smell in the air.

My friends, you smell the volatile essential oil that gives the maple sugar its agreeable odor, and not the sugar itself floating in the air. You can smell burnt sugar also, it is true; but the volatile part in either case is not sugar; for no skill of the chemist will enable him to condense it from the invisible vapor into sugar once more. When it is possible to volatilize sugar by heat, and then condense it again, I shall believe in a honey-dew distilled from the atmosphere, like the dews of the night. If this were possible we should see our sugar slowly passing away, while exposed to the air, precisely as does the moisture it contains. Experiment shows that sugar may be wet and dried innumerable times, but that, while the water passes off very soon, the full weight of the sugar is invariably left behind.

In support of the exudation theory, I will say that I have many times found a liquid hanging on the leaves of the basswood and some other trees, in the form of a lather, like soapsuds; but although this had a mucilaginous property, I could discover nothing sweet about it. Should nature change the starch it contained into sugar, a very simple and oft-occurring change, we should have honey-dew distilling right from the leaves of the trees; and I have been informed that such has been known to be the case—the leaves of the basswood-trees of the forests have been found dripping with honey. This was during the great honey yield in Minnesota, a few years ago.

In support of the theory that it falls from the air or clouds, it is said that, in the old world, there is a substance called manna[345] (I presume in commemoration of the manna of the Bible), which falls from the air during certain seasons of the year, and that it is gathered and used as food. It has been suggested that this manna is the pollen of a certain kind of tree, which, being light, is carried quite a distance by the wind. Pollen consists, principally, of starch; and a little dampness, such as the dews of night furnish, will frequently convert this starch into sugar in a very few hours. It is possible, that some kinds of honey-dew are the results of the decomposition of pollen, which may become scattered over the grass.

Another source of honey-dew has been recently reported. The following letter very graphically describes the species of bark-louse that produces it:

I send you some honey-dew insects. Last Sunday, I noticed my bees moving over a small poplar (tulip tree), and upon examining it, I found the leaves dripping with honey-dew. Did it exude from the leaves? I saw no living insects, and yet the dew fell in a continuous shower. A closer examination showed me the small limbs covered with scale-like bunches, piled on each other like oyster-shells. One end of the apparent shell or scale is larger and broader than the other, with a slight crease up the middle; about midway up this crease is a small white dot; this dot is a small valve covering a hole through which the honey-dew is thrown by the insect. As I stood and watched, I could see the valve open, a few jets of fluid thrown out, and the valve closed again. This would be repeated every moment or two; and as there are untold numbers of these strange things on the tree, you can have some idea of the amount of dew thrown out. For a whole week now, these insects have been making honey-dew; how much longer they will continue to do so I can't tell, but intend to watch them. I send you some of the insects to-day by mail; if it is any thing new, let us all have the benefit of it. I can not yet believe the "Exudation Theory" of honey-dew, but will wait till I find out more about it.

Jonesboro, Ills., May 26, 1878. M. J. WILLARD.

The scaly little fellows (looking, for all the world, like miniature mud-turtles) that cover the twig sent, I should scarcely have thought of calling insects, had it not been mentioned. They are truly wonderful, and, at least, demonstrate that honey-dew is not the product of any one species of insects.

Prof. Cook gives a very complete history of the insect, with drawings, in the *American Bee Journal* for Sept., 1878. I was at first inclined to think it might be worth while to propagate these insects in localities where pasturage is very scarce in the fall of the year, but friend Cook assures us that they are very destructive to our beautiful tulip or whitewood trees. He has given it the name of *Lecanium Tulipifera*.

In conclusion, I would ask those who come across this wonderful substance, or find the bees working on it, to make careful experiments and examinations. Do not jump hastily at conclusions, but go clear to the top and bottom of things. Many have declared there were no aphides on the trees at all; and one man who had so decided, afterward concluded to climb the tree, and, in its very topmost branches, he found the leaves all alive with a sort of green insect, which was spraying the air with the dew in a manner that made it look like a veritable shower, as the sunlight illumined the scene. Look carefully, and then write me your discoveries.

April, 1880.—We have now fair evidence that the leaves of plants do at times exude honey. See the following, taken from page 587 of Dec. GLEANINGS for 1880:

HONEY FROM THE LEAVES OF THE CATALPA.

I came very near forgetting to tell you about the catalpa-tree. It belongs to the family of *Bignonias*. There are about 6 trees just around me. They are planted for ornament. It was rich in honey this year, both in the blossoms and on the under side of the leaf. At the axis of the main ribs, the leaves are large. The drops would be large enough for two loads, I should judge. And did the bees work on them? I should have been very much pleased could you have stood underneath those trees and heard their merry hum; but you would have had to be up nearly as early as you were on the morning that you found out about the spider-plant. It would have dispelled some people's notions about plants and flowers secreting honey only from the blossoms. It is the last tree to leaf out in the spring.

W. G. SALTFORD.

Poughkeepsie, N. Y., Sept. 28, 1880.

On receipt of the above I wrote friend S. for a leaf, and here is the reply that came with it:

Please find inclosed a part of the leaf I told you secreted the honey. They are a little touched by frost now. Their right color is a deep green.

W. G. SALTFORD.

Poughkeepsie, N. Y., Oct. 18, 1880.

We have the catalpa-tree in our town, but it has, so far as I know, never produced any honey. The above facts, and a host of others, seem to indicate, pretty conclusively, that almost every plant in the vegetable kingdom may, at times, be in a condition to secrete honey[346]; more wonderful still, it may come from the foliage instead of from the blossoms. I have many times seen bees prying around on the under side of leaves of different kinds, as if they were in search of something, or had at some time found something there that they remembered. The leaves sent show a black spot at the place where the large veins branch out. To be sure that there are no microscopic insects that have contributed to the production of the honey, a careful microscopic examination would be well, and I gave the dried leaf to the boys, but they could not detect the remains of any such agency.

HONEY-HOUSES. As much of the value of honey depends upon its care after being taken from the hive, and as very much of our success as honey-producers depends largely upon the facilities we have for accomplishing a large amount of work easily and quickly, it is highly important that we have a honey-house that is well adapted to the storing of honey and combs, and that is convenient as a work-shop. Some most valuable suggestions were made regarding the construction of honey-houses, in GLEANINGS, early in 1883. Among them was an article from G. M. Doolittle, that embodies many of the most practical points to be observed; and his remarks are the more valuable, as they apply to the construction of a honey-house on any plan, or even the fixing-over of some building we may already have in use. Inasmuch as friend Doolittle has been not only one of the largest producers, but also one who has produced some of the finest comb honey, we are very glad to have the following valuable hints from his pen :

I am requested to tell in GLEANINGS how I would build a honey-house; and I see on p. 615, of GLEANINGS for December, that E. T. Flanagan desires a plan for building a house for both comb and extracted honey. In the first place I would say, that I should not want extracted and comb honey, and the necessary work for each, done all in one room. My experience says, have a room for comb honey, one for extracted, and a third room large enough to do all the general work for both. Now, any building can be cheaply lined so as to exclude bees, with half-inch stuff, for this general work-room, and the storage-rooms be built on the south side so as to make them convenient, airy, strong, and sufficiently warm to ripen honey thoroughly. If I were building a shop I should build it so that I could partition off these two storage-rooms, one on the southwest and the other on the southeast corner of the same, having the body of the shop for doing work of all kinds pertaining to the apiary. I should build it two stories, and use the upper story for storing every thing not in use, or liable to be used for some little time. If I did not wish to build a shop I should use any old building I had, lining it and fixing as in the case first given for a room for this general work, for such a room is certainly necessary. It would be *preferable* to have this general room both mouse and rat proof; but if an old building is used it could hardly be expected, without quite an outlay. The two rooms used for storing honey I would have mouse-proof, let it cost what it would, for the filth of vermin about honey is not to be tolerated at all. If mice get into the general room, keep them caught out with traps; and as for the rats, they will not be liable to bother unless you have grain of some kind in your room for them to feed upon, and this, of course, you will not tolerate, for this general room is for bee-fixtures and not for grain.

Having given a little outline of what I would have for a general work-room, I will next speak of a room for storing comb honey. This need not be larger than 8 x 10 for storing all the comb honey from 100 stocks in the spring, even should they produce 200 lbs. per swarm on an average. Whether built in with a shop, or at the side of another building, I should have a wall of mason-work for the sills to rest upon, if drainage could be obtained so the water would not stand under the wall, as in such a case the freezing of the water about the wall would soon destroy it. If I could not dispose of the water I would use abutments. The wall, or abutments, need not be more than a foot high; and if a wall, two or four six-inch square holes should be left at the sides so the air can freely circulate under the floor. If a wall is used, 6x8 inch would be plenty large for the sills, and 8 x 10 in any case; for you will see that the abutments, if such are used, are close together, not more than three feet apart. For sleepers I should use 2 x 8 inch, and place them but 8 inches apart from center to center, having them run the shortest way of the room. Now, don't think this too strong, and place these sleepers further apart; for if you do you will repent when you get from five to ten tons of honey in your room. I would have the room 9 feet high, so the studding (2 x 6 in.) should be that length less your plates (4 x 6 in.), if you build this room separate from your shop. If so built I would have a tin roof, and paint it a dark color; but if in a shop, of course no roof will be needed, as the upper floor will make the roof.

So far I would use good hemlock for the wood employed, for this holds a nail well, is strong, and does not easily decay. For the floor I would use $1\frac{1}{4}$ matched spruce 4 inches wide, and inch pine common ceiling for the sides. If all is put together as it should be, you will not be bothered with mice, providing you keep the door to this room shut when not in use. This door is to be on the side next your general room, of course. I would have a window on one side and one end, which are to be opened in warm dry weather, so as to thoroughly ventilate the room and pile of honey. Over these windows, on the outside, is to be placed wire cloth so the windows can be left open at pleasure without any fears of robber bees. To let the bees out, which may chance to come in on the honey as it is taken from the hive, let this wire cloth run 8 or 10 inches above the top of the window, nailing on strips of lath, or other strips, ⅜ thick, so as to keep the wire cloth out that far from the sides of the building, thus giving space for the bees to crawl up on the cloth to the top when they are on the outside. No robber bee will ever think of trying to get in at this entrance, so your room is kept clean of bees and flies all the while. This completes the building, I believe, except that we want it painted some dark color so that the rays of the sun may keep it as warm as possible. Our door should be in the center of one side, so that on each side of our room a platform can be built, upon which to place our honey. Perhaps all will not agree with me, but I think all box honey should be stored in such a room at least a month before crating, to ripen and sweat out. I know it is a saving of time and labor to crate it at once; but I think it pays for all this extra time and labor, in the better quality and appearance of our product. For the platform, I take pieces of 2x12 plank, and cut them 3 ft. 9 in. long, and spike two pieces together, thus making a stick 4x12x3 ft. 9, using three of these on a side, set the 12-way up, which leaves an alley 2½ ft. through the center of the room. Upon these lay four 3x4 sticks, 8 ft. long (4 on each side). Now lay sticks 2x2x3 ft. 9 across these so your sections will stand on them the same as they did in the hive, and have the ends of the sections meet in the center of these 2x2 sticks. Also by means of strips keep the honey out two inches from the side of the building, so that the air can circulate all around the pile, otherwise that next the sides of the building will sweat so as to become transparent. Also, piled in this way the fumes of burning sulphur can penetrate the whole pile by placing your burning sulphur under the pile.

The room for the extracted honey, I would build of the same width, except that I would have it 14 to 18 feet long instead of 10, so as to give plenty of room. The reason we have our comb-honey room small, is, that we can sulphur our honey in as small a room as possible. I would build both rooms as one, so as to save material, and separate them by a partition so made that the sulphur smoke could not get through. You can store your extracted honey in tin-lined vats made to suit you, in barrels, kegs, or in the 300-lb. tin cans sold by A. I. Root, as preferred. In fact, fix up the inside of this to suit you, as probably nearly all will have their own way. I prefer the A. I. Root cans for storing honey, and the Novice extractor. By placing a cloth over the top of these cans, the honey ripens nicely in this warm room, even if the combs are not fully sealed when extracted.

With a description of how I store my combs, which are used for extracting purposes, I will close this already too long article. As you are building your honey-room, have the studding on one side set just as far apart as the top-bar of your frame is long; not from center to center of studding, but leave that space between each. Now nail strips of ⅝ stuff, 2½ feet long by 5 inches wide to these studding, letting them stand out into the room in a horizontal position. Let the distance between each strip from top to top be 1 inch greater than the depth of your frame, so as to give sufficient room to manipulate the frames handily. Three inches from the ends of these strips run a partition clear across the room, which is to have close-fitting, narrow doors placed in it, spaced so as to be most convenient. Now hang in your combs; see that all combs not in use are in their place, and not lying about somewhere else. As often as any signs of worms are found, put in a pot of burning sulphur; close the doors and the work is done. In all this work with burning sulphur, make certain that nothing can by any means take fire from it before you place the fire to the sulphur, for a room full of sulphur fumes is a bad place to go to, to put out a fire.

Borodino, N. Y., Dec., 1882. G. M. DOOLITTLE.

On page 532, Vol. XV. of GLEANINGS IN BEE CULTURE, will be found another valuable article with diagrams, showing how to make a honey-house and bee-cellar, as devised by Prof. A. J. Cook.

HONEY-PLANTS.—Not every flower that blooms helps to fill up our hives. The beautiful flowers of the garden, made double by cultivating them, yield no nectar at all. They produce no seed, so there is no nectar to invite the bees to come and fertilize them. If you will read the article about pollen you will understand this better. Some yield plenty of pollen with little or no nectar. Some yield immense quantities of honey, but the plants are so few in number that they are not worth considering. The poinsettia is an example. I have seen large drops of nectar on one of these plants, which had evaporated to the consistency of honey; but what does it matter how much honey can be obtained from a single plant, if there are no plants except a single one here and there in a greenhouse? Some yield nectar, but the flowers are so constructed that the honey-bee can not obtain it, although some other insect can.

In spite of all this, the list of flowers that are of more or less value to us is a very large one—so large that it is not desirable to give a full list. Throughout the book, in their proper alphabetical places, will be found some account of the principal plants that specially interest bee-keepers. It may be desirable, however, to be able to tell at a glance what they are, so a list is here given.

Included in the list are the names of some that are sometimes spoken of as honey-plants, but are hardly of sufficient consequence to receive much attention, and hence are not mentioned elsewhere in the book.

Abutilon, or flowering maple. An immense yielder, but of no consequence, because so scarce.

Acacia. South.

Actinomeris Squarrosa, or golden honey-plant.

Alfalfa, or Lucerne (*Medicago sativa*), see ALFALFA.

Alsike, or Swedish clover (*Trifolium hybridum*), see ALSIKE.

Apple (see FRUIT-BLOSSOMS).

Apricot.

Asparagus.

Aster (*Solidago*), see ASTER.

Banana.

Barberry.

Basil, or mountain mint (*Pycnanthemum lanceolatum*).

Basswood, or American linden (*Tilia Americana*), see BASSWOOD.

Bean.

Bee-balm (*Melissa officinalis*).

Beggar-ticks (burr marigold).

Bergamot (*Monarda fistulosa*).

Blackberry.

Black gum. South.

Blackheart.

Black mangrove (*Avicennia tomentosa*). A leading honey-plant in Florida.

Black mustard (*Sinapis nigra*), see MUSTARD.

Black sage.

Bladder-nut.

Blood-root (*Sanguinaria Canadensis*).

Blue-bottle.

Blue gum (*Eucalyptus globulus*). California.

Blue thistle (*Echium vulgare*).

Boneset, or thoroughwort (*Eupatorium perfoliatum*). A honey-plant of considerable importance.

Borage (*Borago officinalis*).

Box-elder, or ash-leaved maple (*Negundo acerodes*). Where plentful, quite important.

Buckbush (*Symphoricarpus vulgaris*), see BUCKBUSH.

Buckeye.

Buckthorn. South.

Buckwheat (*Polygonum fagopyrum*), see BUCKWHEAT.

Burdock (*Lappa major*). Has white pollen.

Burr marigold (*Bidens frondosa*). A near relative of the Spanish needle.

Bush honeysuckle.

Button-bush (*Cephalanthus occidentalis*). Important on the overflowed lands of the Mississippi River.

Butterweed.

Cabbage.

Cabbage palmetto (*Chamærops palmetto*). One of the main sources of honey in the South.

Cardinal flower (*Lobelia cardinalis*).

Carpenter's-square, see FIGWORT.
Catalpa.
Catnip (*Nepeta cataria*).
Chamomile.
Chapman honey-plant (*Echinops spherocephalus*), see CHAPMAN HONEY-PLANT.
Cherry, see FRUIT-BLOSSOMS.
Chicory.
Chinese wistaria.
Chinquapin.
Clover, alsike, see ALSIKE CLOVER.
Clover, red (*Trifolium pratense*), see CLOVER.
Clover, white (*Trifolium repens*), see CLOVER.
Cobœa scandens.
Coffee-berry. California.
Coreopsis, see SPANISH NEEDLE.
Corn, Indian.
Cotton (*Gossypium herbaceum*). South. Some say it compares with clover.
Cow-pea. South.
Crab-apple.
Crocus. Coming so early, it would be an important plant but for its scarcity.
Crowfoot.
Cucumber (*Cucumis sativus*). In the vicinity of pickle-factories this plant yields quite a harvest of honey after clover is over.
Culver's-root.
Currant.
Dandelion (*Taraxacum*).
Elm (*Ulmus*). The elms, where plentiful, are of considerable importance, on account of their aid in early brood-rearing.
Esparcette, or sainfoin (see CLOVER).
False indigo.
Figwort (*Scrofularia nodosa*), see Simpson honey-plant.
Fireweed, or willow-herb (*Epilobium angustifolium*). In newly cleared lands, especially in Northern Michigan, much honey is sometimes obtained from this plant.
Fog-fruit (*Lippia nodiflora*). Valued in California and Texas.
Fruit-blossoms.
Gallberry. South.
Gaura coccinea. Well reported in Arkansas.
Germander, or wood-sage.
Giant hyssop.
Giant mignonnette (*Reseda grandiflora*), see MIGNONNETTE.
Gill-over-the-ground, or ground-ivy (*Nepeta glechoma*), see GILL-OVER-THE-GROUND.
Golden honey-plant (*Actinomeris squarrosa*).
Goldenrod (*Solidago*).
Gooseberry.
Grape.
Ground-ivy, see GILL-OVER-THE-GROUND.
Gumbo, or okra.
Hawthorn.
Hazelnut.
Heal-all, see FIGWORT.
Heart's-ease, large smartweed (*Persicaria mite*). On the overflowed lands of the Mississippi this is a valuable fall flower. The honey is quite light colored, and of good flavor. A peculiarity is, that heating injures it so that it is ruined by the temperature of boiling water.
Heather (*Erica vulgaris*), a prolific source of honey in Europe and British Isles.
Hemp.
Hercules'-club (*Aralia spinosa*).
Honey-locust (*Gleditschia triacanthos*).
Hoarhound (*Marrubium vulgare*). Good yields have been reported from this plant, but so bitter as to be worthless except as a medicine.
Horsemint (*Monarda punctata*).
Indian currant, coral-berry, duckbush (*Symphoricarpus vulgaris*), see BUCKBUSH.
Ironweed.
Japan clover.
Japanese buckwheat, see BUCKWHEAT.
Japan plum. South.
Japan privet.
Judas-tree, red-bud (*Cercis Canadensis*).
June - berry, service - berry, shad - berry (*Amelanchier Canadensis*).
Knotweed.
Lentils.
Linden, see BASSWOOD.
Locust (*Robinia pseudacacia*).
Loosestrife (*Lythrum salacaria*). A good honey-plant, but not plentiful enough to be of much consequence.
Lucerne, see ALFALFA.
Lupine (*Lupinus perennis*).
Madrona.
Magnolia. South.
Malva.
Mammoth red or peavine clover, see CLOVER.
Mangrove. Florida.
Manzanita. California.
Maple. The different maples are of much value, yielding well for early brood-rearing.
Marjoram.
Marsh sunflower.
Matrimony vine *Lycium vulgare*).
Meadow sweet.
Melilot (*Melilotus alba*), see SWEET CLOVER.
Melissa.
Melon.
Mesquit-tree. Texas.
Mignonnette (*Resada odorata*).
Milkweed (*Asclepias cornuti*).
Milk-vetch.
Motherwork (*Leonurus cardiaca*).
Mountain laurel (*Kalmia latifolia*). This plant is famed for yielding poisonous honey that produces severe sickness.
Mustard (*Sinapis arvensis*).
Okra, or gumbo.
Onion (*Allium cepa*). There are reports of yields of honey from fields of onions cultivated for seed, having very strongly the peculiar onion odor, which, however, disappeared after a time.
Orange (*Citrus aurantium*). Considered valuable in some places.
Ox eye daisy.
Palmetto. South.
Parsnip.
Partridge pea (*Cassia chamæcrista*).
Peach
Peavine, or mammoth red clover, see CLOVER.
Pepper-tree. California.
Persimmon.
Phacelia. A beautiful cultivated flower.
Plantain, rib-grass (*Plantago major*). Has white pollen
Pleurisy-root (*Asclepias tuberosa*). This

plant is very highly praised by James Heddon.

Plum.
Poinsettia.
Poplar, see WHITEWOOD.
Prairie clover. Good in Texas.
Pumpkin.
Radish.
Ragweed, see POLLEN.
Rape (*Brassica campestris*).
Ratan.
Rattlesnake-root, or tall white lettuce (*Nabalus Altissimus.*)
Rattleweed, see FIGWORT.
Raspberry.
Red-bud, Judas tree (*Cercis Canadensis*).
Red gum (*Eucalyptus rostrata*. California.
Rocky Mountain bee-plant (*Cleome integrifolia*).
Sage (*Salvia*).
Saw-palmetto. South.
Shad-bush.
Sida spinosa.
Simpson honey-plant, see FIGWORT.
Snap-dragon.
Sneezeweed (*Helenium Autumnale*).
Snowdrop (*Symphoricarpus racemosus*), see BUCKBUSH.
Spanish needle.
Spider-flower (*Cleome pungens*).
Squarestalk, see FIGWORT.
Squash.
St. John'swort (*Hypericum*).
Stone-crop (*Sedum pulchellum*). South.
Strawberry.
Sumac (*Rhus*).
Sunflower (*Helianthus*).
Smartweed, see HEART'S-EASE.
Sorrel
Sorrel-tree, or sorrel-wood.
Sourwood (*Oxydendrum arboreum*).
Sweet clover (*Melilotus alba*), see CLOVER.
Teasel (*Dipsacus*).
Thyme.
Tick seed.
Touch-me-not, or swamp balsam, see POLLEN.
Trefoil, see CLOVER.
Tulip-tree, see WHITEWOOD.
Turnip (*Brassica depressa*).
Valerian.
Varnish-tree. South.
Vervain (*Verbena*).
Vetches.
Viper's bugloss (*Echium vulgare*), see BLUE THISTLE.
Virginia creeper.
Vitis bipinnata. South.
White mustard (*Sinapis alba*).
Whitewood (*Liriodendron tulipifera*).
White sage, see SAGE.
Wild cherry.
Wild rose.
Wild senna.
Wild sunflower.
Wild touch-me-not.
Willow (*Salix*). The willows form a very important class, coming, as they do, early in the season, and yielding both honey and pollen.
Willow herb, see Fireweed.
Wistaria.
Yellow-wood.

HORSEMINT (*Monarda punctata*). This plant was first brought to notice several years ago, and at that time the seeds were sold quite extensively as a honey-bearing plant. It was dropped and almost forgotten, until reports of large crops of honey, said to be from this source alone, began to come in.

HORSEMINT OF TEXAS.

It first attracted attention on the alluvial lowlands bordering on the Mississippi River; afterward, wonderful reports came from it, from different parts of Texas — one man reporting as high as 700 lbs. gathered by a single colony in a single season. The bees that did this wonderful feat were Cyprians, or, at least, crossed with Cyprian blood. The hive in which they stored it was the common Simplicity hive, tiered up four stories high. This great yield of honey was reported during the season of 1882. As the crop seemed almost a total failure in the year 1883, it would seem that the yield is a little uncertain, as with a great many other honey-bearing plants. Considerable talk has been made about raising the plants for honey. One drawback is, that the flavor, and especially when first gathered, is peculiar, and a little unpleasant to most people. After standing several months, however, in an open vessel, protected from the flies (with cheese-cloth, for instance), it parts with its rank flavor, and becomes beautiful-tasting honey, and so clear and limpid that print can readily be seen through a glass jar of it, while the honey is so thick that the jar may be turned over without the honey running. As the plant grows spontaneously in parts of the South in vast beds, acres in extent, it would seem better at the present time for the bee-keeper to move to these localities rather than attempt to raise it further north for honey alone.

HYBRIDS. Everybody who has had Italians very long, probably knows what hybrids are, especially if they have kept bees when the honey-crop was suddenly cut short during a drought in the fall of the year. The term hybrid has been applied to bees that are a cross between the Italians and the common bee.* If one buys an Italian queen that is pure, he can at once set about rearing queens if he chooses, and it matters not how many common bees there are around him; if he rears all his queens as I have directed under ARTIFICIAL SWARMING and QUEEN-REARING, he may have the full benefit of the Italians so far as honey-gathering is concerned, just as well as if there were no other bees within miles of him. This seems a paradox to most beginners, for we have letters almost daily, asking if it will be of any use to purchase Italians, when other bees are kept all around them. If you are keeping bees for the honey they produce, and for nothing else, I do not know but that you are better off with other bees in the neighborhood. The queens that you rear will be full-bloods like their mother; but after meeting the common drones, their worker progeny will of course be half common and half Italian, generally speaking. These are what we call hybrid bees. In looks they are much like the Italians, only a little darker. Sometimes a queen will produce bees all about alike; that is, they will have one or two of the yellow bands,[112] the first and broadest [113] being about as plain and distinct as in the full-bloods. Other queens will produce bees variously striped, from a pure black bee, to the finest three-banded Italians. I have had black queens fertilized by Italian drones, and these seem to be hybrids just the same as the others; I have not been able to distinguish any particular difference.

As honey-gatherers, these bees that have the blood of the two races are, I believe, taking all things into consideration, fully equal to the pure Italians. There are times, it is true, when the full-bloods seem to be ahead; but I think there are other times and circumstances when the taint of black blood gives an advantage in respect to the amount of honey gathered, that will fully make up the difference; and I would therefore say, if honey is your object and nothing else, you are just as well off to let your queens meet just such drones as they happen to find. Why, then, do hybrid queens find slow sale, at about one-fourth of the price of pure Italians? Just because of their excitability and vindictive temper.[114]

Italians, as they generally run, are disposed to be quiet and still when their hive is opened, and to remain quietly on their combs while they are being handled, showing neither vindictiveness nor alarm. Black or common bees, on the contrary, are disposed to be frightened, and either make a general stampede, or buzz about one's head and eyes in a way quite unlike the Italians. The Italians do not stand still because they are afraid to make an attack, for, let a robber approach, and they will sting him to death in a way so cool as to astonish one who has seen only common bees under similar circumstances. A race of bees so prompt to repel intruders of their own kind, it would seem, would also be prompt to repel interference from man; but such is not the case. They do not seem to be at all suspicious when their hive is opened, and a frame lifted out. Well, these half-bloods inherit the boldness of the Italians, and, at the same time, the vindictiveness of the blacks. And to raise the cover to a hive of hybrids, without smoke, during a scarcity of honey, would be a bold operation for even a veteran. Without any buzz or note of alarm, one of these sons of war will quietly dart forth and inflict his sting before you hardly know where it comes from; then another, and another, until, almost crazed with pain, you drop the cover, and find that they are bound to stick to you, not only out into the street, but into the house or wherever you may go, in a way very unlike either pure race of bees. Sometimes, when a hive is opened, they will fix on the leg of one's trowsers so quietly that you hardly dream they are there, until you see them stinging with a vehemence that indicates a willingness to throw away a score of lives if they had so many. This bad temper and stinging is not all; if you should desire to introduce a queen or queen-cell to these bees, they would be very likely to destroy all you could bring; while a stock of either pure race would accept them without trouble. During extracting time, or taking off surplus honey, you will find little trouble, providing you work while honey is still coming; but woe betide you, if you leave it on the hives until the yield is passed.[116]

In preparing hybrid stocks for wintering, I have seen them so cross that it was almost impossible to get in sight of the hive, after they had once got roused up; and when I charged on them suddenly with smoker in excellent trim, they charged on me as suddenly, took possession of the smoker, buzzed down into the tube in their frantic madness, and made me glad to beat a retreat, leaving them in full possession not only of the "field," but the "artillery" as well. This was a very powerful colony, and they had been unusually roused up. Although it was quite cool

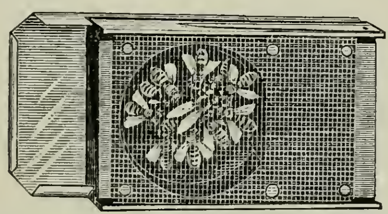
*For test as to what constitutes a hybrid, see ITALIAN BEES weather, they hung on the outside of the hive, watching for me, I suppose, until next morning. I then came up behind them with a great volley of smoke, and got them under and kept them so, until I could give them chaff cushions, and put them in proper wintering trim. The queen was extremely prolific, and I do not know that I ever had one single queen that was the mother of a larger family of bees. Many of these hybrid queens are extraordinarily prolific.

I believe the hybrids are more disposed to rob than the Italians, but not as much so as the common bees. I decide thus, because, when at work among them, the bees that buzz about the hives, trying to grab a load of plunder if a chance offers, are almost invariably full-blood blacks.[117] They may have a dash of hybrid blood, but I judge not, because the hybrids and Italians will often be at work when the blacks are lounging about trying to rob, or doing nothing. I have known a strong hybrid stock to be slowly accumulating stores in the fall, when full-bloods, in the same apiary, were losing day by day. See ITALIAN BEES.

A PART OF J. M. MERCHANT'S APIARY BY BAPTIST CHURCH, WARREN, RHODE ISLAND.

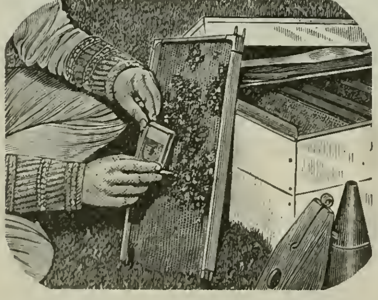
I.

INTRODUCING QUEENS. As a general thing, those who send out queens send along directions for introducing with the cage; but it may be well here to discuss some of the general principles recommended by the best breeders of queens, as well as to take a glance at some of the mailing-cages that are also adapted to introducing. The first cage to which I would call attention—not because it is the best, but because it has been used very largely both as a shipping and mailing cage—is called the Peet cage.



PEET INTRODUCING AND SHIPPING CAGE.

This cut shows a large flat cage, the large hole being 2 inches in diameter. Communicating with this are two smaller ones one inch in diameter, which are to hold the Good candy (see CANDY). One side of the cage is covered with wire cloth, and the other has a movable tin slide. A wooden cover protects the wire cloth while en route in the mails. To introduce, a couple of tin points attached to the diagonally opposite corners are revolved at right angles, and the same are then pushed through the



comb, as shown in the accompanying engraving, the bees having been previously brushed away. After the Peet cage has been anchored, the tin slide is drawn out, leaving the queen and bees caged upon the cells of honey, and brood. This is quite an advantage. If the queen arrives feeble or weak, she is immediately placed upon cells of honey, and protected from any hostile bees. In 24 or 48 hours the bees will gnaw her out, that is, release her automatically. This they do by cutting away the comb on the under side of the cage. About that time the bees are ready to accept her, in 99 cases out of 100.

For an introducing-cage we could not ask for any thing better; but there was one great objection to it, and that was, that it was not a very good *mailing*-cage. From 10 to 25 per cent of the queens would fail to arrive at their destination alive. This was too large a percentage to lose. The trouble was, the compartment shown in the engraving above, 2 inches in diameter, was too large, and the tin slide was cold, and a poor place for bees to cling to during the rough handling in the mails. Every time the mail-bag was thrown out of the car, the bees in the cage would receive quite a concussion, especially those that happen to be standing upon the tin. The remedy, then, seems to be to do away with the tin slide, and reduce the size of the hole to about an inch or less in diameter, and, to maintain sufficient capacity, increase the number of holes. This was very successfully accomplished in the Benton cage, a cut of which is appended below.

THE BENTON SHIPPING AND MAILING CAGE.

This cage was first introduced to the public in 1883 by Frank Benton, formerly of Munich, Germany, and was devised by him solely for the purpose of sending queens across the ocean to the United States by mail; and, furthermore, it is used by him for that purpose with remarkable success. As originally made by him it could not be used for introducing; but we have modified it, as will presently be explained, for that purpose. The queen breeders of this country have now tested it for long distances in shipping queens. In our queen-breeding department we use it successfully for sending queens across the continent—nay, even across the ocean, clear to the other side of the globe. We have sent queens in it by mail to Australia, New Zealand, and the West Indies, with entire success. In the first instance, the queens were on their journey 37 days. They arrived in good order, and were successfully introduced. The great secret of success lies in the fact that, with the exception of the wire cloth, it is constructed entirely of wood. The compartments are small. The end hole is filled with Good candy (see CANDY). The two other holes are used for the occupancy of the bees. The middle one has no communication with the outside air, except by means of the end hole, which has a saw-kerf in one side for ventilation. When queens are sent by mail over the Rocky Mountains, they encounter for a few hours a very low temperature, and the bees and their attendants can seek the center hole, which is warmer than the end one. When the bees arrive in a warmer climate they can seek the end hole, which is well ventilated. The cage is, therefore, to a certain extent, climatic.

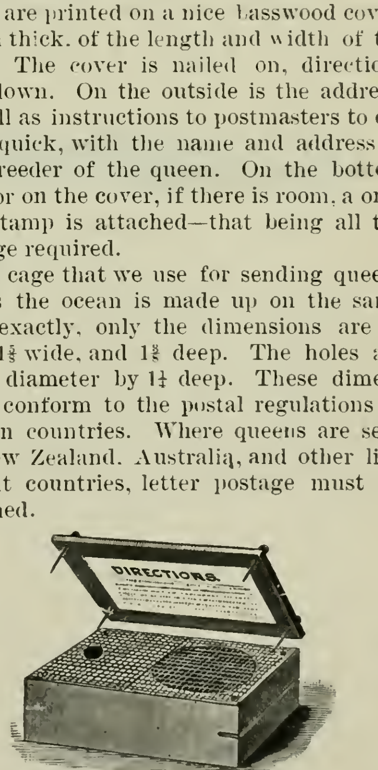
There are two or three sizes of Benton cages, the smallest size being used for ordinary distances, say a thousand miles; the medium size for two or three thousand miles, and the largest size for trips across the ocean or to the islands of the sea. The small size is the one that is used most. It is 3½ inches long, 1¼ wide, and ½ thick. Into it are bored, with a suitable bit, three one-inch holes, $\frac{7}{16}$ deep. These holes should be bored with a bit without any spur to it. These can be obtained, usually, at almost any of the hardware stores. The two end holes are bored just close enough to the center hole to leave an opening, as shown in the engraving.

To prepare for mailing, one of the end holes is filled with the Good candy, as explained under CANDY. This should be made just right Now all, except the end hole, with a saw cut in it, is covered with a piece of paraffine paper. The object of this is twofold—to prevent the honey evaporating from the candy, or running out and soiling the contents of the mail-bag, and to make the center hole as warm as possible. Wire cloth, 3 inches long and 1½ wide, covers the whole. One end—the end that covers the candy—has a hole in it ⅜ inch in diameter. To make a nice job, take a ⅜-in. piece of iron or steel, 2 or 3 inches long, and point it about like a leadpencil (a hard-wood bodkin of the same shape and size will answer for a while). Introduce the point of this tool into one of the meshes, near the end of the wire cloth, and worm it through, when you will now have a nice round hole.

To introduce, after receiving it in the mail, the wooden cover is pried off and the cage is laid upon the top of the frames. The bees will eat out the candy, and in 24 or 48 hours they will release the queen. The means of introduction is, therefore, automatic, without any assistance from the apiarist, and without disturbance, so detrimental to successful introducing.

The substance of the directions above given are printed on a nice basswood cover, ⅛ inch thick, of the length and width of the cage. The cover is nailed on, directions side down. On the outside is the address, as well as instructions to postmasters to deliver quick, with the name and address of the breeder of the queen. On the bottom side, or on the cover, if there is room, a one-cent stamp is attached—that being all the postage required.

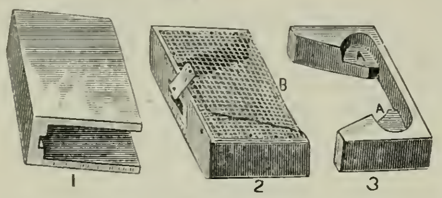
The cage that we use for sending queens across the ocean is made up on the same plan exactly, only the dimensions are 4⅝ long, 1⅝ wide, and 1⅜ deep. The holes are 1⅜ in diameter by 1¼ deep. These dimensions conform to the postal regulations of foreign countries. Where queens are sent to New Zealand, Australia, and other like distant countries, letter postage must be attached.



JENKINS' CAGE.

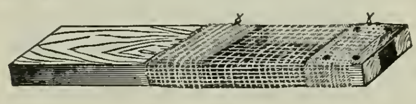
The accompanying engraving illustrates the cage used by J. M. Jenkins. It has the same general features about it, only it has one hole instead of three. The method of introducing is the same. This goes for one cent postage; and, perhaps, for short distances it will do as well as the Benton.

There is another cage which deserves at least a passing notice, although it is not used very largely as yet. The accompanying engraving will make the plan of the cage self-explanatory.



MORRISON'S CAGE.

This is considerably more expensive than the Benton, and is not as well adapted to sending queens long distances, although perhaps better for introducing. To introduce, remove the cage proper from the wooden case. Revolve the tin slide at right angles, and set the cage down between the combs. As with the Benton, the bees eat the candy out, and release the queen automatically.



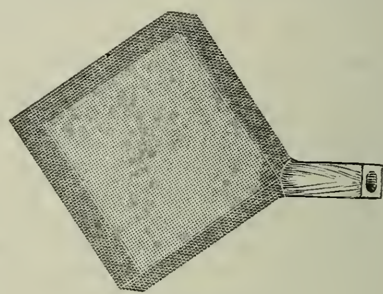
MILLER'S INTRODUCING-CAGE.

It is very convenient to have in the apiary small cages for introducing, as well as for caging and holding queens that come out with swarms until they can be introduced or disposed of. The one above illustrated is, perhaps, as good as any. In fact, if the apiarist is in a hurry all he has to do is to slide this in at the entrance, without even removing the cover of the hives, and the bees will release the queen by the candy method. I copy its manner of construction from Dr. Miller's own words:

Take a block 3 inches long, 1¼ wide, and ⅜ thick; two blocks 1 inch by 7/16x⅜; two pieces of tin about an inch square; a piece of wire cloth 4½x3½; two pieces of fine wire about 9 inches long, and four small wire nails ½ or ⅝ long. That's the bill of material. Lay down the two small blocks parallel, ⅜ of an inch apart, one piece of tin under, and one over them. Nail together and clinch. These two blocks, being ⅜ inch apart, make the hole to fill with Good candy, through which the queen is liberated. A good way to make sure of having this hole all right is to lay between the two blocks, when nailing, a third block ⅜ square. Put this nailed piece at the end of the large block, and wrap the wire cloth around it, letting it come flush with the end of the small piece, and it will come within about half an inch of the end of the large piece. Wind one piece of wire within about a quarter of an inch of one end of the wire cloth, and fasten by twisting, and wind the other wire at the other end. Play the large block back and forth a few times, so it will work easily in the wire cloth, and trim off the least bit of the corners at the end of the block so it will enter easily. To provision it, let the large block be pushed clear in; fill the hole with candy, and tamp it down. When to be used, after putting in the queen, push the block in far enough to allow the queen a room about 1½ inches long. After the bees have had it for some time it will be so glued that the plug must be scraped off before using again.

Another excellent introducing-cage is the one devised by J. F. McIntyre. As to how it is managed, I copy from Mr. McIntyre's article in GLEANINGS IN BEE CULTURE, page 880, 1890:

I take a piece of wire cloth 5½ inches square, cut little pieces ¾ of an inch square out of each corner, and bend the four sides at right angles, making a box 4 inches square and ¾ inch deep. In one corner I fasten a tube of wood or tin ½ inch in diameter, and two inches long, which is filled with Good candy, for the bees to eat out and liberate the queen.



MCINTYRE'S CAGE.

I use this cage altogether in my apiary, for changing laying queens from one hive to another. I kill my old queens when they are two years old, and introduce young laying queens in their place. My practice is to go to the nucleus with the young laying queen; lift out the comb with the queen on, and press one of these cages into the comb over the queen, and what bees may be around her. Carry this comb to the hive with the old queen; find and kill the old queen, and place the comb with the young queen caged on it in the center of the hive, taking one comb from the hive back to the nucleus. In a week I go and take the cage out and find the young queen laying. When I receive a valuable queen from a distance I liberate her at once on a comb of hatching brood, with some young bees; and when she commences to lay I introduce her as above.

Fillmore, Cal., Oct. 21. J. F. MCINTYRE.

The great feature of this cage is, that it can be set right down over a nice queen, and the whole carried, comb and all, to a hive where you wish to introduce the queen.[349] Her laying can go right on without let or hindrance, just the same, until the bees have eaten her out and released her.

HOW TO TELL WHETHER A COLONY IS QUEENLESS OR NOT.

Having discussed mailing and introducing cages, it may be pertinent at this point to give one of the prime essentials to successful introducing. The very first thing to be determined before you attempt to introduce at all, is that your colony is *certainly* queenless. The fact that there may be no eggs nor larvæ in the hive, and that you can not find the queen, is not sufficient evidence that she is absent, although this state of affairs points that way. But during the earlier part of the summer there should be either brood or eggs of some kind if a queen is present. Yes, there should be eggs or brood clear up until the latter part of summer. In the early fall, queens very often stop laying, and shrivel up in size so that a beginner might conclude that the colony is queenless, and therefore he must buy another. In attempting to introduce the new queen, of course he meets with failure, and the new arrival is stung to death, and probably carried out at the entrance. As a general thing, if you can not find eggs or larvæ at that season of the year when *other* stocks are breeding, and the supposedly queenless colony build cells on a frame of unsealed larvæ that you give them, you may decide that your colony is surely queenless, and it will be safe then to introduce a new queen. If you find eggs, larvæ, and sealed *worker* brood, the presence of queen-cells simply indicates that the bees are either preparing to supersede their queen, or making ready to swarm. See SWARMING.

HOW LONG SHALL A COLONY BE QUEENLESS BEFORE ATTEMPTING TO INTRODUCE?

The worst colony to introduce a laying queen to is one that has been queenless long enough so that there is a *possibility* of one or more virgin queens being in the hive. It is hard to decide definitely in all cases when such colonies are queenless. The young virgins, after they are three or four days old, are very apt to be mistaken for workers, especially by a beginner. It is not always practicable to wait until they will build queen-cells, especially if you happen to have a nice surplus of laying queens which you wish to find room for. We prefer colonies that have not been queenless more than a couple of days—just long enough to see cells start, and just long enough so the bees begin to recognize their loss, but not long enough for them to get cells under way. Cells nicely started or capped over are quite apt to make the colony act as if it wanted something of their own; and when a laying queen is introduced to them they take a notion sometimes that they *won't* have a strange mother.

WHAT TO DO IF BEES BALL THE QUEEN.

When we introduce queens in the old-fashioned way—that is, before cages were constructed so as to release queens automatically, we used to experience much trouble by bees balling queens. If the bees were not ready to accept her when she was released by the apiarist, they were pretty apt to ball her. But here is a point that it is well to observe: When the *bees* let the queen out they will rarely ball her. But when it is necessary for the *apiarist* to release the queen, the opening of the hive, accompanied by the general disturbance, is apt to cause the bees to ball her as soon as she is released. Well, suppose they do ball her. Lift the ball out of the hive and blow smoke on it until the bees come off one by one. When you can see the queen, get hold of her wings and pull the rest of the bees off from her by their wings. Do not be nervous about it, and you can get her loose and cage her again. Put more candy in the opening, and give her another trial. Some one — I do not remember who — advised dropping the queen, when she is balled, into a vessel of water. The angry bees will immediately desert her, when the queen can be easily taken out of the water, and recaged. We have never tried it, but I believe we should prefer the method we first described.

WHAT TO DO WHEN THE QUEEN FLIES AWAY.

Sometimes a beginner is very nervous, and by a few bungling motions may manage to let the queen escape from the hive where he expects to introduce her. Or this may happen: The queen may take wing right off from the frame—become a little alarmed because there are no bees about her, and fly. In either case, step back immediately after opening the hive, and in fifteen or twenty minutes she is quite likely to return to the same spot, and you must not be surprised if you find her again in the hive. If you do not discover her in the hive near where you are standing, in about half an hour look in other hives near by. If you see a ball of bees somewhere down among the frames, you may be quite sure that she is the queen that flew away, and that she has made a mistake, and entered the wrong hive.

WHAT TO DO WHEN A COLONY REFUSES TO ACCEPT A QUEEN.

Immediately after the honey season the bees are apt to be out of sorts with everybody and with every thing; and at such times it is pretty hard to make them accept a queen. If the ordinary methods fail, give them a little tobacco smoke—just enough to intoxicate them a little. This gives all one scent—including the queen—so much so that they do not know which from t'other. But immediately after smoking them you must be careful that no robbers get started; for, after being intoxicated with tobacco, robbers can get in and steal every bit of honey they have, and they will make almost no resistance. Tobacco seems to have the property of taking the fighting disposition out of them. I remember one year we received an importation of fifty queens. Half of them were given to neighbor H. to introduce, while we retained the other half. Neighbor H. had entire success in introducing all of his, while we lost some four or five of ours. We used the same methods, and our colonies were all queenless not over three or four days. The difference was, that Mr. H. used a little tobacco smoke on every queen he attempted to introduce, while we used none. But while tobacco may sometimes be used advantageously in the apiary I do not wish any of our readers to understand that I am a user of it, or that I recommend it for any human being for use on himself. It is a bad poisonous weed, but sometimes bad things have a legitimate use.

A SURE WAY OF INTRODUCING.

There is one perfectly sure way of introducing a very valuable queen, such as an imported one, if we only observe the conditions carefully. Remove frames of hatching brood from several hives, and shake off every bee; put these in an empty hive, closing it down to a small space: and if the weather is not very warm, place the whole in a warm room; let the queen and her attendants loose in this hive, and the young bees, as they hatch out, will soon make a swarm. As several who have tried this plan have been so careless as to leave the entrance open and let the queen get out, I would warn you, especially, to have your hive so close that no bee can by any possibility get out.* If the frames you have selected contain no unsealed brood, you will have but little loss; but otherwise, the larvæ, having no bees to feed them, will mostly starve. As soon as a few hundred bees are hatched, the queen will be found with them, and they will soon make a cluster; if the combs have been taken from strong colonies, where the queen is laying hundreds of eggs in a day, in a week or two the swarm will be a very fair one. Three frames will do very well at first, and one or two more may be added in the course of a week or more. Remember, *no live bee* is to be given to the queen. A queen is seldom lost by the first plan given, if you are careful, and watch them until they are safely received.

*They can be set out and allowed to fly in two or three days.

HOW SOON SHOULD AN INTRODUCED QUEEN BEGIN TO LAY?

As a general thing, we may expect her to begin laying next day; but sometimes, especially if the queen has been a long time prevented from laying, as in the case of an imported queen, she may not lay for three or four days, or even a week. If introduced in the fall of the year, she may not commence laying at all until spring, unless the colony is fed regularly every day for a week or more. This will always start a queen that is good for any thing.

INVERTING. See REVERSING.

ITALIAN BEES. At present, the Italians are by far the most profitable bees we have; and even the hybrids have shown themselves so far ahead of the common bee that I think we may safely consider all discussions in the matter at an end. Many times we find colonies of hybrids that go ahead of the pure stock; but as a general thing (taking one season with another), the pure Italians, where they have not been enfeebled by choosing the light-colored bees to breed from, are ahead of any admixture. There has been a great tendency with bees, as well as other stock, to pay more attention to looks than to real intrinsic worth, such as honey-gathering, prolificness of the queens, hardiness, etc.; and I think this may have had much to do with the severe losses we have sustained in winters past. Since the recent large importations of queens direct from Italy, and a disposition to be satisfied with bees that are not all golden yellow, we have certainly met with much better success in wintering as well as honey-gathering.

Even if it were true, that hybrids produce as much honey as pure Italians, each beekeeper would want at least one queen of absolute and known purity; for although a first cross might do very well, unless he had this one pure queen to furnish queen-cells he would soon have bees of all possible grades, from the faintest trace of Italian blood, all the way up. The objection to this course is, that these blacks, with about one band to show trace of Italian blood, are the wickedest bees to sting that can well be imagined, being very much more vindictive than either race in its purity; they also have a very disagreeable way of tumbling off the combs in a perfectly demoralized state, whenever the hive is opened, except in the height of the honey-season, and of making a general uproar when they are compelled, by smoke, to be decent. In attempting to introduce some queens to hives of this class, a few days ago, they uncapped nearly all the honey in the hive, and gorged themselves every time I looked them over. The consequence was, that, after they had been looked over several times for their queen, queen-cells, etc., a large part of their winter stores was uselessly consumed; for the honey they had gorged themselves with started them to building comb at a season when it was not wanted, and so stirred them up that they were boiling out at the entrance at a time when "honest bees" should have been snugly tucked away in their winter doze.

Our pure Italian stocks could have been opened, and their queens removed, scarcely disturbing the cluster, and, as a general thing, without the use of any smoke at all, by one who is fully conversant with the habits of bees. Neither will this class of hybrids repel the moth, as do the half-bloods and the pure Italians. For these reasons and several others, I would rear all queens from one of known purity. If we do this, we may have almost if not quite the full benefit of the Italians as honey-gatherers, even though there are black bees all about us.

Suppose you get an imported queen, and rear queens from her eggs for all your other hives, and all increase you may have during the first season. None of your worker-bees, the next season, will be less than half bloods, and all your drones will be full-bloods. See Drone and Queen. The queens that are reared now, will, many of them, prove pure; and by persistence in this course, year after year, Italians will soon be the rule instead of the exception. This is no theory, but has been the result, practically, in hundreds of apiaries.

Now this is all very clear, plain sailing; but we must take into consideration that our drones are all the time meeting the queens from our neighbors' hives, and from the forests. This will have no other effect the first season than to produce hybrid workers, without changing the drone progeny; but when these hybrid stocks begin to send out swarms, these swarms will furnish hybrid drones, and soon will come all sorts of mixtures.

Well, we shall have to let them mix, I suppose, and I do not know that it does any particular harm, for any admixture of Italian blood improves the common stock.

But if we are going to buy or sell bees, we want to know what to charge for them, and also what to sell them for; we also wish to know which queens to remove, when we are Italianizing our apiary throughout; hence it becomes very important to know which are Italians and which are not. To be candid, I do not believe it is possible *always*, to tell; but I think we can come near enough for all "practical purposes," as they say in making astronomical computations.

The queens, and drones from queens obtained direct from Italy, vary greatly in their markings, but the worker bee has one peculiarity that I have never found wanting; that is the three yellow bands we have all heard so much about. Unfortunately, there has been a great amount of controversy about these yellow bands; and to help restore harmony, I have been to some expense for engravings. As is often the case, I failed to get our city friends to understand just what I wanted the engraving for, so we have made a sketch of the body of the bee ourselves, as shown on next page.

Every worker-bee, whether common or Italian, has a body composed of six scales, or segments, one sliding into the other, telescope fashion. When the bee is full of honey these segments slide out, and the abdomen is elongated considerably beyond the tips of the wings, which are ordinarily about the length of the body. Sometimes we see bees swollen with dysentery, so much that the rings are spread to their fullest extent, and in that condition they sometimes would be called queens, by an inexperienced person.

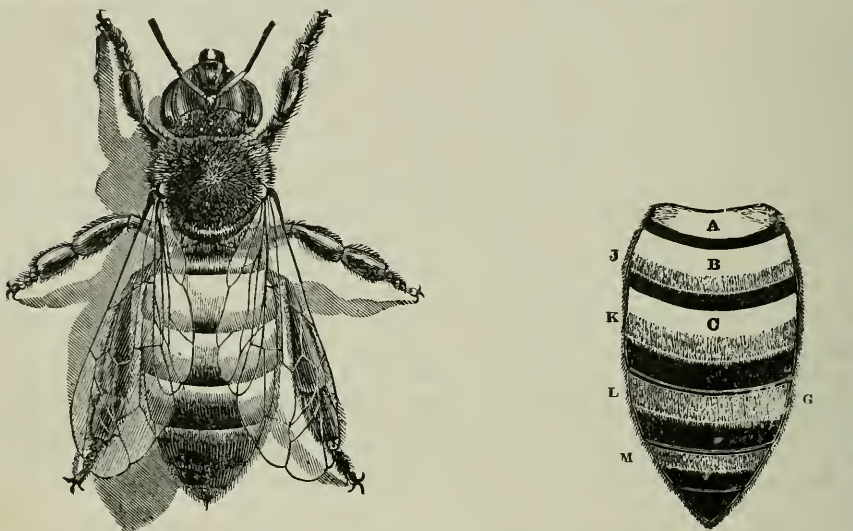
On the contrary, in the fall of the year when the bee is preparing for his winter nap, his abdomen is so much drawn up that he scarcely seems like the same insect. The engraving on the right shows the body of the bee detached from the shoulders, that we may get a full view of the bands or markings that distinguish the Italians from the common bees. Now I wish you to observe particularly, that all honey-bees, common as well as Italian, have four bands of bright-colored down, J, K, L, M, one on each of the four middle rings of the body, but none on the first, and none on the last. These bands of down are very bright on young bees, but

 ITALIAN BEES.

may be so worn off as to be almost or entirely wanting on an old bee, especially on those that have been in the habit of robbing very much. This is the explanation of the glossy blackness of robbers often seen dodging about the hives. Perhaps squeezing through small crevices has thus worn off the down, or it may be that pushing through dense masses of bees has something to do with it; for we often see such shiny black bees in great numbers, in stocks that have been nearly suffocated by being confined to their hives, in shipping, or at other times. These bands of down differ in shades of color, many times, and this is the case with the common bee, as well as with the Italian.

Under a common lens, the bands are simply fine soft hair, or fur, and it is this principally which gives the light-colored Italians their handsome appearance. You have, perhaps, all noticed the progeny of some particular queen when they first came out to play, and pronounced them the handsomest bees you ever saw; but a few months after, they would be no better looking than the rest of your bees. This is simply because they had worn off their handsome plumage, in the " stern realities " of hard work in the fields. Occasionally you will find a queen whose bees have bands nearly white instead of yellow, and this is what has led to the so-called albino bees. When the plumage is gone, they are just like other Italians. Now, these bands of down have nothing to do with the yellow bands that are characteristic of the Italians; for, after this has worn off, the yellow bands are much plainer than before. A, B, C, are the yellow bands of which we have heard so much, and they are neither down, plumage, nor any thing of that sort, as you will see by taking a careful look at an Italian on the window. The scale, or horny substance of which the body is composed, is yellow, and almost transparent, not black and opaque, as are the rings of the common bee, or the lower rings of the same insect.

The first yellow band, A, is right down next the waist; now look carefully. It is very plain, when you once know what to look for, and no child need ever be mistaken about it.



HOW TO TELL HYBRIDS FROM PURE ITALIANS.

At the lower edge is the first black band; this is often only a thin sharp streak of black.

The second, B, is the plainest of all the yellow bands, and can usually be seen in even the very poorest hybrids. The first band of down is seen where the black and yellow join, but it is so faint you will hardly notice it in some specimens.

We have at the lower edge of the scale, as before, a narrow line of black; when the down wears off, this shows nearly as broad as the yellow band.

Now we come to disputed ground; for the third band, C, is the one about which there is so much controversy. Some contend that a pure Italian should show it whether he is filled with honey or not; others, among whom was our friend Quinby, admit that a part of the bees would show it only when filled with honey. Now there are, without doubt, hives of bees that show this third band at all times, but it is pretty certain that a small part of the bees of Italy do not. The conclusion, then, is that all the bees of Italy are not pure. Now, I think we should be careful about going to extremes in these matters, for it is honey, and not yellow bands, that is the vital point. The bees from Italy are better honey-gatherers, etc., than ours are; and if we import from Italy, I think we should be satisfied to get such as they have, especially so far as the markings are concerned.[128] My advice is just this: If you are undecided in regard to a queen, get some of the bees that you are sure were hatched in her hive, and feed them all the honey they can take; now put them on a window; and if the band C is not plainly visible, call them *hybrids*. I advise you to put them on the window, because you may mistake the band of down, which is often very plain and yellow, for the permanent yellow band, C. Now, the bees from Italy are not all alike, and the yellow bands have different shadings, as well as the bands of down; but they are always found there, so far as my experience goes, if examined with sufficient care.

When we come to hybrids, we shall find a greater diversity; for while the bees from one queen are all pretty uniformly marked with two bands, another's will be of all sorts; some beautifully marked Italians, some pure black, others one or two banded. Some will sting with great venom, while others with only one or two bands will be as peaceable as your best Italians. Without a doubt, many queens have been sent out as pure, that produced only hybrids; but since my recent studies in the matter, I am pretty well satisfied that I have sold several queens as hybrids, that were really full-bloods. A very slight admixture of black blood will cause the band C to disappear on some of the bees,[130] but we should be very careful in such matters to be sure that the bees in question were really hatched in the hive; for bees of adjoining hives often mix to a considerable extent. If you examine a colony of blacks and one of hybrids that stand side by side, you will find many Italians among the blacks, and many blacks among the Italians. Take young bees that you are sure have hatched in the hive, and you will be pretty safe, but you can not readily distinguish the third band until they are several days old.

FOUR AND FIVE BANDED ITALIANS.

In 1890 and the present year ('91) there is quite a rage for four and five banded Italians. These are nothing more nor less than Italians bred for *bands* by selection. For instance, you may take a lot of black fowls, and from one having a few white feathers you may, by selection, breed fowls that are entirely white, at each generation selecting the whitest fowls to breed from. Some Italians show a tendency toward the fourth band. Perhaps some of the daughters of the mother of these bees will show in their bees a *greater* tendency toward the fourth band. Again, you breed from the last-named queen, and select from her another breeding queen whose bees show quite clearly the fourth band with a glimmering of the fifth. By continued selection you may be able to get the fifth. But after all, when you have bees with four and five yellow bands, you have bees for color and not for business.[129] It is possible to develop any trait that you may wish to have characteristic in your bees. In the same way it is possible to breed bees that are very energetic. But as a general rule you will have to lose sight of fancy colors. Mr. A. E. Manum, of Bristol, Vt., has, by careful selection, reared a very hardy race of bees for wintering, and they are also extra honey-gatherers, but these bees are leather-colored—that is, the yellow bands are not strikingly prominent. It *may* be possible to secure both beauty and utility, but the tendency in such breeding is to ignore utility and run for exhibition bees.

HOLY-LAND AND CYPRIAN BEES.

In 1882 considerable excitement arose over two new races of bees brought over from the Old World by our most enterprising and philanthropic friend D. A. Jones. of Beeton, Ontario, Canada. They are called Cyprian and Holy-Land bees, from the places where he found them. The former, from the Isle of Cyprus, seem to have been for many years isolated, and are a very distinct and uniform race. I at first glance called them very nice Italians; and after seeing them the third season, I am strongly tempted to call them very nice Italians still. They have a few distinctive marks that enable an expert to distinguish them, however, and their traits of temper are also different. I believe they have been mostly objected to on account of the vindictive temper displayed by the progeny of some of the queens. We had handled them in our apiary several months before I discovered any difference; but on opening the hive one day toward dusk, and being a little careless in handling the frames, I found I had a job on my hands (or, rather, in my face and hair)—a lot of enraged bees that even smoke did not bring into subjection. The Holy-Lands seem quiet enough, and the queens are enormously prolific; but for some reason or other, at the present writing quite a number of the friends are getting rid of them, and going back to the Italians again, as more gentle. The queens are exceedingly prolific, generally filling one frame complete with eggs before beginning on another, giving, when sealed, a solid mass of brood. If in any case a Holy-Land colony becomes queenless they will build a number of cells, exceeding by far that of any other known race. The queens that hatch from these are as strong and robust; we have had them fly[131] immediately on emerging from the cells.[350] One of their peculiar characteristics is, that the cells all hatch at or about the same time. Several years ago we had twenty-five queens hatch within thirty minutes from one frame. Other cases of like nature have been reported. Now, the fact that the Holy-Lands will raise such an abundance of cells is of great value to queen-breeders. For instance, if we desire a great quantity from some choice Italian stock, we can exchange their unsealed larvæ for that of a queenless Holy-Land colony. The stock, if left to itself, would probably not raise over six or eight cells[351]; whereas the Holy-Lands would very likely raise five or possibly ten times that number. Thus we greatly reduce the number of cell-raising colonies required, at the same time allowing the rest to go on with their regular work.[132] In fact, we can use them much as poultry-breeders use a few select sitting hens for raising the young chicks from non-sitters.

ITALIANIZING. Few questions are asked oftener than, "How shall I Italianize? and when shall I do it?" There is always a loss in removing a queen and substituting another, even where we have laying queens on hand; and where we are to use the same colony for rearing a queen, there is a still greater loss. Under the head of ARTIFICIAL SWARMING and QUEEN-REARING, these points are fully discussed. Where one has an apiary of black bees, his cheapest way, especially if he has plenty of time to devote to the subject, is to purchase a choice tested queen, and rear his own queens from her. If he has as many as a dozen colonies, and proposes to continue to increase the number, it may be his best and surest way, to purchase an imported queen. If the choice queen is purchased in the spring or summer months, I would not remove the old queens until the summer crop of honey is over; but, instead of allowing natural swarming, take two or three frames from each old stock about swarming time, and make nuclei, giving them queen-cells from the Italian brood. When these queens are hatched and laying, build the nuclei up, with frames of brood given one at a time, until they are full stocks. By such a course, you have the full benefit of your old queens during the honey-season, until the new ones are ready to take their places. After the honey-yield has begun to cease, you can remove the old queens, and give the now small colonies queen-cells, as you did the nuclei at first. This does the swarming for the season, and the Italianizing, at one and the same time.

If you have more money than time to spare, and wish to have the work done up quickly, purchase as many queens as you have colonies, and introduce them at any season of the year, as directed in INTRODUCING QUEENS. You can purchase all tested queens if you wish, but I would advise taking the dollar queens, while there is any great difference in price.

After your stocks have all been provided with Italian queens, by either of the plans given above, if you wish your bees to be pure Italians, you are to commence replacing all queens that prove to be hybrids, as soon as the young bees are hatched in sufficient numbers to enable you to decide. See ITALIAN BEES. Now, if honey only is your object, I would not replace these hybrids, until they are one or two years old; for they will average nearly as well as honey-gatherers, and will raise just as pure drones, as full blood Italians. If you should find the bees of any particular queen too cross to be endurable, replace her with another, at any time. Be careful, however, that these hybrid colonies are not allowed to swarm naturally, for, if they raise a queen, she will produce hybrid drones*; and this is something we wish scrupulously to guard against. It will be better to raise all the queens yourself, and practice artificial swarming exclusively, while you are seeking to Italianize, especially if you are surrounded with common bees. If you practice in the manner given above, you can reap the full benefit of the Italian blood, even though there are hundreds of stocks of the common bees within the range of your apiary. But, if you are going to raise queens for the market, you should buy up or Italianize all the common bees within two or three miles of you,

*To get rid of black and hybrid drones, see DRONES.

in every direction. The more faithfully you do this, the better satisfaction will you give your customers. Your neighbors will very soon be converted to the Italians, if you keep right along and let crops of honey, rather than talk, decide the matter, and then they will be quite willing to pay you for introducing Italian queens into their colonies. Be sure you do not quarrel, and foster any bad spirit in the matter, but let them have their own way, even if it, at times, is aggravating; and, in a very few years, you will succeed in having your whole neighborhood Italianized.

MR. H. B. ISHAM'S BEE-YARD AND POULTRY-HOUSE, NEW HAVEN, VT.

K.

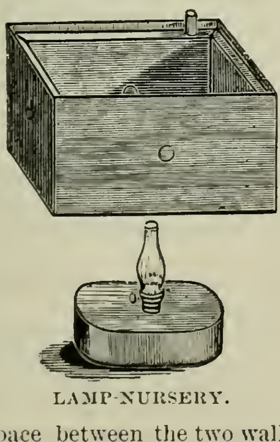
KING-BIRDS. Quite a number of the feathered tribes have a fashion of eating bees. Even our common fowls sometimes get into the habit of gobbling them, with as little fear of consequences as if they were the most harmless insects in the world. It is quite likely that birds have a way of crushing their prey with their bills so as to prevent the possibility of the bee's using its sting. It has been suggested that the birds and fowls eat only the drones; but several examinations of their crops show that it is, without question, the workers, and it is quite probable that the honey contained in the honey-sac is the principal inducement.

Mr. T. L. Waite, of Berea, Ohio, furnishes some very positive evidence, and also mentions a habit of the king-bird not generally known to naturalists. During the month of June, '72, a flock of seven of these birds were making such regular and constant visits to his apiary that his suspicions were aroused, and, concealing himself, with watch in hand, he observed a single bird snap up 5 to 8 per minute. After having pursued this "innocent" amusement for a sufficient interval, his birdship was in the habit of taking a rest on a neighboring tree, where, after a short meditation, he commenced a series of muscular contortions of the head and neck, that finally resulted in his opening his mouth wide, and "heaving up" a wad of some strange black-looking substance. By chance his perch was close over a bed of rhubarb, or pie-plant, and our friend secured a number of these wads as they fell, and thus settled the point of their being nothing more nor less than crushed bees. After he had "squeezed" out all the honey, there being probably no further use for the "pumace," it was unceremoniously cast aside, while his worship, with a keen appetite and zest for the sport, went "bee-hunting" again. They came regularly for a "meal" two or three times a day. I think we had better use our rifles and shot-guns in such a way as to teach them that apiaries are "unhealthy" localities for such boarders.

The foregoing, in reference to king-birds, was written some ten years ago. Considerable discussion arose in 1887, in *Gleanings in Bee Culture*, as to whether the king-bird did or did not swallow its victims. Several insisted that the birds did not do so—that they simply crushed the bees, extracted the honey from their sacs, and then dropped the bee. But the testimony of the majority, however, was to the effect that the king-birds did actually swallow their victims.

L.

LAMP-NURSERY. Many have observed that, in hot weather, if queen-cells are taken out just before they are ready to hatch, the queens will sometimes gnaw out just as well as if they were with the bees. It is also known, that queens just emerging from the cell may generally be allowed to crawl among the bees of any hive, and will, as a rule, be well received. Taking advantage of these two facts, our neighbor, Mr. F. R. Shaw, of Chatham, Medina Co., O., in the fall of 1873, constructed the first lamp nursery. This first machine worked well enough to demonstrate the feasibility of the plan, but, as he depended entirely on hot air to keep up the requisite temperature, it was quite liable to destroy the cells by the unevenness of the temperature. The day after I visited him, I noticed that the copper reservoir on our Stewart stove was sufficiently warm to hatch queens, although no fire had been in the stove for more than 15 hours, and the last night had been cool. This gave me the idea of using a considerable body of water; and before night, I had a hive made with double walls of tin, as shown in the cut below.



LAMP-NURSERY.

The space between the two walls is, perhaps, one inch, and extends under the bottom, as well as around the sides, that the body of water may entirely surround the contents of the nursery, except on the top. The top is to be covered with a quilt, or a warm blanket. The whole should be used in a room well protected from the changes of the weather. It may be kept in a large box, but it is not nearly as convenient as a room. As accidents sometimes happen to lamps, I would set the lamp in a tall stove, one of the kind that will admit of the top's being taken off, and set the nursery over it. The top of the lamp chimney should be about a foot below the nursery. A second-hand stove, such as was mentioned for making CANDY FOR BEES, will answer every purpose. Such a body of water between two sheets of tin will cause them to bulge badly unless we put a brace across from one to the other in the center on each side; the position of these braces is shown by the tin cap that covers them in the cut. Light your lamp, turn on a strong blaze, and watch until the thermometer, which should be kept inside the nursery, shows between 90 and 100°, then turn down the wick, until the temperature remains about there. If it gets much above 100, the cells may be injured; and it should not be allowed to fall much below 80. We are now ready for our queen-cells.

HOW TO GET CELLS FOR THE NURSERY.

You can cut out queen-cells from any place in the apiary, and lay them in the nursery; but as we wish to avoid cutting such unsightly-looking holes in our combs, it is better to take the whole frame, cells and all. Brush (don't *shake*) off every bee, and hang the frame in the nursery as you would in the hive. Get frames from different hives, until you have the nursery full, if you like. The reason we have the nursery so large, is that it may contain a great number of frames having queen-cells. Now you find a trouble right here; the worker-bees will hatch and bite out in this warm temperature just as well as the queens; and very soon we shall have a smart hive of bees, and be no better off than in an outdoor hive. You can take out these young bees as fast as they hatch and give them to some colony that needs them, or start nuclei with them; but this is so much trouble, I would advise a better way.

AN UPPER STORY IN PLACE OF THE LAMP-NURSERY.

During the summers of 1890 and 1891 we tried using, in lieu of a lamp-nursery, the upper story of a strong colony, with a queen excluding honey board between the two stories Whenever we found a frame having nice cells on it—cells that were merely started or capped over, we gently brushed the bees off the frame and inserted it in the upper story of the colony referred to. We find that cells will be nicely built out, and they can be cut out and put into a queenless colony, or can be allowed to hatch, and the young queens disposed of accordingly. Strange as it may seem, the bees in the upper story, although there is a reigning queen below, will complete and take care of all such cells given them, and will not molest young queens that happen to hatch out before the apiarist discovers them. The lamp nursery is open to the objection that the heat is artificial, and sometimes the temperature goes up to over 100 or below 80, in either case resulting in a loss of all the cells in the nursery. This trouble is entirely obviated in the upper story of a colony The lamp nursery is not used by us now, as we prefer the upper story instead, as being both cheaper and better For further particulars in regard to this, see Doolittle's method, under QUEEN-REARING.

INTRODUCING VIRGIN QUEENS.

Although these young queens, like newly hatched chickens, or young puppies and kittens, are disposed to take up with the first animated object they set their eyes on, yet there has been considerable trouble in introducing them. With weak stocks or nuclei, that have been a day or two queenless, there is little trouble; and, in fact, the bees of a large colony will allow these young queens to crawl in without a word of objection at the time, in the majority of cases; but when they get a day or two older, then comes the difficulty. I have not been able to discover how the trouble comes about; but so many of them are found in front of the hive, either dead or just able to crawl, that I have rather given up introducing them to full stocks, unless they have been some time queenless.

It may be well to remark, that these virgin queens are introduced to full-blood Italians, with much less trouble than to either blacks or hybrids; they are also accepted by a small colony or nucleus, better than by a full hive; and by any hive that has been a day or two queenless, better than by one from which a laying queen has just been taken. With the lamp-nursery or an upper story it is an easy matter to raise queens by the thousand, at a cost generally not exceeding 25 cts. each; but the most expensive part of the work comes afterward — getting them fertilized. At present I know of no better way than the one given in QUEEN-REARING and ARTIFICIAL SWARMING (giving each queen a small colony).

A QUEEN-HATCHER.

An arrangement has been used to some extent, called a "hatcher," for short. It is simply a series of cages, laid over the top of the brood-nest of a strong colony. When the weather is cool the hatcher should be covered with a chaff cushion. A cheap way of making the cages is to bore holes, about $1\frac{1}{2}$ inches in diameter, in a piece of thick board or plank, and cover the under side with wire cloth. A queen-cell nearly ready to hatch is put into one of these holes, the heat of the colony below giving it the requisite temperature; and by frequent examinations, so that the queens are taken out shortly after they hatch, no provision is needed for food.[139]

LOCUST. This tree is so well known as scarcely to need a description. It grows very rapidly, and bears blossoms at a very early age; and could we be assured of having every year the crop of honey that the locust bears (perhaps one year in five), I should at once plant a locust-grove exclusively for honey. It blossoms profusely almost every season; but the bees often pay no attention at all to the flowers.

The honey comes at a time when it is very much needed, as it is a little later than the fruit-bloom, and a little earlier than white clover. If any thing could be done by a selection of different varieties, or by cultivation, to make it bear honey every season, a locust-grove would be a very valuable addition to the honey-farm.

The leaf of the locust much resembles the leaf of the clover, only it has a great number of leaves on a stem instead of only three; the blossom is much like that of the common pea, both in appearance and size. It is an interesting fact, that the locust, pea, and clover, all belong to the same order, *Leguminosæ*.

M.

MANIPULATING FRAMES. See FRAMES, HOW TO MANIPULATE; also REVERSING.

MIGNONNETTE (*Reseda odorata*). We have had little practical experience with this plant, beyond a small patch of the tall variety in the garden. Although this kind did not have the perfume of the ordinary small kind, it was humming with bees for months; and, as they work on it all day, it will prove valuable for keeping them busy during the fall months. The following we extract from Lane's catalogue:

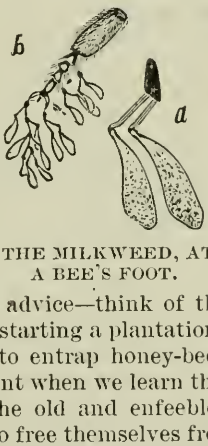
"If cultivated to that extent that it might or ought to be, it would certainly furnish a rich pasturage for bees. A small patch of it will perfume the air for quite a distance; and were it cultivated by acres for bee-pasturage alone, we should be favored with a fragrant atmosphere that would vie with the spicy breezes of Ceylon, and a honey that would outdo the famed honey of Hymettus for aromatic flavor.

"It blossoms in the latter part of June, and continues in bloom until cold weather (heavy frosts do not injure it); indeed, we are informed by our Southern friends that with them it continues in full bloom during the entire winter. There are many varieties, but we think all are inferior, for field culture, to Parson's New Giant. The seeds, which are very small, should be sown in the spring, sowing thinly and covering lightly, in drills at least three feet apart. Would not advise sowing broadcast."

December, 1879.—We have had a half-acre on our honey-farm, of different varieties, during the past season. Although visited by the bees for several months, at all hours in the day, it has not compared at all with the Simpson honey-plant. A small patch in the garden, on very rich soil, did very much better.

MILKWEED (*Asclepias Cornuti*). This plant is celebrated, not for the honey it produces, although it doubtless furnishes a good supply, but for its queer, winged masses of pollen, which attach themselves to the bee's feet, and cause him to become a cripple, if not to lose his life. Every fall, we have many inquiries from new subscribers, in regard to this queer phenomenon. Some think it a parasite, others a protuberance growing on the bee's foot, and others a winged insect-enemy of the bee. We give below an engraving of the curiosity, magnified at *a;* and also of a mass of them attached to the foot of a bee.

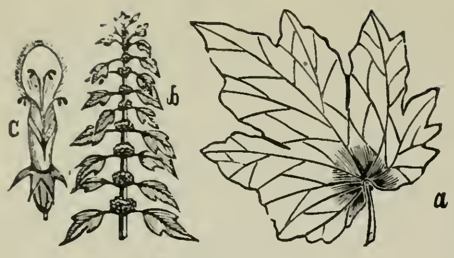
It is the same that Prof. Riley alluded to, when he recommended that the milkweed be planted to kill off the bees when they become troublesome to the fruit-grower. The



POLLEN OF THE MILKWEED, ATTACHED TO A BEE'S FOOT.

folly of such advice—think of the labor and expense of starting a plantation of useless weeds just to entrap honey-bees—becomes more apparent when we learn that it is perhaps only the old and enfeebled bees that are unable to free themselves from these appendages, and hence the milkweed can scarcely be called an enemy. The appendage, it will be observed, looks like a pair of wings, and they attach themselves to the bee by a glutinous matter which quickly hardens, so that it is quite difficult to remove, if not done when it is first attached.

MOTHERWORT (*Leonurus Cardiaca.*) Quite a number of the bee-folks insist that motherwort is superior, as a honey-plant, to either catnip, hoarhound, balm, wild bergamot, or any of the large family of *Labiatæ*, and I presume such may be the case under some circumstances, or in favorable localities. In comparing plants, it should be remembered, that those which usually bear much honey may, at times, furnish none at all; and also those which usually furnish none may, under very favorable circumstances, yield largely.



MOTHERWORT.

This plant often flourishes about fence-corners, and around the ruins of old dwellings, sheds, or even hog-pens. The large leaf, taken by itself, much resembles the currant; the stalk is much like catnip; and the little flowers are in tufts, close to the stalk. It remains in blossom a long time, and may be as worthy of cultivation as any of the plants of its class.

MOVING BEES. Perhaps about as many mishaps, especially with beginners, have come about from moving bees unwisely, as from any other one cause. A little thought in regard to the habits and ways of bees would save much of this. Bees fly from their hives in quest of stores, perhaps a mile; sometimes a mile and a half or two miles; but they will seldom go beyond these limits, unless at a time of great scarcity of pasturage.[141] Well ,after a bee has once fixed his locality, he starts out in the morning on a run, and never stops to take the points, as he does the first time he sallies out from a new locality. The consequence is, if you have moved his hive, either in the night or day time, and have not moved it more than a mile, he will, when he goes back, strike directly for his old locality. On reaching there and finding his hive gone, he is lost and helpless; and even though the hive may be but a few rods away, he will never find it in the world. New hands frequently move their hives close together at the approach of winter, that they may better protect them with chaff or straw. I do not know how many times mishaps resulting from this kind of proceeding have been related to me. All goes very well, perhaps, until we have a warm day; then the bees start out for a fly, and very naturally return to their home just as they have been doing all summer; if no one is near to restore their hive to its former location, they fly helplessly around for a while, and then alight on the trees and fences, scattered about, and finally perish. If other hives are near, they will get into the wrong hives and get stung; or, if their numbers are great enough, they will sting the queen, because she is a stranger to them. Sometimes the bees of the whole apiary will become so mixed up that they have a general melee and fight, resulting in great damage, if not in the destruction, of many of the colonies. Moving hives short distances during the working season is almost always done with loss of more or less bees, and consequently honey.

It is true, bees may sometimes be moved without loss, for there is quite a difference in the disposition of colonies; and where one may be moved all about the yard without any apparent loss, the next may suffer, if moved only a few feet. I once purchased a very strong colony of blacks of a neighbor, and, to be on the safe side, moved them on a cold day in December. I think it was a week afterward when it became warm, and the bees went back to their old home in such numbers that the first cold night froze out the remaining ones, and I lost my stock entirely.[142] At another time, a neighbor wished me to take a swarm from a very strong stock of blacks. As I had but little time, I set another hive in its place, containing a frame of brood and a queen - cell, and moved the old one several rods away. He told me next day that the bees had all found their old home, and deserted the brood-comb entirely. I directed him to move it again, and place it the other side of the orchard; but it seems these wily blacks had learned the trick, for they all found it even there.[152] Italians, as a general thing, are more ready to take up with a new location than the blacks, and stick more tenaciously to their home and brood.

Sometimes, shaking the bees all in front of the hive, and letting them run in just like a natural swarm, will answer to make them stick to their new locality; at other times, moving the hive away for an hour or two, until they get really frightened at the loss of their home, will have the same effect, after it is once brought back to them. In this case they seem so glad to get their dear old home again, that they will adhere to it wherever it is placed. Neither of these plans can be relied on implicitly, and I really do not know of any that can.* Sometimes we succeed by leaving a comb for the returning bees to cluster on, and then take them to the new stand just at nightfall. When allowed to run in, they exhibit their joy by loud notes of approval, but, just as likely as not,

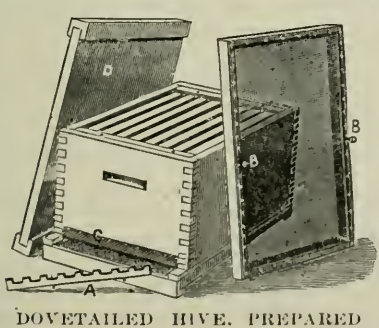
---

*Placing a board, or other object, over the entrance so as to hinder the bees a little as they come out, is sometimes practiced to make them return.

they will be back at the old spot the next day, just the same. With patience, we can by this means save most of them. As a natural swarm will stay wherever they are put, any thing that reduces a colony to the condition of a natural swarm will accomplish our object. Bees depend very much on the surrounding objects, in taking their points; and I have known a whole apiary to be successfully moved a short distance, by moving all the hives and preserving their respective positions with reference to each other. Carrying bees into the cellar for several days or a week will usually wean them from their location, so that they may then be located anywhere; but this plan is objectionable, inasmuch as the colony is prevented, for that length of time, from doing any work in the field, and this is quite an item in the height of the season. Where we wish to divide a swarm, the matter is very easy, for we can carry our stock where we wish, and start a nucleus of the returning bees. The usual way, and by far the easiest where it can be done, is to wait until winter, and move them after they have been confined to the hive for several weeks by cold weather. Bees moved in the spring seldom go back to their old quarters, for they generally mark their location when they take their first flight, whether they have been moved or not. Bees can also be moved short distances, in warm weather, by taking them a mile or more, leaving them a couple of weeks, and then bringing them back to the spot where you wish them to remain. This plan, would be too much trouble and expense to be practicable generally.

SHIPPING BEES LONG DISTANCES BY EXPRESS.

During hot weather, great care should be exercised that the bees be not smothered, nor their combs melted down by the intense

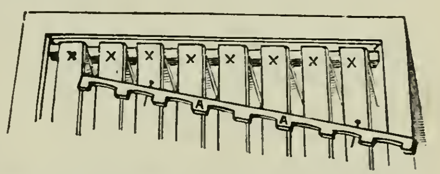


THE DOVETAILED HIVE, PREPARED FOR SHIPPING BEES.

heat that is generated where they have an insufficient quantity of air during shipment. After a large experience, and many mishaps in shipping bees in the summer time, we have now decided on covering both the top and bottom of the hive with wire cloth. For short distances, and more moderate weather in summer, a piece of wire cloth tacked over the entrance, a id a single wire-cloth cover, will answer; but the entrance itself should not be closed, for it affords a draft that passes up through the cluster, to the wire cloth above. The preceding cut illustrates the method we have used for shipping bees with success with the Dovetailed hive, described elsewhere.

A couple of screws, B B, fasten the wire screen to the hive. The bottom is similarly secured. To move the screen, no prying nor pounding is necessary. Simply loosen the screws, and the screen will lift off without a jar.

To secure the frames so that they will not shuck about, we use a notched stick, as shown in A A, of the accompanying cut, the notches passing down between the frames just over the rabbet in the hive.



A couple of wire nails hold it secure. A similar notched stick is nailed to the bottom-board, notches upward, transversely through the center. This keeps the bottoms of the frames from jarring against each other. After the wire cloth has been tacked to the entrance, the combs put in the hive, and secured by the notched sticks, the wire screen screwed down, the whole arrangement is ready for shipment.

Of course if your bees are on fixed frames —that is, either the Hoffman or the closed-end, referred to and described under FRAMES, MANIPULATING; FIXED FRAMES. and under HIVE-MAKING, no notched spacing-strips wil be necessary. The frames are already fastened for moving or shipping; and the beauty of it is, no time need be lost in preparing them for that purpose.

It is almost absolutely necessary that the combs themselves be wired, or at least that they be old and tough, and securely attached to the bottom-bar if not wired. It is always risky, however, to ship in combs when not wired.[14] It is impossible to tell what sort of rough usage they will receive at the hands of careless or indifferent express agents;

and while we should not be too hasty in condemning railroad officials for careless handling, we should take every precaution. The bees buzzing around the wire cloth is usually enough to guarantee safe handling; but as many do not know how to handle and take care of bees, we are in the habit of printing in large letters, in red, on a piece of cardboard, as follows:

KILLED!

This Hive contains Live Bees, and they will be "Killed" if roughly handled, or left in the Sun, or not kept This Side Up. Will you please be careful of the little fellows?

A. I. ROOT, Medina, O.

This card is tacked on one corner of the wire-cloth screen. Of course, the word "killed" is to command attention; and there are very few railroad officials who will not heed the instructions. Bees should always be sent by express. Although I have sent them safely by freight as far as Massachusetts, I would by no means recommend it.

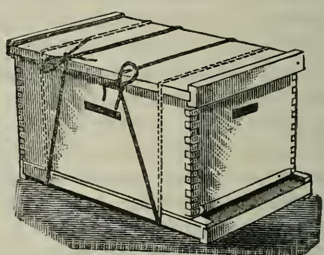
If bees are to be sent long distances, be sure that they have plenty of stores, for the excitement attendant upon confinement and jolting about sometimes causes them to consume honey enormously.

MOVING BEES SHORT DISTANCES, TO AND FROM OUT-APIARIES, ETC.

If you wish to move bees during the daytime, while many are in the fields, you can get them nearly all in by smoking them at intervals for about half an hour. This will give those that are out time to come in, and the smoking will prevent any more going out. If the colony is a very strong one, leave a hive with a comb of brood on the old stand, and the owner can start a nucleus very conveniently with the returning bees.

In very hot weather, the wire-cloth screen before illustrated should be put on in lieu of the cover, and the entrance should be likewise closed with wire cloth. In cooler weather, say toward fall, it will not be necessary to remove the cover, because the bees will have ventilation enough from the entrance, providing it is not closed with any thing but wire cloth.

Most bee-keepers have the bottoms of their hives movable. When it becomes necessary to move the bees from the out-apiary to the home apiary, some means should be used whereby the cover and bottom can be secured quickly and safely. We can not nail the cover down, because that would take too long, and mar the cover besides. Neither can we afford to lift the hive up while an assistant screws the bottom fast while the bees are in. About as satisfactory a way as any we have found, to fasten both cover and bottom simultaneously, is to cut a couple of lengths of strong twine, each just long enough to tie around the body of the hive transversely, in a bow-knot. Pass one of these lengths around under the bottom, near the front end, then over the top of the cover. Draw it as tight as possible, and tie it in a bow-knot. In like manner loop the rear end. Draw these cords as tight as you can, and they will still be comparatively loose — enough so, so that the cover may be able to slide a small trifle. To draw these cords taut, take a hammer and drive the upper part of the loop, which passes over the cover, toward the center of the hive.



HOW TO FASTEN BOTTOM-BOARD AND COVER.

Do likewise with the other cord. The result will be, that the strands passing over the cover will be closer together than the strands passing around the bottom of the hive; and you will find that the cover is fastened almost as tight as if it were nailed. To save time and labor, get out just enough strands to accommodate as many hives as you can carry at one load. With the strands thrown over your shoulder, after you have hitched your horses at a safe distance from the apiary, and after you have tacked wire cloth over the entrances, lift the front end of the hive up; tie the front strand as described, and then the rear one; stretch them taut, in the manner described. In like manner treat the rest of the hives. The labor of preparing the bees for moving will be reduced to a minimum.

Another very ingenious method of fastening the cover and bottom is to take a very heavy cord, pass it transversely around the hive, and tie it loosely. With a stick about an inch square, loop it under the string, and then twist the stick until the cord is taut. This is, perhaps, a quicker way than the other one; but one cord is surely not as safe as two. We have secured the cover and bottom both ways, but we like the double-loop plan best.

A LOAD OF BEES TO OUR OUT-APIARY.

Our wagon, a platform spring, will hold 45 empty hives; and on smooth roads we carry that number of hives containing colonies. Ordinarily 30 to 35 make a good load, because we seldom have roads in such perfect condition that we dare risk such a weight. The box of the wagon will take 12 hives, and the raised platform will carry the remainder. The hives will probably stay in their place; but to prevent accident they are secured with ropes, as shown in the cut. The driver sits in the middle of the load, so that he can watch for and prevent any unexpected developments.

HOW TO PREPARE A CARLOAD OF BEES.

If you use loose, hanging frames, fix them with the spacing strips illustrated on a previous page. If your frames are of the fixed type, of course no spacing device will be necessary. Remove the cover, and cover the top of the hive with wire cloth. The best way will be to make a two inch rim and nail the wire cloth on top of this, as explained on a previous page. There should be about two inches between the brood-frames and the wire cloth Before loading them in the car, strew about four or five inches of loose straw on the car floor and then place your colonies upon this, four or five inches apart. After the car bottom is covered put some 2 x 4 pieces across the tops of the hives, and then your next tier of hives on top of these. For convenience in loading, leave a passageway through the center of the car, and then, if you accompany your bees, you can easily get at any of the colonies The purpose of the straw is to give a spring to soften the heavy concussions. One thing more that is important: Be sure to load the hives so that the frames are parallel with the rails; and, don't pile them up more than two or three tiers high. In loading on the wagon, put the frames so that they are parallel with the axletree.

CAUTION.

Before closing, let me add a caution. In moving bees, be sure that you have fixed all the entrances so that not a bee can by any possibility escape. Do not have your wire cloth too short, and then splice it out with leaves. Be sure to have it cut exactly the right length. For further particulars, see OUT-APIARIES.

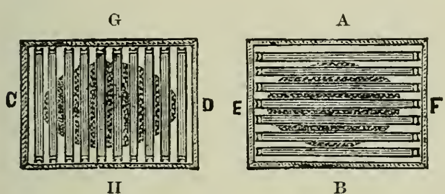
MUSTARD (*Sinapis arvensis.*) This belongs to the same family as the turnip, cabbage, rape, etc., all of which, I believe, almost invariably furnish honey while they are in bloom. We have a good opportunity of testing these plants, because acres of them are raised for other purposes besides the honey. It will be a hard matter to determine which is best for your locality, without trying some of each. Find out what kind of a market you have for your seed, and then proceed to raise it, as if you were going to depend on the seed alone to pay expenses. Should you secure a good crop of honey from it, you will then be so much ahead, and there is little chance of any great loss.

The honey from these plants is said to be very light, equal to any in flavor, and to command the highest price in the market. The seed should be sown very early in the spring, either in shallow drills so far apart that the cultivator can be used between them, or broadcast. The former plan is, of course, the better one for nearly all honey-plants, but is more trouble. From 6 to 10 lbs. per acre will be needed, if sown in drills, and from 15 to 20, if sown broadcast. If you wish to save the seed, it should be sown not later than July 1st. When the greater part of the pods are ripe, the stalks are to be cut and carefully dried. A cloth should be spread in the bottom of the wagon, when gathering, for the seed will shell out considerably, if it is in proper condition to thrash. I presume we have machines especially adapted for cleaning and thrashing the seed, but I have always seen a flail and fanning-mill used. Of course, it should be thrashed on a tight floor, or on a floor made tight by a large piece of canvas. The seed of the common kinds of mustard brings four or five dollars per bushel. I do not know how many bushels are raised per acre. The Chinese variety has been highly extolled for bees; but we have found the common black mustard that grows almost of itself to thrive better, and be more visited by the bees. Who will give us the results of some practical experiments?

N.

NUCLEUS. This word, applied to bee culture, signifies a small swarm of bees, perhaps from one-fourth to one-tenth of a full colony. The plural of the word is nuclei; it were well to bear this in mind, for there is much confusion in the use of the terms, even in printed circulars. If you remove a dozen bees from the hive, take them so far away that they are homeless, and then let them fly, they will after a time come pretty nearly back to the place from which you released them; but unless they have a queen with them, they will soon wander away and be lost. If you give them a queen, they will come back to where they left her, and will probably remain if *she* does not stray away. She, like the rest, must fulfill her destiny, or she will wander away; we shall therefore have to provide her a comb wherein to lay eggs. The bees would build the comb themselves, if there were enough of them, and they had plenty of food. A dozen would never build any comb; neither would they make any attempt to rear and hatch her eggs, if the comb were given them. Perhaps a hundred bees put in a suitably small box, with a fertile queen, might start a colony, and this is what we call a nucleus.[145] It is the center, about which a colony of bees may in time be formed. If they should be built up to a full colony, the building-up would be done by the queen's filling her combs with eggs, which, when cared for by the nursing bees (see BEES), would be converted into larvæ, and in 21 days would be hatched into perfect bees. These bees would then help the original hundred, and the queen would fill a still larger area with eggs, which would be hatched in the same way, and so on. The difficulty in the way of building up from such small beginnings seems to be that the queen will lay all the eggs a hundred bees can care for, perhaps in an hour or two, and then she has to sit or loaf around for the whole 21 days, until she can have another "job." Before the 21 days are up, she will be very likely to get disgusted with such small proceedings, and swarm out, or at least induce the bees with her to do so. See ABSCONDING SWARMS. If we should increase the number of bees to 500 or 1000, we should get along very much better, and there should be little danger of swarming out, unless the hive given them were too small. A very spry and ambitious queen might fill all the cells the bees had prepared for her, then set about filling them the second time, as they sometimes do, and then swarm out; but, with a quart of bees—about 3200, if I have figured rightly—things will generally go along pretty well.

If we are to have this quart of bees work to the best advantage, something depends upon the sort of hive they are domiciled in. A single comb, long and narrow, so as to string the bees out in one thin cluster, is very bad economy. Two combs would do very much better, but three would be a great deal better still. It is like scattering the firebrands widely apart; one alone will soon go out; two placed side by side will burn very well; and three will make quite a fire. It is on this account that I would have a nucleus of three, instead of one or two frames. The bees seem to seek naturally a space between two combs; and the queen seldom goes to the outside comb of a hive, unless she is obliged to for want of room. Is not the Langstroth frame, then, a poor shape for building up nuclei? and would not the small Gallup be better? The L. frame is a bad shape for two or three frame nuclei, and, for that matter, I think the Gallup is also.[146] The one is too long, and the other too deep; in one case we have the ends extending beyond the cluster, unless we contract the hive so as to crowd the bees out to the ends, and, in the other case, the bottom of the frame extends below the cluster.[147] This matter of deep and shallow frames seems not to be very well understood, if I may be excused for saying so much. If you will examine bees at the approach of frosty weather, you will see, from the way in which they draw up and condense, how their combs need to be proportioned. To have them stand the rigors of severe winter weather, they should fill their hive as nearly as possible, and there should be no cold unfilled spaces, either at the ends or underneath the cluster. If their hive is so full that bees are standing in the doorway, even during severe cold weather, we need have little fear of their suffering. Now, with a shallow hive they will come clear down to the bottom-board, and keep that warm as well as the ceiling overhead. With a frame as deep as the Gallup, I have not succeeded so well in making them do it. Nor can I succeed so well with any frame, whose depth is as great as the width. The warm combs are at the sides of the bees, and the open ends between the combs are at the ends of the cluster. The diagram below will help to make it plain.



GALLUP. LANGSTROTH.

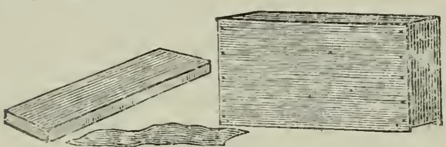
It is very plainly evident, that the sides of the clusters, A,B, and C, D, are much better protected than the sides G, H, and E,F; and also that the long frames protect the center of the brood-nest much better than the short ones. Taking this fact into consideration, in connection with what has been said of the importance of a shallow frame, and we shall have just about the dimensions of hive and frame given us by Mr. Langstroth; and, if I am correct, all these things were taken into consideration when he settled down on his frame and hive, after years of careful experiment in regard to different sizes.

Well, if the L. frame is the best economy for the average progeny of a queen, we must have a smaller frame in just about the same proportions, if we wish to work with nuclei to the best advantage. As we can not well have a frame for a pint of bees, and another for a quart, and so on, on account of the complication it would make in an apiary, it behooves us to discuss well what sizes we shall use, if any, less than our regular frame. A frame as deep as the usual one, and as wide as the *width* of our hive, makes a very pretty frame for queen-rearing. See first page of HIVE-MAKING.

The Gallup frame would do nicely, and, in fact, is much used for this purpose, but it is too deep; were it cut down to the depth of the L. frame, I should like it much better. A frame has been suggested, and I believe somewhat used, for a nucleus hive, of the depth of the L., and just wide enough to go crosswise, in the Simplicity hive. An ordinary hive, with a rabbet along the sides, as well as across the ends, will hold these frames or the usual L. frames, as may be desired. If it should be desired to use this small frame entirely in an apiary, the size is exactly right to hold 6 of the 1-lb. sections. When used for queen-rearing, three of these small frames will make a very comfortable nucleus. One of the prettiest queen-rearing apiaries I have ever seen was composed of about 50 three-frame hives of this description.

Although I have described this small frame, and spoken of its advantages, please do not understand that I would advise you to adopt it. If I were going to have two sizes of frames in my apiary, I would adopt just these, without question—the large one for honey, and the small one for queen-rearing. But, can we afford to have these two sizes, even if they do both hang in the same hive? Before answering, I would state that I have worked for years with two or more kinds of frames in the same apiary, and have multiplied, divided, and united again, until I think I have had experience in nearly all the changes that come about, and each year I grow more determined that I will have but one size of frame in the apiary, and no odd ones any more *under any circumstances*. This one size shall be the L. frame I have given you; and if I should sell all my bees to-day and start anew, I would use this without hesitation. If this is our determination, it behooves us to see what can be done toward ameliorating the objections to the long and large L. frame. Strong nuclei will do it without question; and if one wishes to make his queen business a sure thing, without the vexations of swarming out, robbing, etc., there is nothing like strong nuclei, to take care of themselves. For queen-rearing, I would have the Dovetailed or 8-frame hive, one story, with a division-board, and then the increase can readily be accommodated, and all that increase to a full swarm are all right, without any changing and shifting of hives. If desired, two nuclei can be put in one hive, by using a tight division-board, and making the entrances at either end.[355] Of course, when we use hives with a division-board between two colonies, great care should be used in making the division-board *tight*. I do not know how many failures have resulted from having the board shrink or warp, and thus let the bees through. Although wire cloth has been made to do in a few cases, it will not do to depend on it. Sooner or later the bees will kill one of the queens, and behave themselves as one colony. I have raised queens, one in each side of a hive, both nuclei using a common entrance, with no division - board at all, but such cases are exceptional.

The above arrangement does very well so far as queen-rearing is concerned; but where nucleus colonies are to be sold and shipped, we must have a little 3-frame hive on purpose. These are to be as light as possible, consistent with strength, to save express charges, and, to save expense, should be as simple as possible.



THREE-FRAME NUCLEUS HIVE.

A sheet of enameled cloth, hemmed at the sides and ends, is made to lie over the frames, as in the large hives, but the cover is made to shut over the hive. These hives answer perfectly for rearing queens during the warm months of July and Aug., and one of them will be found on a shelf attached to the trellis, in the engraving given under QUEEN-REARING. No bottom is used to the hive, the shelf that it rests on being bottom enough; the front board is made ¼ inch shorter than the sides and back end, to form the entrance. When the bees are to be shipped, the cover is placed under the hive, closing the entrance, and a piece of wire cloth is tacked over the top, after having fastened the frames by pushing sticks of proper size between them, or by the use of spacing-boards. See MOVING BEES. In these small hives, this gives ventilation enough. For 3 frames, the hive should be 4¾ in. wide inside.

There is still another reason for using a nucleus hive with full-sized frames, and it is that those who purchase valuable queens in a nucleus, to save the risk of introducing, usually wish to build them up at once to full colonies; with an odd - sized frame, this would be very inconvenient.

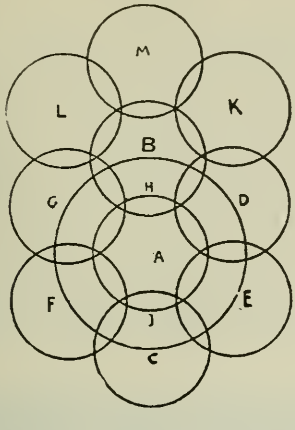
OUT-APIARIES.—Within late years this term has been used to apply to bee-yards remote or distant from the home yard by some two or three miles. It is a well-known fact, that only a limited number of colonies, comparatively, can be accommodated in any one locality, different localities being able to support a wide difference in the number of colonies. Not having had any very large experience ourselves in managing and running out-apiaries, in order that I might present to my readers the best there is on the subject I have asked Dr. C. C. Miller, of Marengo, Ill., to write it up. He is one who has kept and managed out-apiaries successfully for several years, and he has written considerably on the subject. Although the space is limited, the doctor has covered the subject, pointing out some of its difficulties as well as its advantages, in an admirable manner. Without going into preliminaries he plunges directly into the subject as follows :

NUMBER OF COLONIES IN AN APIARY.

The number of colonies of bees that can be profitably kept in one locality is limited by the amount of pasturage. Of late years quite a number of bee-keepers have established one or more out-apiaries, for the sake of keeping more bees than the home pasturage would support. Just how many bees can be supported in a single locality has probably never been ascertained, and it is just as probable that it never will. One field may support five times as many as another, and the same field may support five times as many this year as last. Most bee-keepers, however, think it not advisable to keep more than 75 to 100 in one apiary, whilst a few think their locations so good that 200 or more can be profitably kept together. The man who has only a few more colonies than he thinks best to keep in one apiary may find it better to have his bees *just a little* crowded at home before he goes to the extra expense of an out-apiary. Indeed, it depends somewhat upon the man, whether, having been successful with one apiary, he will find any profit in the second. But having gone so far as to have one or more apiaries away from home, it is not best for him to have any crowding in the least. If 100 colonies will do well in each apiary, the probability is that 75 will do better; and while there is unoccupied territory all about him he would better keep on the safe side and have so few in each place as to feel sure of no overstocking. His own convenience would have much to do in deciding. For instance, if he has, in all, 300 colonies, and thinks that 100 can find enough to do in a place, but can get through the work of only 75 in a day, then he will keep the 300 in 4 apiaries of 75 each, rather than in 3 apiaries of 100 each. For it will make him less travel to have in each apiary just what he will do in a day's work. If he can do 50 in a day, then he may just as well have 100 in two apiaries as in one, for in either case he must make two trips to get through with them.

DISTANCE BETWEEN APIARIES, AND LOCATION THEREOF.

A location for an out-apiary must, of course, be far enough distant from the home apiary not to interfere much; but just how far is best, it is not easy to decide. Perhaps, all things considered, a good distance is something like three miles apart. As the area of flight is a circle, the ideal plan of locating out-apiaries so as to fully occupy all adjoining territory, is to put them in hexagonal form, in which case a circle of six will surround the home apiary.



In the diagram, A represents the home apiary, and B, C, D, E, F, G, the out-apiaries, at equal distances from A and from each other. If more than seven are needed then a second series may be started, as at K, M, L, indicated by the letters. The circles representing the area of flight from each apiary are seen to overlap each other; but this is at the outer parts, where the ground is more sparsely occupied, and the doubling on the same ground is compensated by the convenience of the shorter distance to go from one apiary to another. But this ideal plan, although a good thing to work from as a basis, is not likely ever to be fully carried out. Many reasons will make it desirable to vary. The roads may run in such directions as to make a difference; no good place may be found for an apiary at some of the points, etc. It may be remarked, that the area of flight is not always a circle. An apiary placed in a valley between two ranges of hills might have an oblong area, the bees perhaps flying twice as far along the line of the valley as in the other direction. If only a single out-apiary is to be planted, it is probably best to go in the direction of the best pasturage — a thing not always easy to determine. Sometimes one location proves to be better than another, year after year, although no apparent reason for it can be seen. It may even be worth while to vary a location a mile or more for the sake of having it where pleasant people live. But you can do much toward making the people pleasant by being pleasant yourself. See to it that you make as little trouble as possible, and be still more careful than at home to avoid every thing that may incite robbing, for robbing begets cross bees on the place.

RENT FOR OUT-APIARIES.

The agreement between the bee-keeper and his landlord, for rent, is as varied as the cases that occur. Some pay a fixed sum, five or ten dollars per year; some agree to pay a per cent of the crop; some make a bargain to pay so much for every swarm hived by some one of the landlord's family, and so on, while some can not get the landlord to agree to take any rent whatever. In this latter case it is only right to make sure that the landlord have a good supply of honey for his family to use during the coming year. In any case, make sure to do *a little better* than is expected of you.

HAULING BEES.

Whenever you decide to start a second apiary, you must give some attention to the matter of hauling. If you winter on summer stands, there will be less hauling than if you bring all your bees home to winter in the cellar and then take them back again in the spring. If you use chaff hives, you can have light cases made to carry merely the brood-frames with the bees. The first thing to see to is to make *very sure* that no bees can get out to sting the horse or horses. Of course, you think you are careful, and that there is no need of anxiety in your case; but, wait and see. The probabilities are, that, with all your care, one of your first experiences in hauling bees will be to get your horse stung; and you may be thankful if you get off without a runaway and a general smashup. Some little leak evaded your notice, from which the bees escaped, or you drove your horse too close to the apiary, or in some other way you will have got yourself into such a scrape that you will wish you had had nothing to do with bees. A. E. Manum puts on his horses a covering of cotton cloth which completely covers head and body, and this is kept on till some half a mile distant from the apiary.

You may haul bees on almost any kind of vehicle. Some use wagons with springs; some use a hay-rack with two or three feet of hay on it, while others use a common lumber-wagon, or a hay-rack with neither hay nor springs, leaving the frames with no other fastening than the propolis and brace-combs. With smooth roads this latter plan is very satisfactory; but frames with metal corners, or otherwise easily moved, should be fastened in some way. With good smooth roads it may be best to have the brood-combs running across the wagon, as most of the shaking comes from the wagon rocking from side to side, while a road very rough may make it best to have the combs running parallel to the line of travel. If the combs are secure enough, it will matter little how they are placed. To carry colonies of bees to advan-

RACK ON WAGON-BOX, FOR HAULING BEES—FOR A ONE-HORSE WAGON.

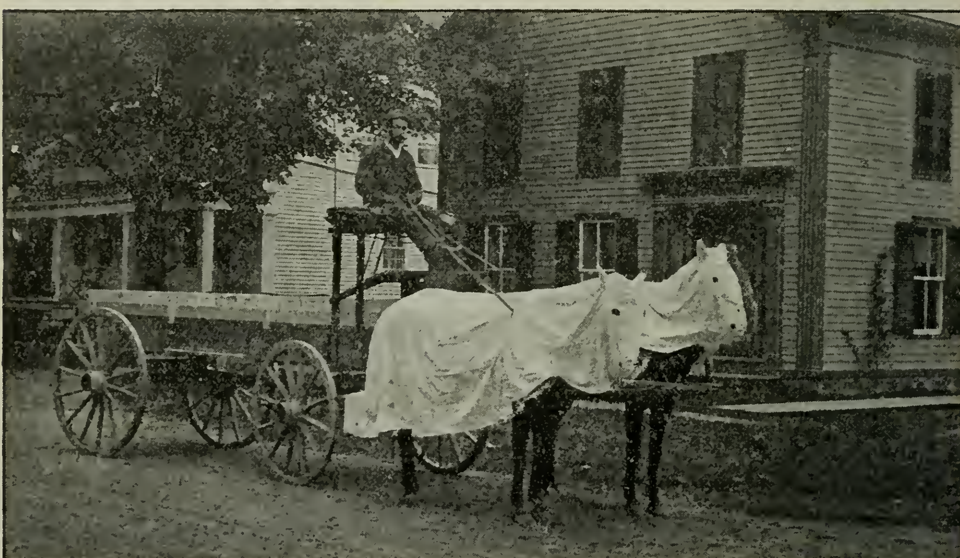
tage, some sort of rack is necessary. As I am not a farmer I had to extemporize a rack for my one-horse wagon. It is made of fence-boards. Two side-boards rest on the side-boards of the wagon-box, and at or near each end two pieces are nailed in, forming an open box without top or bottom. Then five cross-pieces are nailed on top, and blocks nailed on these to hold the hives in place. Two pieces are nailed on each side (as seen in the cut), which slip down on the wagon-box and keep the rack from slipping off. A loose board in front answers for a seat. The hind end of the rack is propped up, at the time of loading, till three hives are slid under from behind, then the rack is let down, and the eight hives loaded on, making eleven hives for the full load. I have a similar rack, only larger, to fit Jack Wilson's milk-wagon, on which, drawn by two horses, I can haul seventeen hives. Jack is one of the brothers-in-law worth having, for generally about the time I want to haul bees he seems to have things happen so as to say that he has an idle team that I can have just as well as not. Thus I can take 28 colonies at each trip. This refers to 10-frame hives. With 8-frame hives and racks to correspond, the same wagons will carry respectively 14 and 22 hives. These are both spring wagons, and, although not absolutely necessary, I like springs, for then you don't need to drive so carefully. By using a longer wagon, or by piling up, some have carried as many as 50 hives on one wagon.

Whatever the kind of hive you may decide to use, some plan must be adopted, in fastening in the bees, that they may have abundance of ventilation while being hauled. As, however, the hauling is done in spring and fall, less ventilation is needed than in hot weather. The ordinary entrance, say 14 inches by ⅜, covered by wire cloth, will answer, as that gives a ventilating surface of about 5 inches, although more will be better, and it might be bad to have so little if the day should be warm. Of course, the bees must be shut in when not flying, and in spring it is a good plan to shut up in the evening all that are to be hauled the next day. In the fall the weather may be such that bees will not fly at any time in the day, otherwise you must get to the out-apiary early enough in the morning to shut in all the bees you will haul that day. If you are to take bees to an out-apiary in the spring, the sooner it is done the better, as pasturage is then apt to be rather scarce at best. If bees are to be brought home in the fall to be cellared, they may as well be brought just as soon as heavy frost occurs, or as soon as they stop gathering; at least, they should be brought early enough to have a good fly before going into winter quarters. After being unloaded from the wagon the bees may be liberated at once by blowing in a little smoke or dashing in some cold water; or, if unloaded too late in the evening to fly, they may be left till the next morning, when they will be quietly settled down; and if carefully opened, no smoke need be used.

TOOLS FOR OUT-APIARIES, AND WHERE TO KEEP THEM.

Whatever tools you use in the home apiary, you are likely to need the same in each out-apiary. If a different person is in charge of each apiary, then each one must have his own set of tools; and even if the same force go in succession from one apiary to another, it may be the most convenient to have a separate outfit kept at each place. I do not think just now of any thing in the line of tools needed for an out-apiary, different from those that are needed at home, unless it be a robber-cloth. I should not like to be without one of these in the home apiary, but they are specially valuable in out-apiaries where, sometimes, notwithstanding robbers are troublesome, your plans are such that you want to force through a certain amount of work. By having two or three robber-cloths I have sometimes been able to go on with my work when, without them, I should have been obliged to desist. I'll tell you how to make one. Take about a square yard of stout sheeting or cotton cloth: if your hives are small, less will do. Lay one of the cut edges on a piece of lath, about the length of your hive. Lay a similar piece of lath on top of it, and drive wire nails through both, at a distance of perhaps three inches apart. Let the nails be long enough to reach through and clinch. Then treat the opposite edge the same way, and your robber-cloth is complete.

This robber-cloth is exceedingly convenient to throw quickly over any hive or super that you want to cover up temporarily. You can grasp the lath at one side with one hand, and, with a single fling, throw it over a hive and it is instantly bee-tight. It does not kill bees, if any happen to get under it. If you have one hand occupied with something else, you can very quickly uncover and cover with the other. I have



A. E. MANUM'S RIG FOR HAULING BEES AND HONEY TO AND FROM OUT-APIARIES.

sometimes worked with a colony when robbers were so bad they would pounce into every opening; but a robber-cloth covering the frames at each side allowed me to have an opening at the frame I wished to take out. As a general rule, of course I would try to manage not to work at bees at such times.

But, to return. It would be very convenient, if you go about from one apiary to another, to have a little tool-house at each. I am not sure, however, that it would pay. A hive or box covered over with a water-tight cover (I use a tin hive-cover) answers very well. I would have one or more of these at each apiary, in any case, for there are some things you want to be sure of having on hand, as smoker fuel. Matches should also be kept under cover in such a place, in a tin box. A baking-powder box does well. Bee-hats, smokers—in fact, a full set of every thing, may be kept in the same way.

It is possible, however, to get on very well by always taking your tools with you, provided you never forget them. One day we went to the Hastings apiary, without any smoker, and we realized then how important a smoker is. Don't trust to memory. In your record-book have a list of the things you generally need to take; and after you are all in the wagon, or ready to get in, read aloud the list and be sure that every thing is in the wagon, as: Hats, smokers, dinner (we never forgot our dinner), chisel, etc. My own practice has been a kind of compromise between having a full kit of tools at each apiary and taking every thing along. If a buggy is used, it is not convenient to have very much bulk. By the way, a bad season is not without its compensations. I have had two years of such dead failure that we could make almost every trip the entire season in a buggy, for there was no honey to haul, and little in the way of supplies.

GENERAL MANAGEMENT OF OUT-APIARIES.

The ways of managing out-apiaries will be just as many as the men who manage them; but the general management will be about the same as at the home apiary. There will always be the advantage of moving at any time a colony or part of a colony from one apiary to another, and feeling sure that the bees will stay where they are put. The more you are interested in out-apiaries the more you are likely to be interested in the prevention of swarming; and if you have been in the habit of wintering in the cellar, an out-apiary will make you debate somewhat the question whether you may not find some way of safely wintering outdoors. Some practice having a competent assistant in charge of each apiary, remaining there all the time; while others have a sufficient force of helpers to go from one apiary to another, doing the work of each apiary as often as convenient, perhaps every six days or oftener.

On page 883, 1890, of *Gleanings in Bee Culture*, appeared an article from Mr. E. France, of Platteville, Wis. (see Biographical Sketches); and as it contains so many valuable suggestions, we are glad to reproduce it here entire, with the diagram. It very nicely supplements what Dr. Miller has already said on the subject:

I have taken pains to make a correct diagram of the territory that we occupy with our bees; and I must say that I was surprised myself when I saw the exact position of each yard. They are clustered together more than I had supposed. The accompanying diagram will show how they stand, and I will give some facts and figures that will make quite an interesting study about setting out out-apiaries and overstocking our pasture. Of course, it is impossible to locate a set of out-apiaries just so far from the home apiary, in a circle, each one in its proper place, just as nicely as we could make it on paper. We have to take such places as we can get, and many of the places that we can get won't do at all, for some reason or other; and when you have six or eight yards planted you will be likely to find, as in our case, some of them badly crowded—too much so for profit.

The circles in the diagram are three miles each, or 1½ miles from center to the outside, which is a very short distance for a bee to go in search of honey. If the bees fly three or four miles, as I think they do in poor seasons, it is plain to see how it works in a poor season. The outside apiaries may be getting a fair living, while the inside yards are nearly starving. In first-class seasons, when honey is plentiful everywhere, and very few bees go over one mile, there is enough for all. I here give the number of bees in each yard this spring, the amount of honey taken, and the amount of feeding this fall to put the bees in trim for winter.

Atkinson yard.	Colonies, spring count,	100
Cravin "	" " "	90
Kliebenstein yard.	" " "	96
Waters "	" " "	88
Jones "	" " "	80
Gunlauch "	" " "	90
Home "	" " "	105
	Total	649

No increase to speak of.

Honey extracted:

Atkinson	yard	190
Cravin	"	200
Kliebenstein	"	740
Waters	"	497
Jones	"	600
Gunlauch	"	350
Home	"	540
	Total	3125

Fed back:

Atkinson	yard	000
Cravin	"	336
Kliebenstein	"	000
Waters	"	000
Jones	"	210
Gunlauch	"	486
Home	"	900
	Total	1932
	Surplus after feeding,	1193

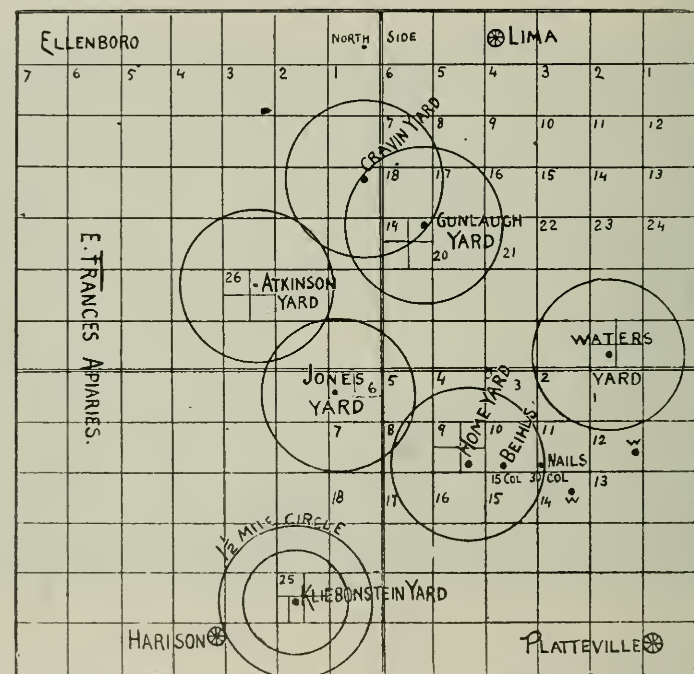
Now, notice the Kliebenstein yard, how it is located, away by itself, as for distance, from other yards. It has a great advantage; and then there is plenty of basswood all around it. It has no bees belonging to other parties on its territory. It gave the most honey, no feeding, and is in the best condition of any yard for winter stores.

We will now notice the Atkinson yard. It is pretty well hemmed in on the north and east sides by the other yards, but it has an unlimited field on the west, of good pasture. We took but little honey there, but it is in good condition for winter, without feeding.

Now, away over on the east side we have the Waters yard. It is two miles from basswood, but a splendid white-clover range — plenty of basswood two miles north and east. This yard gave some honey, and required no feeding for winter.

Then there are the Cravin and the Gunlauch yards, each 90 colonies in spring, only 1¼ miles apart—too close, with very little basswood north of them. Both of these yards were fed more honey than we took from them. There were a few acres of buckwheat near them that helped them some. The Jones yard did fairly well, considering its surroundings. It had the least number of bees, an abundance of basswood near, and then had eleven acres of buckwheat just over the fence.

We will now notice the home yard. There were 105 colonies. The Jones yard is rather too close. Then there is an apiary of 20 colonies a little over half a mile east, at a point marked Beihls; another apiary 1½ miles east, 30 colonies, marked Nails; another apiary southeast, marked W, about 40 colonies. Another apiary still further to the east, and a little to the north, marked W, about 40 colonies. So you see the home-yard territory is overstocked the worst of all, and had to be fed 360 lbs. more than was taken



E. FRANCE'S SYSTEM OF OUT-APIARIES.

from them. The home yard has the best clover field of any, but basswood is scarce within two miles. In looking at the diagram, one not acquainted with the ground would naturally ask, "Why don't you use that open space southeast of the home yard?" It is all prairie land. Corn and oats don't yield much honey.

We will now just look back to the record of a year of plenty, 1886, and see how the yards averaged up then.

COLONIES, SPRING OF 1886.

Atkinson	yard, 72 cols.;	average lbs.	per col.,				106
Cravin	"	80 "	"	"	"	"	106¼
Kliebenstein	"	60 "	"	"	"	"	109
Waters	"	72 "	"	"	"	"	107
Gunlauch	"	50 "	"	"	"	"	100½
Home	"	61 "	"	"	"	"	117

Jones yard not planted then.

FOR 1885.

Atkinson	yard, 56 cols.:	average lbs.	per col.,				90
Cravin	"	53 "	"	"	"	"	74
Kliebenstein	"	46 "	"	"	"	"	62
Waters	"	57 "	"	"	"	"	57
Gunlauch	"	46 "	"	"	"	"	77½
Home	"	62 "	"	"	"	"	71½

FOR 1884.

Atkinson	yard, 51 cols.;	average lbs.	per col.,				107
Cravin	"	41 "	"	"	"	"	113
Kliebenstein	"	51 "	"	"	"	"	109
Waters	"	41 "	"	"	"	"	130
Gunlauch	"	41 "	"	"	"	"	106½
Home	"	61 "	"	"	"	"	113½

FOR 1883.

Four yards, average for the whole............105 lbs. Number of colonies, 35, 48, 33, 60.

In 1887 we kept no record. It was a very poor season, and we got but little honey.

The year 1884 was a very poor year also.

	Cols. in spring.	Average per col.
Atkinson yard,	76	23
Cravin "	75	20
Kliebenstein "	67	31
Waters "	69	32
Gunlauch "	77	21½
Home "	66	37½

FOR 1889.

	Cols. in spring.	Average per col.
Atkinson yard,	72	40
Waters "	79	40
Kliebenstein "	87	63
Gunlauch "	79	47
Cravin "	78	49
Whig "	52	40
Home "	84	52

Now, friends, you have the figures and the map of the ground that our bees are on. Study it for yourselves. But if you plant out-apiaries, don't put them less than five miles apart if you can help it. If you are going to keep help at the separate yards, to run the bees, six miles apart is near enough; then, if the pasture is good, you can keep from 100 to 150 colonies in each place. If you go from home with your help every day, then you want to gauge the number of colonies so as to work one whole yard in one day; or if you have but three or four apiaries in all, you will have time to work two days in each. But don't go over the roads for less than a full day's work when you get there; and remember, when you are locating an apiary, that, when you are hitched up and on the road, one or two miles further travel will pay you better than to crowd your pasture. Don't overstock your ground. E. FRANCE.

Platteville, Wis., Nov., 1889.

Soon after the appearance of Mr. France's diagram, there appeared in *Gleanings*, page 60, 1891, another valuable article from the pen of C. P. Dadant, of the firm of C. Dadant & Son (see Biographical Sketches). It substantiates what Mr. France has said, and shows the relation that apiaries bear to each other along on the banks of the Mississippi.

The very interesting article of Mr. France, on out-apiaries, has induced us to give you our experience in this matter, not because we can throw any more light on the question, but because our practice, which extends back to 1871, in the matter of out-apiaries, confirms the views of both Mr. France and Dr. Miller, and will add weight to their statements.

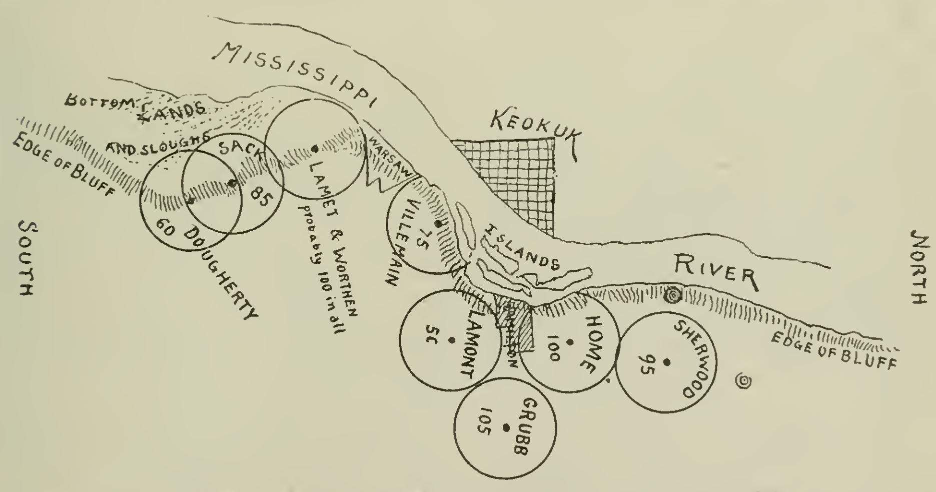
Under ordinary circumstances it is not advisable to place apiaries nearer than four miles apart; but Dr. Miller is undoubtedly right when he says that the configuration of the land has a great deal to do with the greater or lesser distance that the bees will travel in certain directions.

In the accompanying diagram you will perceive that these apiaries are all located on land sloping toward the Mississippi River, and are separated from one another by creeks, and groves of timber land. The Grubb apiary is owned by D. W. McDaniel, who has had charge of our apiaries also for a few years past. Of all these apiaries, the Sherwood is the best in the product of both spring and fall crops, although there are seasons like the past when the fall crop fails there altogether.

The Villemain apiary has the poorest location, to all appearances; but it is located near the only basswood grove there is in the country, and has also quite a fall pasture from blossoms that grow on the islands near it. But what will you think of the Sack apiary, which is located a little over two miles south of the Lamet apiary, with another apiary close to the latter, and not shown on the diagram, and only one mile and a quarter north of another apiary of 60 colonies, owned by A. Dougherty? Yet this Sack apiary gives us the best average of honey of all, excepting the Sherwood apiary. The reason of it is, that the pasturage is all west of it on the river bottoms, and very abundant. It is probable that the bees in this apiary go as far west as the river, about three miles, while they perhaps do not travel over a mile east on the bluffs. Their course north and south, in the direction of those other apiaries, is over a hilly country covered more or less with timber, which makes their flight more difficult.

The two small circles in the north part of the diagram show spots on which we have had apiaries formerly, and which, you will perceive, were further away from home than the present. At that time the Sherwood apiary did not exist, nor did the Grubb apiary; and yet we must say that we can see no difference in the yield of the home apiary. We are satisfied that the Grubb bees go east, the Sherwood bees and the home bees northeast, for their crop. When we say the bees go in a certain direction, we do not mean *all* the bees, but the greater part of them. We can give you one convincing instance of the correctness of this opinion.

By glancing at the diagram you will notice that the home apiary is just about a mile and a half from the north point of an island in the river. In certain seasons the islands are covered with water in June; and after the waters recede they become covered with a luxuriant vegetation, and the yield of honey from them very large. In one of these seasons we found a colony, belonging to a neighbor, located



THE DADANT SYSTEM OF OUT-APIARIES ALONG THE MISSISSIPPI RIVER.

half way between us and the river, harvesting a large yield of honey from this source, while our bees harvested nothing. Is it not evident that our bees had not gone that far? Yet we have seen them two miles and more from home in another direction.

Hamilton, Ill. C. P. DADANT.

In the summer of 1890 I visited a number of extensive apiarists in the States of New York and Vermont. Among others whom I called upon was Mr. P. H. Elwood, who occupies a territory for his system of out-apiaries not many miles from that formerly occupied by Mr. Quinby. Mr. E. runs about 1000 colonies in a series of eight or ten out-yards, and they are located in the valleys in the midst of those York State hills. These hills are anywhere from 500 to 1000 feet high, and are covered with basswoods and clover. As the former are scattered over the hills from top to bottom, the duration of the honey-flow is very considerably prolonged. Instead of there being only ten days or two weeks of basswood, it sometimes lasts a whole month. The first basswoods that blossom are at the foot of the hills; and as the season advances, those higher up come in bloom; and the flow does not cease entirely until the trees at the very top of the hills have gone out of bloom. The bees will first commence flying on the horizontal; and as the season progresses, they will keep flying higher and higher, until they have scaled the top of the hills. Bee-keepers who are situated in such a country, or in swamp land, are in the best of localities for honey. It might be well to observe, in this connection, that these hills form excellent windbreaks for apiarists in the valleys. In Vermont, in a colder climate, this feature cuts quite a figure. Mr. Manum's apiaries are also located among the hills, and in some cases on the sides of the mountains; but, unlike Mr. Elwood, he has no basswood on the mountains

MOVABLE APIARIES.

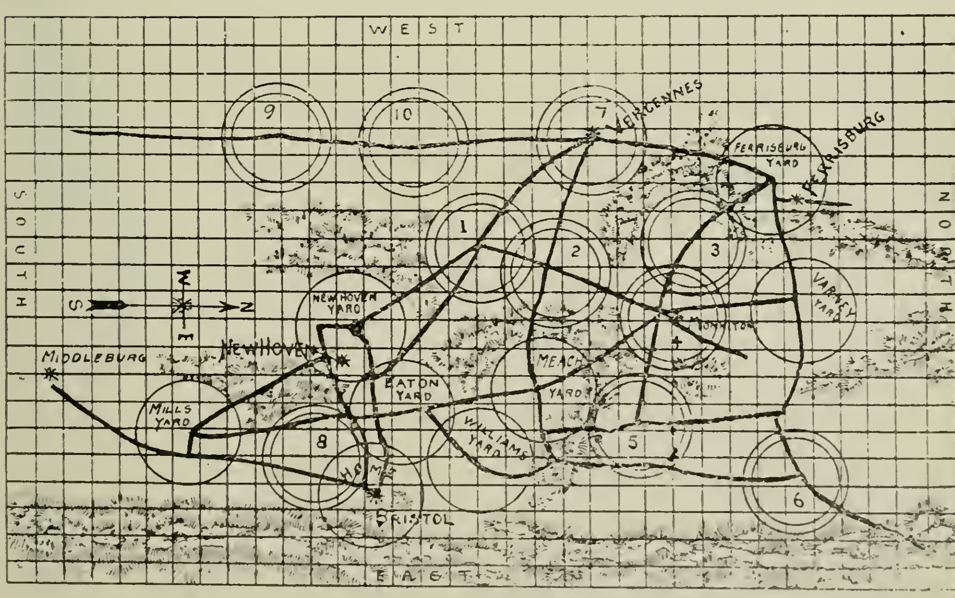
Experience has shown, in many instances, that a yard that has in years gone by furnished tons of honey is now practically worthless, or so nearly so that the moving of the bees to some location more favorable is a necessity. For instance, four or five years ago an apiary furnished an abundance of basswood honey; but the basswoods have all been cut off; there is no clover, and the field is worthless. Again, a locality has once furnished immense quantities of white clover; but extensive agriculture has set in, and clover pasturage has given way to immense wheat-fields. The inroads of civilization sometimes cut off the honey-resources of a locality; and, conversely, augment them very considerably. There are a few locations in York State that formerly gave but very little honey; but the farmers, in recent years, have introduced buckwheat to such an extent that these are now splendid buckwheat counties; and the yield of this dark rich honey plays a considerable part in the net profits of the season. In a word, we want our apiaries so we can load them up at a moment's notice, and move them at practically little expense to any new field that may be more inviting. We can not always tell at first whether it will be a favorable location or not. If it does not come up to our expectations, we can "pull up stakes" and try elsewhere again. How are we to make our apiaries movable? Keep them on fixed frames, to be sure. Neither Mr. Elwood, Captain Hetherington, nor Mr. Hoffman fusses with fastening frames. When it becomes desirable to move a yard, all that is necessary is to close the entrance and load up the bees. See FIXED FRAMES.

A SCALE HIVE FOR AN OUT-YARD

It is a well known and established fact, that one yard may yield quite a crop of honey while another one, only a few miles distant, may require to be fed. It is highly important to be able to tell just what bees are doing at stated periods during the season. Mr. Manum keeps a hive on scales in each yard; and every time he visits one he consults the scales. If they indicate an increase of several pounds, he knows then that the bees in this apiary need more room, and they are also liable to swarm; but if they indicate a loss of several pounds, he infers that the whole yard is losing likewise, and that some colonies may need to be fed. Of course, the hive on the scale should contain a fair average colony. In many cases it is not always possible to visit yards at regular periods, and so Mr. Manum has some resident near the apiary to watch the scale, and report any unexpected developments by a postal card.

A CAUTION ABOUT ENTERING INTO THE OUT-APIARY BUSINESS.

We have already gone over the ground of the general subject of out-apiaries, and what contributes toward making their management a success. While there are many bee keepers who have brains and capacity enough to manage a series of out-apiaries, there are also many who had better never think of entering into the project. To be a keeper of several out-apiaries means great perseverance and a good deal of system, besides ability to manage not only the bees, but the help who are to take care of them. If you can not make fifty or sixty colonies pay in one location, do not delude yourself by the idea that you can make bees pay if you establish a series of out-apiaries. A man who can not make a small business pay will not probably make a large one do so. If you can manage successfully your home apiary, it may be profitable, as soon as the increase is sufficient, to take a part of it to an out-yard. If you have the ability to manage both yards successfully, you may then with propriety establish another. But do not go and buy up a lot of bees to do so. Your better way is to increase from your own original stock. Your experience, ability, and judgment, will probably keep pace with the increase in the number of stocks—that is, providing you make them pay their way. For further particulars on the subject of moving bees, out-yards, etc., see MOVING BEES; also *Gleanings* for 1889, where Dr. Miller has a series of articles on the subject, beginning Feb. 1, and continuing throughout the year.



A. E. MANUM'S SYSTEM OF OUT-APIARIES.

P.

POISONOUS HONEY. Honey may be poisonous in two ways. It may be poisonous for human beings, and not for the bees, or it may be poisonous to both bees and humanity; in the latter case, it could not well happen that we should suffer very much, for the bees would die before they could make any accumulation. It has been reported that the honey from certain blossoms, such as the ailanthus, poisons the bees, even before they can get away from the tree; but, so far as I can learn, this is a mistake.

The wild honey of the Southern States, in many localities, is quite liable to produce sickness, and, in some instances, this sickness has been so sudden and violent as to give good grounds for thinking that the honey was obtained from poisonous flowers. The following is from Feb. GLEANINGS, for 1875:

Wherever the mountain laurel grows, the bees are very fond of it, and laurel honey is not confined to the *wild* bees, for the tame ones will also resort to the flowers, and it is dangerous, for any one unable to detect the taste, to eat the honey. It has a highly poisonous effect, being an extremely distressing narcotic, varying in its effects in proportion to the quantity eaten. During the war, as a surgeon in the Confederate army, and campaigning a good deal in *the Valley* (as we call it), I had many opportunities of witnessing its effects, and, on one occasion, personal experience gave me the right to say that I know something about it, as well as your correspondent. He says he only *tasted* it, but, not being forewarned, or, rather, not being acquainted with the taste of the "laurel honey," I ate a small quantity of it, and was prevented by the disagreeable taste from eating more. My comrades, equally ignorant, and not quite so fastidious, indulged more freely, and consequently suffered in proportion. I do not remember very distinctly the symptoms; but as nearly as I can recall them, my sensations were these: Some time after eating, a queerish sensation of tingling all over, indistinct vision, caused by dilation of the pupils, with an empty, dizzy feeling about the head, and a horrible nausea that would not relieve itself by vomiting. In my case this lasted perhaps an hour; but my companions were worse off, and complained of the symptoms two or three hours. They, however, had not eaten enough to suffer as much as I have seen others. The first cases that I saw were entirely overpowered by it, and their appearance was exactly as if they were dead drunk, and I should certainly have pronounced them so, had not their messmates assured me to the contrary, and had I not discovered that they were rational and sensible of their condition, as shown by their imperfect efforts to articulate. To speak technically, the innervation of all the voluntary muscles was completely destroyed. The use of the usual remedies, or antidotes for narcotics, partially restored them in a few hours, but the effects did not entirely wear off for two or three days, and I was assured that fatal consequences have been known to follow a too free indulgence in the sweet but treacherous product of the "models of industry."

Where there is no mountain laurel to poison their honey, the wild bees of Virginia can make as good honey as any others. Of course, the quality of the honey varies with the character of the flowers from which it is made, and I have seen as good honey from a bee-tree on the edge of a field of clover as perhaps the bees of Hymettus ever made.

Halifax C. H., Va. J. GRAMMER, M. D.

POLLEN. Doubtless, you have all heard bees humming about hollyhock blossoms, but perhaps most of you have passed on, thinking that it was nothing strange, for bees are always humming about flowers. Suppose we stop just a minute, and look into the matter a little. The bee, although on the wing, is almost motionless as he hovers about the dust in the center of the flowers, and, by careful watching, we may see that his tongue is extended to a considerable length. This tongue looks much like a delicate pencil-brush as he sweeps it about among the grains of pollen; and as the pollen adheres to it and is from time to time put away somehow, we are led to infer that there must be something adhesive on it. I believe the bee, when he starts out to gather pollen, does carry some honey if he finds some in the blossom. Well, we will suppose he has moistened his long, flexible, brush-like tongue with honey, has spread it out and brushed it among the pollen-grains and then —I rather think I shall have to give you some pictures before I can well explain to you what happens next. See next page.

Fig. 1 is a collection of pollen-grains highly magnified, and A is exactly the kind the bee finds in the hollyhock. Fig. 2 is the tongue of the bee, and Fig. 3 is one of his fore feet, just to show you what a funny machine he is provided with, for getting the pollen off his tongue. There are bristles forming a sort of brush on the under side of the fore leg just above the claws. The bee, when his tongue is well loaded, just claps it between his two fore legs, and in some way which I can not determine to my full satisfaction, the bristles, in conjunction with the claws or hooks, catch the pollen so quickly that he leaves sleight-of-hand performers all far in the shade. I believe he generally wipes his tongue with both fore feet at once; and when he does this, his appearance, viewed through a glass, is comical in the extreme. Now it is another "knack" he has, of getting it into his pollen-baskets, after he gets it off his tongue. kinds of traps and rigging, to prevent the drones and queens from going out and in with the workers, have been objectionable on this very account.

Well, between the pollen-gathering legs and the pollen-basket legs is another pair. These play a very important part in getting the pollen into the pollen-baskets. With the tongue, fore leg, and middle leg, the bee pads up the pollen and honey until there is quite a wad of it, and then, with a very pretty sleight-of-hand, he carries this little cake, scarcely so large as the head of a small pin,

Fig. 1

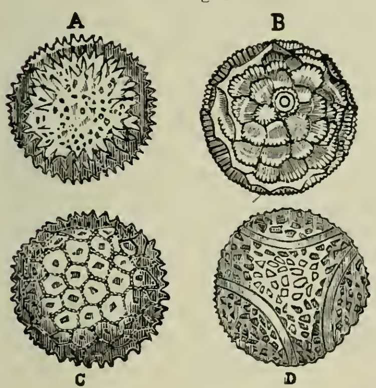
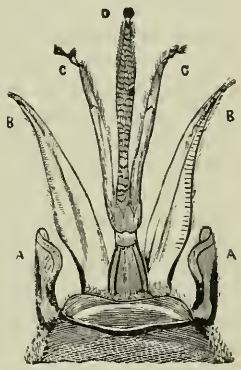


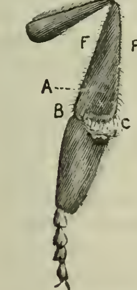
Fig. 3*

Fig. 2



HOW THE BEE GETS THE POLLEN FROM THE FLOWERS.

Bear in mind that a bee has six legs; the first two legs remove the pollen from the tongue; the last two bear the pollen-baskets. They are called baskets, and enclose the space marked by F, B, C, F, and they consist of a flat place, or slight depression as at A, on the side of the leg, and a number of short stiff hairs to hold the pollen from tumbling off. The engraving will give you a good idea of it. Observe the pollen is carried in the upper joint of the leg.



POLLEN-BASKET.

You will see that, should he not moisten the pollen into a kind of paste or dough, he would never be able to make it stick in such a place. Well, it does sometimes tumble off, especially if he takes very heavy loads, or has an inconvenient entrance into his hive. I have seen quite a large heap of pollen, just in front of a hive, when the entrance was so badly arranged as to cause the bee to scrape it off when going in. All

between the middle and fore legs, back to the pollen-basket. When in place, it is firmly pressed into the basket, and then neatly patted down with the middle leg, much as a dextrous butter-woman gives her neat rolls the finishing taps. This motion seems to be a sort of automatic movement; for the bee is the while intently engaged, with tongue and fore feet, in gathering more pollen from the flowers. The operation may be witnessed easily, by taking on your finger a bee that is gathering propolis from some old quilt or hive. As he picks and pulls off bits of wax with his mandibles, he will convey them back to the pollen-basket much more leisurely while he stands still, and you can easily follow the whole proceeding. Even on a cool day, when his motions are sluggish, you will be astonished at the wonderful celerity and swiftness with which these funny little legs move. When he has a load

*C is a groove in the fore leg, and B is a sort of finger or spur which closes over it. When a bee gets his antennæ, or feelers, dusted over with pollen, he uses this little mechanical device for cleaning them off much as you would clean off a muddy rope or round stick by passing it between the thumb and forefinger. To witness the operation, dust the antennæ of a bee with flour, and, with a glass, watch his beeship.

that he deems sufficient, he spreads his wings and soars aloft; but, if the field is a new one, he will circle about and take his points, returning again and again, that he may not mistake where to come back, his plump little load being plainly visible while he is on the wing.

When he gets into the hive, if a young bee, he has to go through with a series of rejoicings—see BEES; but if a regular laborer, he proceeds at once, or at least as soon as he has had a breathing-spell (for carrying large loads of pollen is like carrying a hod of brick to the top of a three-story brick building), to deposit the pollen in the cells. This is done very quickly, by crossing his pollen-legs while they are thrust to the bottom of the cell, and then kicking the loads off, very like the way in which our blue-eyed baby kicks off her shoes, when she takes a notion to go barefooted.[356] After the load is off, he starts out again, without paying any further attention to the matter. The question keeps coming up to me, Does the bee that brings the pollen never stop to pack it in the cells or eliminate it for the young larvæ? I am convinced that he usually does not; but where the hive is deprived of young bees, I think almost any bee can do this work. If there are plenty of young bees in the hive, he probably concludes he has nothing further to do with it.

After the pollen is dropped in the cells, it will fall out if the comb is turned over; and when the maples are first out in the spring, I have heard and seen the pollen rattle out like shot, in turning the combs horizontally to look at the queens. Very soon after the pollen is thus deposited, the nursing-bees come and mash it down into a hard cake; I have not been able to discover how they do this, unless it is done with the head. The *British Bee Journal* for May, 1876, graphically describes the whole operation as follows:

The pollen-laden bee, upon entering the hive, makes directly for the brood-nest; and where its load is required, it quickly disencumbers itself. Sometimes the nurse-bees are in want of the all-necessary pollen, and nibble it from the legs of the worker without ceremony; but more often the bee goes to a cell devoted to pollen-storing, and hangs by its first pair of legs to another cell immediately above, and by the aid of its middle pair of legs it unloads its hindmost, and (as it were) kicks the balls of pollen into the proper receptacle. Here they are mixed with a little honey, and kneaded into a stiff paste, which is then rammed hard against the bottom of the cell, for future use, the bee using its head as a battering-ram; these operations are repeated until the cell is almost filled with the kneaded dough, when a little clear honey is placed on the top, and it is sealed over and preserved as bee-bread. If a cell full of pollen be cut in two, longitudinally, its contents will, as a rule, be found of many colors, stratified, the strata of varied thickness standing on edge, as if the bees, instead of storing bread, had stored pancakes.

The principal supply of pollen in our locality is from maple in the spring, and from corn in the latter part of summer and fall.[357] Almost all flowers that yield honey yield pollen also, to a greater or lesser extent, and when the bee comes in laden with the one, he almost always has some of the other.[150] Red clover yields a peculiar dark-green pollen that pretty surely indicates when the bees are gathering honey from it. They often get a considerable load of honey, with but a very small one of pollen; but if you did not notice very carefully, you would quite likely declare that they had gathered no pollen at all.[358, 151]

The pollen from corn is generally gathered early in the morning; when it is first coming into bloom, I have seen them start out in the fore part of the day, much as they do for a buckwheat-field.

For further information in regard to the offices of pollen in the hive, see BEES.

NECESSITY OF POLLEN FOR BROOD-REARING.

We are interested about pollen, because bees can not rear brood without either it, or some substitute for it. Bees kept in confinement, and fed on pure sugar and pure water, will thrive and void little or no excrement; but as soon as pollen, or food containing the farinaceous element, is given them, their bodies will become distended; and instead of a transparent fluid, they will void a fluid of a darkish tint, which will soil their hives, and emit quite an unpleasant smell. I once kept about 300 bees in a cage with a queen, and gave them only pure sugar and water. They built comb, and seemed quite contented, the cage emitting no smell whatever. In order to start brood-rearing, I gave them some sugar candy containing flour, and they got uneasy very soon, and tried in vain to get out. At this time the cage gave off quite an unpleasant smell, and so they were allowed to fly; had the pollen element not been given them, I presume they would have stood the confinement for a month or more. I once wintered a fair colony of bees, on stores of pure sugar syrup, and when they flew in the spring there was no perceptible spot on the white snow about their hives. They had no pollen, and, of course, no brood-rearing could go on without it. A few years ago I made some experiments with bees confined in a large room under glass. As it was late in the fall, after brood-rearing had ceased, I did not know whether I should succeed in starting them again. After feeding them for about a week, eggs were found in the cells, but none of them hatched into larvæ. A heap of rye meal was placed in the center of the room near the feed, and anxiously I waited to see them take notice of it. After several days, a bee was seen hovering curiously about it. In breathless suspense I watched him, until he finally began to dip his tongue into the heap, and then to pad it on his legs. He carried home a small load. I had the hive open, and the frame out, as soon as he was among his comrades, and watched the behavior of the rest while he shook himself among them, until he deposited his treasure in a cell, and hurried away for another load. Very shortly some of the rest followed him, and buzzed about the room, until they found where he was loading up, and soon they were at work on the meal, as merrily as in the spring. Of course, the eggs were very soon, now, transformed into unsealed larvæ, then into capped brood, and, in due time, I had young bees hatched out in the month of December.

By warming the room with a stove for several days in succession, I found I could start brood-rearing and pollen-gathering even in the month of January. It may be well to state here, that although I succeeded in rearing bees in midwinter, as strong and healthy, apparently, as those raised in summer time, the experiment was hardly a success after all; for about as many bees died from what I suppose was the effect of confinement, as were hatched out. It was a decided success, in determining many unknown points in regard to bees, aside from the office of pollen, and I presume, if it ever should be necessary, we could overcome the difficulties of flying bees under glass.

ARTIFICIAL SUBSTITUTES FOR POLLEN.

It has been known for many years, that in the spring time, bees will make use of the flour or meal of many kinds of grain, and many bee-keepers feed bushels of it every season. The favorite seems to be rye;[152] and, as the bees are apt to fall into it and sometimes get so covered as to perish, I have been in the habit of having the rye ground up with an equal quantity of oats. A great many plans have been devised for feeding it without waste; but, after all our experiments, a heap of meal on the ground is about as satisfactory as any way.[359] Of course, it should be protected from rain; and as there is usually much high wind in the spring, which is, to say the least, very annoying to the bees, it is well to have it in a spot sheltered as much as possible, always aiming to give them as much sunshine as may be. By way of experiment, I have concentrated the rays of the sun on the meal heap, by mirrors, that the bees might work on days otherwise too cold; I have also made glass-covered structures for the purpose; and have even kept their meal hot by means of a lamp nursery; all these plans have succeeded, but I am inclined to doubt whether stocks pushed along, in brood rearing, by such means, were really in advance of some that were left to take their chances. It is amusing to see the little fellows start from their hives on days so cold that they would not otherwise stir out, hie to the warm meal and load up, and then go home so quickly that they do not have time to get chilled.

Is there any danger of feeding them too much meal? In our own apiary, I have never known them to take so much that it was not used at once for brood-rearing; but I purchased of a neighbor some hives which contained flour in the cells, dried down so hard as to make it necessary for the bees to cut it out, comb and all, as the only means of getting rid of it. I presume this came about by the sudden appearance of natural pollen, when they had laid in a pretty good supply of the flour; it is well known, that as soon as the natural pollen can be obtained, they at once abandon all artificial substitutes. I think there is but little danger of giving them too much rye and oat meal, but I would not risk giving them great quantities of fine wheat flour.

Not a few of our readers have been perplexed and astonished, doubtless, by seeing the bees, in early spring, greedily appropriating sawdust, just as they do rye meal. I have seen them at the sawmills, so thick on a large heap of fresh sawdust as to attract a large crowd of people; and when I caught them, and tasted of the pollen from their legs, I was somewhat amazed to find it sweet and very much like the pollen from the flowers. I presume they had plenty of honey but no pollen, and that these fine particles of wood contained enough of the nitrogenous element to answer very well, mixed with honey, as they have it, when packed in their pollen-baskets. The pollen from green timber contains an essential oil, besides some gummy matter, that gives an odor doubtless reminding the bees of the aroma of the opening buds. Not only do they thus collect the (to us) tasteless sawdust, but they have been found at different times on a great variety of substances. A friend in Michigan, at one time found them loading up with the fine black earth of the swamps, and they have been known to use even coal-dust; but the strangest thing of all was told me by the owner of a cheese-factory, near by. He said the bees were one day observed hovering over the shelves in the cheese-room, and, as their numbers increased, they were found to be packing on their legs the fine dust that had accumulated from handling so much cheese. Microscopic investigation showed this dust to be embryo cheese-mites, so that the bees had really been using animal food as pollen, and living animals at that. If one might be allowed to theorize in the matter, it would seem this should be a rare substance to crowd brood-rearing to its uttermost limit. As cheese can be bought here for 6 or 8 cts. by the quantity, it might not be so very expensive for bee-food after all.

Bees can be taught to use a great variety of articles of food in this way, when they are in need of pollen, and therefore the story of giving a hive of bees a roasted chicken, to promote their comfort and welfare, may be not entirely a myth. Ground malt, such as is used in making beer, has been very highly recommended in place of rye meal; but as I have never succeeded in getting any of it I can not speak from practical experience.

THE AGENCY OF THE BEES IN FERTILIZING PLANTS, BY MINGLING THE POLLEN.

This is too wide a subject to be discussed at full length here, but I will give you a few examples, to start you on the track. A perfect blossom contains both stamens and pistils, the male and female organs of reproduction; but sometimes we find flowers having stamens only, and others having pistils only; and these two blossoms may be borne by the same plant or by different plants.

If I am correct, the plant is fertilized by the pollen from the stamens falling on the stigma at the summit of the pistil. Unless this is done, the plant ripens no seed. Nature has adopted a multitude of devices for carrying this pollen from one blossom to the other; but perhaps the most general, and the one with which we have to do principally, is the agency of the bees. Common corn is an illustration of a class of plants that bear both kinds of blossoms on the same stalk. The blossom that bears the seed is low down, and is what we commonly term the silk of the ear. The one that bears the pollen is at the very summit of the stalk, and the pollen, when ripe, is shaken off and falls on the silk below; or, what is still better, it is wafted by the wind to the silk of the neighboring stalks, thus preventing in-and-in breeding, in a manner strikingly analogous to the way in which the drones fly out in the air, that the chances may be greatly in favor of their meeting queens other than those from their own hives. You may object, that the silk from the ear of corn is not properly a flower, so I will give you a more striking instance. The common ragweed, *Ambrosia artemisæfolia*, also sometimes called bitterweed, or hogweed, bears two distinct and entirely unlike flowers.

RAGWEED AND CORN, SHOWING THE TWO KINDS OF BLOSSOMS ON ONE STALK.

On the ends of the tall racemes, as at B, the pollen-bearing blossoms are seen very conspicuously; and many of you who are familiar with the weed, perhaps never imagined that it had any other blossom at all: if so, will you please go outdoors and take a look at them again? Right close to the main stem, where the branches all start out, you will find a very pretty little flower, only that it possesses no color except green, and it is here where all the seeds are borne, as you will see on some of the branches where they are matured. Now, if you will get up early in the morning, you will find that these plants, when shaken, give off a little cloud of fine green dust, and this is the pollen of the plant. Before I knew what it was, I used to find it annoying on account of the way in which it soiled light clothing. As this plant is in no way dependent on the bees for the fertilization of its blossoms, they contain no honey, or at least I have never been able to detect any; although I have, during two seasons, seen the bees quite busily engaged gathering the pollen. It is said that corn sometimes bears honey as well as pollen, although I have never been able to get proof of it. These two plants, as I have before remarked, seem to insure crossing the seed with other plants of the same variety, by bearing the pollen-bearing flowers aloft, on slender spines; also by furnishing a great preponderance in numbers of these blossoms, for precisely the same reason that a thousand or more drones are reared to one queen. A stalk that succeeds in pushing itself above the others, and in bearing a profusion of pollen-flowers, will probably be the father, so to speak, of a multitude of the rising generation, and this process, repeated for generations, would develop just the tendency of corn and ragweed, to shoot up tall spires, clothed with an exuberance of the pollen-bearing blossoms. As the plants that give the greatest distance on the stalk between the lower, or seed-blossoms, and the upper ones, are most likely to shed the pollen on neighboring plants, this, too, fosters the tendency mentioned.

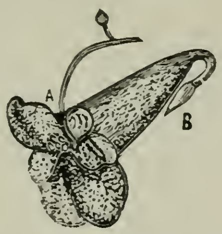
But, what shall the great multitude of plants do, that have no tall spines with which to shake their pollen to the breezes? Here is where the bees come in, and fulfill their allotted task, in the work of animal and vegetable life. They would, it is true, visit many plants for the pollen alone; but with by far the greater part of them, the pollen is only a secondary consideration, or not sought for at all. In vieing with each other, or in the strife to perpetuate their species, what shall the plant do to offer the greatest attraction to the bees to visit them, and carry the precious pollen to the neighboring blossoms, for the purpose we have mentioned? Suppose we wish to gather a group of school-children about us, what will be the surest and most effectual method of doing it? Coax them with candy, maple sugar, and the like, of course; and that is just what the plant does; or it does still more, for it ransacks its storehouse, and, I dare say, sends its roots abroad through the soil, with untiring efforts, to steal a more delicious and enticing nectar, more wonderfully exquisite than even the purest and most transparent maple-sugar syrup ever distilled, or "boiled bown," by the skill of man, for the sole purpose of coaxing the bees to come and dust themselves in their precious pollen, or to bring from some other blossom the pollen they have previously been dusted with. Now, this honey is precious, and it must tax the plant to its utmost to produce it. Nature, therefore, who is a most careful economist, not only deals it out in small doses, but she places it in the most cunning nooks and corners, that the bee may be obliged to twist himself into all possible shapes, around and among the stamens, until the pollen is most surely dusted all over him. Observe, that the flower secretes no honey until the pollen is ripe, and ready to do its work; that the honey slowly exudes into the nectaries, that the bees may be kept coming and licking it out every hour in the day; and that the flow of honey ceases just as soon as the pollen is ripened and gone. A lady has suggested a beautiful experiment, to determine the amount of honey yielded by the spider-flower, *Cleome*. She tied lace over the stalk, to keep away the bees that were constantly visiting it. The honey collected in quite a large drop. I presume we could measure the amount with many other plants in a similar way. The little cups on the flower of the FIGWORT, I have seen full to the brim with honey, when found standing alone out in the woods. Truly:

"Full many a flower is born to blush unseen,
And waste its sweetness on the desert air."

Did you ever notice the spot of fur, or down, on the back of the bee, just between the wings? Well, bee-hunters sometimes put a small drop of white paint on this spot, that they may know a bee when he comes back. Several years ago bees were going into many of the hives, with a spot of white on this fur that looked, at first sight, almost like white paint. For several seasons in succession I hunted in vain to see where they got this white spot. At one time it seemed to come from working on thistles; but I was obliged to give this up, for I found it most on the bees one season when they did not notice thistles at all. One swarm of beautiful Italians had filled their hive nicely in September, and almost every bee had a white back. I lined them from the hive, and followed them. They went toward a large piece of wild woodland, and I scanned the tops of the trees in vain; finally, over between the hills, beside a brook, I found acres of the wild touch-me-not (*Impatiens*), the same plant that we have often played with in childhood, because the queer little seed-pods will snap all to pieces when ripe, if they are touched ever so carefully. The honey is secreted in the spur to the flower, shown next page at B.

The bee can reach this only by diving

down into it almost out of sight: and when the coveted treasure is obtained he backs out with a ludicrous kicking and sprawling



FLOWER OF THE WILD TOUCH-ME-NOT, SHOWING THE WAY THE BEE GETS THE POLLEN ON HIS BACK.

of his legs, and in so doing the down on his back is ruffled up the wrong way. Now, this would be pretty certain to get the pollen dusted all over him; but nature, to make sure, has planted a little tuft that bears the pollen just on the upper side of the entrance to the flower, at A, and, in his struggles to get out, the white pollen is brushed all over his back most effectually, to be carried to the next flower, and so on.

A year or two after this, I took a friend of mine to the spot to show him my wonderful discovery; but, lo and behold! the sharp-witted Italians had taken a short cut to the honey by biting* through the spur, and inserting their tongues, without the laborious operation of crowding down into the flower. I really can not say how many years it will take the plant to discover that it is secreting the honey in that little spur in vain, or whether it will, for self-preservation, make the spur so thick and hard that the bees can not bite through it, or put the honey somewhere else, or do some other way. It seems very certain, that it must soon become extinct, unless something is done; for not a seed can mature so long as the bees bite through, instead of pushing past the pollen as they have formerly done.

But will there really be no seed, unless the bees visit the blossoms? I will give you some well-known facts, and leave you to judge.

Common red clover was, a few years ago, introduced to Australia, and it made a most excellent growth in that warm rich soil, but not a bit of seed could they raise. After trying in vain, it was suggested that bumble-bees were required to fertilize the blossoms. Some nests were accordingly shipped from the New-England States, and the result was perfectly satisfactory; for seed was raised then, without trouble. I presume a few colonies of Italian bees would have answered equally well; but as bad luck has attended their efforts at importing, I do not know that the experiment of substituting Italians for the bumble-bees has yet been tried. Darwin noticed, long ago, that bumble-bees were necessary for a good crop of clover seed, and suggested the following reason why better clover seed could be raised in the vicinity of towns than elsewhere: The greatest enemy of the bumble-bee is the field-mouse, that preys upon their nests; therefore, if the mice are kept at bay, the bumble-bees will flourish. In the vicinity of towns more cats are kept than in the country, for every family, generally, keeps a cat, and some fearless individual has gone so far as to suggest that a town which contains an unusual number of maiden ladies, who are said to favor cats especially, will prove the most profitable neighborhood for raising clover seed.[153]

A few years ago, the people in some part of Mass. got an idea that the bees, which were kept there in large numbers, were in some way prejudicial to the fruit; after some controversy, the bees were banished from the town. In a year or two they found the fruit not only no better, but decidedly the reverse; for the trees blossomed profusely but bore no crops. By a unanimous request, our friend was persuaded to return with his bees, and since then the trees have not only blossomed, but have borne fruit in profusion. It is well known to those who raise the earliest cherries, that unless the sun comes out, when they are in bloom, long enough to allow the bees to visit the blossoms, no fruit will be produced. As the very earliest varieties blossom before the weather has really got settled and warm, this is one great drawback to their culture.

The Catawba is a very desirable variety of grape, as is also the Delaware; but the former is very late, and the latter very small. Dr. Grant originated the Iona by fertilizing the blossoms of the one with the pollen of the other; but in his first attempts he failed repeatedly, because the bees were sure to upset all his experiments by their intermeddling.[154] When he thought of the idea of covering the flowers from which he wished to produce the hybrid seed with lace, or something of a similar nature, to keep the bees away, he succeeded at once, and we now have the Iona, as the result, a grape

* This point was called in question in *Gleanings in Bee Culture;* but so many corroborating testimonies from eye-witnesses came in, to the effect that Italians do bite through the spur, that the point is now better established than ever.

that is just about half way between the Delaware and Catawba, having very distinctly the flavor of each.

Throughout the animal and vegetable kingdoms there seems to be a constant struggle for the perpetuation of their species, which is secured only by ripening perfect seeds. Notice how the weeds in our garden will struggle and fight, as it were, to get a foot-hold until they can get a crop of seeds ripened, and then notice the numerous ways they adopt to scatter this seed as widely as possible. If the plants were animated beings, we might almost call it tricks and sharp practice; some of the seeds have wings, and fly like grasshoppers; others have hooks, and catch on our clothing, and on the fur of different animals, in the hope of being carried to some spot where they may have a more favorable place to germinate. Fruits and berries, instead of clothing themselves in the sober green of the foliage surrounding them, when the seeds are fully ripened affect scarlet red and other bright colors, and, sometimes, fancy stripes, just to induce the birds to take them in preference to the fruit of other trees. Why do they want their fruits to be eaten by the birds, if it is their purpose to secure a place for their seed? Well, if you examine, you will find that the seed is encased in a horny shell that is proof against the digestive organs of the bird, and these seeds and stones are, therefore, voided frequently, if not invariably, while on the wing, in just the condition to take root in the soil wherever they may be cast. Bear this in mind while we go back a little to the bees and flowers.

I have suggested that the honey is placed in the flowers to attract the bees; after a bee has found honey in one flower he will be very likely to examine others of a similar kind or appearance. If the flowers were all green, like the leaves of the plant, the insects would find much more trouble in hunting them up than they now do, because the contrasting color, such as the white or red of the clovers, makes them conspicuous. If you look back to what I said about corn and ragweed you will see that the flowers of both are a plain green, for they have no need of bees to insure their fertilization.

It is easily proven, that bees have a sort of telescopic vision that enables them to perceive objects at long distances; when a bee starts out in the morning, he circles up aloft, then takes a view, and starts out for business. If one field of clover should be more conspicuous than the rest, he would probably give it the preference—at least, so far as to make an examination. If he has been at work on a profitable field the day before, he will, doubtless, strike for it again without any preamble. That bees look for honey, and hunt it out, I have proven to my full satisfaction; and I am well convinced that what is often called instinct, and allowed to drop there, is only profiting by experience, and an excellent memory of past events, much in the same way human beings do. We say that bees instinctively go to the flowers for honey; I have watched them in the spring when the blossoms first open, and many a one, very likely a young bee that has never before seen a blossom, will examine the leaves, branches, and even rough wood, of the trunk of the tree, intently smelling and sniffing at every part, until he finds just where the coveted treasure is located. After he has dived deep into one blossom, and tasted the nectar, he knows pretty well where to look next.

One afternoon the door of the honey-house was left open, and the bees were doing a "land-office" business, before the mischief was stopped. After closing the door until they had clustered on the windows in the room, it was opened, and the process repeated until all were out; but, all the rest of the afternoon they were hovering about the door. Toward night they gradually disappeared; and when I went down, about sundown, to try a new feeder, not a bee was near the door. I put the feeder in front of a hive where the bees were clustered out; and as soon as a few bees had got a taste, and filled themselves, they of course went into the hive to unload. I expected a lot to come out, as soon as these entered with their precious loads, but was much astonished to see an eager crowd come tumbling out, as if they were going to swarm, and still more when they rushed right past the feeder and took wing for— where do you suppose? the honey-house door, of course. How should they reason otherwise, than that it had again been left open, and that was where these incomers had found their rich loads? On finding it closed, back to the hive they came, to repeat the manœuvre over and over.[155]

HOW TO START BEES AT WORK ON RYE MEAL.

A beginner hears the feeding of oatmeal highly recommended as a substitute for pollen. He places some near the entrances of the hives, but not a bee touches it. He is told again to wait until early spring, before the bees have access to natural pollen, and then they will take it. He does so, but, as before, not a bee notices it. He is next told to put a heap of it in the sun, a few rods distant from the hives. This time he may succeed; but it would not be strange if he should once more report that his bees would have nothing to do with it. Finally he is directed to take a piece of honey and get some bees to feeding on it, then to set it on the heap of meal. The bees soon gather over it in great numbers; those who go home loaded start out many more searching all about the vicinity, to see where the treasure comes from. The hum of the busy ones on the honey soon attracts them, and, in snuffing about the pile of meal, some bee discovers that it can be used as a substitute for pollen; the others soon follow suit, and, in a little time, both the bees and their owner are happy, and the pile of meal quickly disappears. After this he never has any more trouble in getting the bees to work on meal, for he *knows how.* The bees and their owner have both learned a valuable lesson about pollen. Is there any very great difference in the way they have been taught? Did they not both learn by practical experiment?[350]

The touch-me-not has learned, by ages of experiment, to produce a bright orange flower, to secrete honey in the spur, to place the pollen-bearing stamens at the point where the bee must rub against them in getting the honey, to construct those wonderful seed-pods, which explode and scatter the seed far and wide, just that it may reproduce and multiply its species. I should judge it had succeeded pretty well in a waste piece of woodland near my home, for there are now acres of it as high as one's head, and it is quite a valuable acquisition to our apiary. As nearly as I can make out, the plant has much increased since the advent of the Italians, as might be expected; and instead of having a dearth of pasturage for several months in the fall of the year, we not only have honey enough so that the bees trouble the houses and groceries very little, but they amass sufficient stores to carry them through the winter, with little if any feeding. This is true of dandelions as well; and the large, brilliant, showy blossoms that now line our roadsides and waste places, instead of unsightly weeds, should remind one of how much an apiary of bees contributes to fulfill the words of sacred prophecy:

> The wilderness and the solitary place shall be glad for them; and the desert shall rejoice, and blossom as the rose.—*Isaiah* 35: 1.

Now, I can not positively affirm that the flowers were given their gaudy colors by the bees' selecting the brightest and most conspicuous, thereby inducing such blossoms to bear seed in preference to those less gaudily attired, neither do I know that cherries became red because the birds selected those that showed a disposition to that color, year after year, for many centuries; nor can I prove that the bright plumage of male birds came about in the course of time, simply because the female encouraged the attentions of and showed a preference for those most handsome. I can only suggest that the actions of birds, bees, flowers, and fruits, seem to point that way. You all know how quickly we can get fancy-colored flowers, yellow queen-bees, or birds of almost any shade or color, by careful selection for several generations. Have not the bees so colored the flowers, and birds the berries, etc., although they did it all unconsciously?

My friend, before you again complain because you have found a cell or two of bee-bread in your comb honey, would you not better ponder on the wonderful agency which those simple grains of pollen exert on the plant life that is yet to come, years, perhaps, after we have faded away and gone?

POLLEN IN SECTION BOXES AND COMB HONEY.

I do not mean to convey the idea that we should be satisfied with pollen in our honey, for a very good and useful thing is sometimes a very bad one, if out of place. When pollen or meal is brought into the hive, it is taken, at once, very near to the brood; in fact, it is placed in the comb opposite, if possible. When opening hives in the spring, we find pollen scattered all through the brood-combs to some extent; but the two combs next to the two outside brood-combs are often a solid mass of pollen. Should a few stormy days intervene, however, this will disappear so quickly that one who has not witnessed the rapidity with which it is used in brood-rearing would not know how to account for it. When it is gone, of course the brood-rearing must cease, although the queen may continue to lay. The amount of brood that may be reared by keeping a stock supplied with pollen artificially, during such unfavorable weather, is a very important item, where rapid increase of stock is desired.

Using the candy slabs with $\frac{1}{4}$ or $\frac{1}{5}$ wheat flour is, perhaps, the surest way of doing this. See CANDY FOR BEES.

A friend has a house-apiary, where the combs are pretty deep, and no upper story is used. His comb honey was all secured in frames containing sections at the side of the brood. When asked if the bees did not deposit pollen in the sections when used in that way he replied, "Not if a comb is interposed between the brood and the honey." This is because they always want the pollen next the brood. Now, we can get more comb honey by having it near the brood than in any other way; what shall we do to keep out the pollen, and to keep the queen from laying eggs in our surplus-honey sections? The remedy I have adopted, and advised through this work, is the use of separators, with the small one-pound section boxes; for it is well known that the queen is averse to using small pieces of comb, or comb near much wood. In our own apiary, I have never known the queen to deposit eggs in these sections, when thus prepared, even if they are placed next the brood-combs; but others have written that they are, at times, filled with both brood and pollen, even when thus prepared. If I could see the hives, I think I could find the trouble, yet there may be exceptional cases. The frames or sections used in the lower story are more likely to be filled with pollen than those in the upper story; for if the wide frames and sections are so made that but about ¼-inch space is left for the bees to go up into them, the queen is very unlikely to attempt to go up.[157] An occasional cell of pollen will sometimes be found, which I regret the more, because such combs are much more likely to contain worms, if taken out in warm weather. If it were not for this small, accidental quantity of pollen, I am not sure we should ever find worms in the comb honey. See BEE-MOTH.

POLLEN IN THE SECTIONS AS THE RESULT OF CONTRACTING THE BROOD-CHAMBER TOO MUCH.

Pollen will be forced into the surplus apartment if contraction (see COMB HONEY) be carried too far. The brood-chamber should not be reduced, ordinarily, to more than two-thirds its former capacity. During one season, when the honey-flow was rather meager, desiring to get all the honey into the sections that was gathered, we contracted the brood-nest of two or three of our best colonies down to two or three frames. This, of course, left the bees very little room for the storage of honey below, and, as we reasoned, the overplus of honey would go above right speedily, which it did. The bees went to work in the sections, without any trouble. The supers of these colonies were filled, while colonies whose brood-chambers were moderately contracted made no demonstration above. When, however, we came to take off the honey at the close of the season, from the first-mentioned colonies, we found that it contained more or less pollen. The sections from the colony which had only two brood-frames, contained the most pollen.

A fair average colony will bring in just so much pollen, and they will put it somewhere. They prefer to put it in and around the brood; but if this is denied them they will put it "upstairs," just where we don't want them to put it, especially when running for comb honey. Had not queen-excluding honey-boards been placed between the upper and lower stories, the queen, no doubt, would likewise have deposited eggs in the sections; for, of course, her field of labor was considerably reduced. Indeed, reports have been received where such excessive contraction has resulted in depositing eggs in the sections, when the slatted honey-board was not queen-excluding. In view of the foregoing, if you desire to keep brood and pollen in their proper places, do not contract the brood-nest to less than 6 Langstroth frames.

QUEEN-EXCLUDING HONEY-BOARDS NOT NECESSARILY AN EXCLUDER OF POLLEN.

It is said, that the strips of perforated zinc in the slatted honey-board will largely prevent the storage of pollen above. From what experience we have had, I am inclined to think the zinc will discourage it to some extent; but from the incident above related it will be observed that, if contraction be carried too far, the bees will put the pollen where they please, zinc or no zinc.

PROPOLIS. This is the gum or varnish that bees collect for varnishing over the inside of their hives, filling cracks and crevices, cementing loose pieces of the hive together, and for making things fast and close generally. It collects, in time, on old hives and combs, so as to add very materially to their weight. It is not generally gathered in any great quantity until at the close of the season, and it seems to be collected in response to a kind of instinct that bids them prepare for cold weather. I wish I were able to tell you more definitely where they get it; it has been suggested that it is collected from the resinous buds of the balm-of-gilead, and trees of a like nature; but to tell the truth, I do not know that I ever saw bees collecting fresh propolis at all.[158] I see them almost every day, collecting propolis from old hives, old quilts, and pieces of refuse wax, when we are so wasteful and untidy as to leave any such scattered about. That the principal part of it comes from some particular plant or class of plants, or tree, I am pretty well satisfied, for almost the same aromatic resinous flavor is noticeable, no matter what the locality or season of the year. Bees gather propolis with their mandibles, and pack and carry it precisely as they do pollen. It is never packed in the cells, however, but is applied at once to the place wanted. It is often mixed with wax, to strengthen their combs, and is applied to the cells as a varnish, for the same purpose. In the absence of a natural supply, the bees frequently resort to various substances, such as paints, varnishes, resins, pitch, and the like; and the superstition, popular in some sections, that bees follow their owner to the grave, after his death, probably obtained credence from seeing the bees at work on the varnish of the coffin. To save the bees the trouble of waxing up the crevices in their hives, it has been suggested that a mixture of melted wax and resin be poured into the hive and made to flow along the cracks and corners. This may do very well, although I fancy the bees can do this better and cheaper than we can. Our principal trouble has been to get rid of the surplus propolis, and I should much rather hear of some invention to keep it out of the way, than to add more.

It has been recently suggested, that we paint our hives both inside and out, and also the frames, except where we wish to have the comb attached. From what experience I have had with painted bottom-boards, I am inclined to favor the idea, for, even if propolis is attached to the paint, it cleaves off much more readily than from the plain wood. By keeping the surface on any wood-work on the inside of the hives well oiled, or even rubbed with tallow, we may almost entirely prevent the accumulation of propolis. Many inventors of hives, and arrangements to be used inside of hives, seem utterly oblivious of the fact that every thing, in the course of time, is not only waxed over with this gum, but all holes, cracks, and interstices, where the bee can not crawl, are filled and covered up with it. Many new arrangements work nicely the first season, but after a year or two more are so clogged and fastened up as to be utterly impracticable.

HOW TO KEEP PROPOLIS FROM SURPLUS HONEY.

Of course, the readiest means is to remove all sections just as soon as a single one is capped over; and, as but little propolis is gathered during a strong yield of honey, but little will be found on the honey, unless it is left until the yield has ceased. The bees not only cover all the wood-work of the sections if left on too long, but they also varnish over the whole surface of the white capping, almost spoiling the looks and sale of the honey.

It is next to impossible to keep propolis from the sections entirely. Bees will deposit at least some in the interstices between the sections. As Nature abhors a vacuum, so bees seem to abhor a crack or crevice. The nearer we can get surplus arrangements so as to leave but few crevices or places of contact accessible to bees, the less propolis will be deposited. Some surplus arrangements are made so as to produce compression upon the sections, thus reducing the space formed by contact with sections to a minimum. Some prefer to have the outside of the sections covered entire. This can be accomplished either with the wide frames or with surplus arrangements having the top and bottom so as to cover the outsides of the sections. For removing propolis from sections, see COMB HONEY.

HOW TO REMOVE PROPOLIS FROM THE FINGERS.

A variety of substances have been suggested. Alcohol is perhaps the neatest, but is rather expensive; benzine answers nearly as well, but has an objectionable odor; soap will answer, if a little lard be rubbed on the hands first, but will have little effect on it otherwise. A friend down South says he has a pair of light cotton gloves, which he slips on when handling the waxy frames, and his hands are left clean whenever he is obliged to stop work. For removing it from glass, etc., alcohol is perhaps best. When we have much glass soiled, it can often be cleaned most expeditiously by boiling it in a kettle of water with a quantity of wood ashes.

DO THE BEES NEED PROPOLIS?

Much discussion has arisen in regard to the habit of the bees, of making all openings tight with propolis. Theory says, if allowed to follow his bent, or instinct, he will smother himself to death. Practice says, he does, at least at times, so prevent the escape of moisture, that his home gets damp and wet, filled with icicles, etc., so that he suffers; or, at least, such is the case in the hives we have provided for him. Who is right—the bee or the enlightened bee-keeper? Well, I think the greater part of the fault lies in the hive we have given him. The enameled cloth which I have lately been using for covering bees is as impervious to air and moisture as the propolis he collects with so much pains and trouble. If the outside of this is allowed to get frosty, it will, most assuredly, condense the breath of the bees on the inside; and if the outside is but thinly protected from the weather, icicles will certainly form on the inside, and freeze the bees all fast in a lump. Now I would have no fear at all in having the bees wax up every thing as tight as they wished, if I could have their winter apartment made so small that they completely filled it—filled it so full, indeed, as to be crowded out at the entrance, unless in very cold weather—and have the entire outside protected with some non-conductor that would enable the bees to keep the inner walls warm at all times, I think then we should have no dampness. With chaff packing and chaff cushions, I have succeeded so well that I am perfectly willing the little fellows shall fix up just as snug for winter as their instinct prompts them to do.

VALUE OF PROPOLIS.

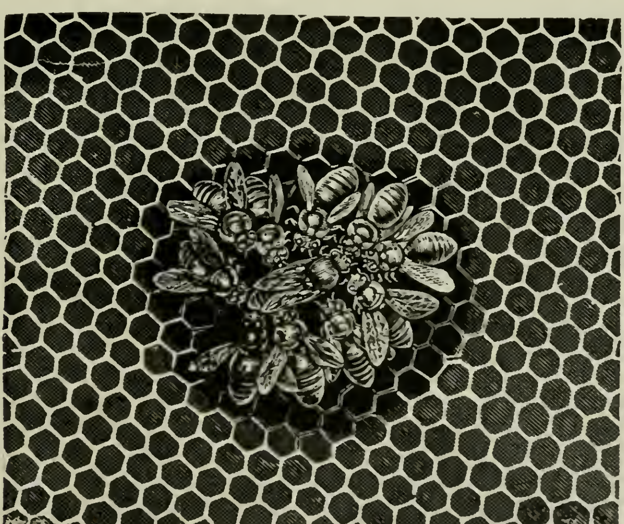
Although this gum has been used to some extent in medicine. I believe it possesses no particular value over burgundy pitch and other cheap gum resins.

REMOVING WAX AND PROPOLIS BY STEAM.

A friend sends us the following, which will prove very serviceable when one has a steam-boiler convenient:

I have tried all the formulas for cleaning wax from utensils, and, in my experience, have found that concentrated lye cleans it off faster and more thoroughly than any thing else. All the methods are troublesome, and it takes time to clean, especially the perforations. My plan of cleaning wax from the perforated basket of the wax-extractor is, to have two pieces of gas-pipe, each one foot long, just large enough to screw into the sprinkler of the fountain pump. Attach the sprinkler to one end of the pipe, procure a globe valve, and screw this on the other end: screw one end of the other piece of pipe on the globe valve, and the other end into the steam-boiler, about one or two inches below the water-line. Open the valve, and spray the articles covered with wax, with steam and hot water. You will be astonished to find how quickly it makes things look like new.

St. Gabrielle, La., Aug. 8, '79. J. A. Pritchard.



THE QUEEN AND HER RETINUE.

(See following page.)

Q.

QUEENS. The most important personage in the hive is the queen, or mother-bee. She is called the mother-bee because she is, in reality, the mother of all the bees in the hive. So much has already been said of queens, in ARTIFICIAL SWARMING, DRONES, and QUEEN-REARING, that I presume our A B C class are already pretty well acquainted with her majesty, as she is frequently designated.

If you deprive a colony of their queen, the bees will set to work and raise another, so long as they have any worker-larvæ in the hive with which to do it. This is the rule, but there are some exceptions: the exceptions are so few, however, that it is safe to assume that a queen of some kind is present in the hive, whenever they refuse to start queen-cells from larvæ of a proper age.

What do I mean by a queen of some kind? Well, I shall have to tell you that bees, especially when deprived of their queens unnaturally, and broken up into small colonies or nuclei, as beginners are very apt to have them, in order to raise a queen, often select a worker-larva so old that the queen raised from it is about half worker and half queen.

IMPERFECTLY DEVELOPED QUEENS.

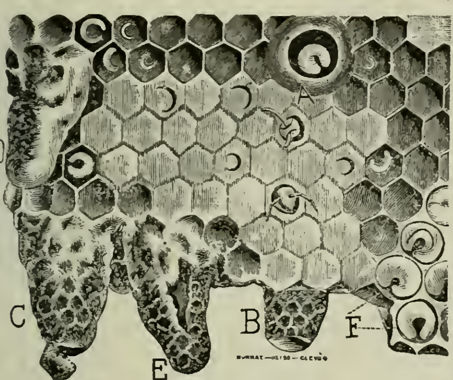
Such queens are small, usually dark in color, and will sometimes become fertilized, and lay eggs for a little while (all the way from a week to several months), but they are never profitable. Sometimes they will not lay at all, but will remain in a colony all through the season, neither doing any good nor permitting any other queen to be either introduced or reared. A wingless queen, or one with bad wings, will produce the same result. The remedy is to hunt them out and remove them. Where they are so near like a worker-bee as to make it hard to distinguish them. they may often be detected by the peculiar behavior of the bees toward them. See INTRODUCING QUEENS, also cut on preceding page.

So far as I have been able to make out, these half-worker queens are the result of trying to raise a queen when there are too few bees, or when the larvæ with which they are obliged to rear a queen are too old; that is, too nearly ready to seal up. Where they can do no better, they will undertake to rear a queen from a larva only one day before sealing up; it will be, at this age, almost full size, being 8 days from the time the egg was laid. They enlarge the cell, dose it with the royal jelly, and from that time onward it has the care given a queen from the egg. I have watched such queens when they first came from the cell, and some of them were little, if any, different from a common worker; others would have the body a little more elongated, and a peculiar taper, or slimness, that, to a practiced eye, invariably distinguishes the queen from the worker.

HOW A WORKER-EGG IS MADE TO PRODUCE A QUEEN.

This is a question often asked, and it is one that puzzles me about as much to answer as any question a visitor can ask. I cannot promise to tell you all about it, but I will tell you all I know about it. We will first get a frame of eggs, as we did in studying BEES, but we will vary the experiment by putting it into a colony having no queen. The minute eggs will hatch into larvæ as before; but about as soon as they begin to hatch, if you look carefully you will see some of the cells supplied with a greater profusion of the milky food than others. Later, these cells will begin to be enlarged, and soon at the expense of the adjoining ones. These are queen-cells, and they are something like the cup of an acorn in shape, and usually occupy about the space of three ordinary cells. In the drawing given, you will see cells in different stages of growth.

At A, is a cell just being converted into a queen-cell; at B, one where the thin walls are extended so as to form a queen-cell proper, almost ready to seal up. This occurs at just about 9 days from the time the egg was laid. In 7 days more, 16 days in all from the time the egg was laid, the queen will hatch out, a perfect insect. C is a cell just vacated. Now bear in mind exactly what I say, or you will get confused. If, instead of eggs, larvæ 3 days old are given the bees, they will rear a queen, and, in this case, she will hatch in only ten days after the larvæ were given them. These ten-day queens may be just as good as any;[160] but to be on the safe side, I would prefer giving them larvæ one or two days younger, that they might have the benefit of this excess of food and larger cell, during the whole of their larval period. The six-day larvæ are quite large fellows, as you will see by the cut at F.



QUEEN-CELLS.

There are some queer things about queen-cells, as you will notice. After the cell is sealed, they go and put a great excess of wax on it, give it a long tapering point, and corrugate the sides something like a thimble, as shown at C. This corrugation, or roughness, when closely examined, will be seen to be honey-comb on a very small scale. Now right here is a point that you will not fail to observe: Bees, like other folks, sometimes make mistakes; for they do not seem to know any better than to use a drone-larva for rearing a queen, if such happens to be present. Therefore, when selecting eggs for this purpose, be sure you do not give them any contained in drone comb. They will go right on, and dose the poor drone with the royal jelly, but the poor fellow usually dies before it is time to hatch out, and then the bees and their owner wait in vain for the cell to hatch. It has been reported of late, that the inmate of such a cell sometimes hatches, but he is only a drone, even then, and not a queen. Well, I am glad to be able to tell you that you never need waste time on this kind of cells,* for the bees have a way of marking them, unconsciously, it would seem. Queen-cells containing drone-larvæ (see D in cut) are always smooth, without corrugation, so you can detect and remove them before valuable time is wasted.

* Once in a great while there is an exception to even this rule: it is when the bees build an unusually large queen-cell with corrugations so large and fanciful that it is really miniature honey-comb over the surface of the queen-cell. The only reason I can suggest for this is, that it is because they are out of work, and want something to do.

Now, it is very handy to be able to tell about when any queen-cells you may happen to find unexpectedly will be likely to hatch; and the bees are very accommodating in this respect also; for, about the day before the queen hatches, or it may be two days, they go and tear down this long peak of wax on the tip of the cell, and leave only a very thin covering, similar to D. I do not know what this is for, unless it is because they are anxious to get a peep at their new mother. It has been said, they do it that she may be better able to pierce the capping; but sometimes they omit the proceeding entirely, and I have not been able to see that she has any difficulty in cutting the cap off. If the cell is built on new comb, or on a sheet of fdn., and it be held up before a strong light, at about the 15th day, or a little later, you will see the queen moving about in the cell. A little later, by listening carefully, you can hear her gnawing her way out. Pretty soon the points of her sharp and powerful mandibles will be seen protruding, as she bites out a narrow line. Since she turns her body in a circle while doing this, she cuts out a circle so true that it often looks as if cut out by a pair of compasses. Now observe, that the substance of which the cell is made is tough and leathery,[161] and, therefore, before she gets clear around her circle, the piece springs out in response to her pushing, and opens just about as the lid of a coffee-pot would, if a kitten should happen to be inside crowding against the lid. I have often seen them push the door open and look out, with as much apparent curiosity as a child exhibits when it first creeps to the door on a summer morning: often, after taking this look, they will back down into their cradle, and stay some time. This is especially the case when other queens are hatching, and there is a strife as to who shall be sovereign.

We will now consider the strange substance

ROYAL JELLY.

The milky food before described, which is given to the young larvæ, and which is supposed to be a mixture of pollen and honey partially digested, is very similar, if not identical, in composition with the royal jelly. The bees are not the only examples in the animal kingdom, where the food is taken into the stomach by the parent, and, after a partial digestion, is thrown up for the use of the offspring. Pigeons feed their young precisely in this way, until they are able to digest the food for themselves. It has been stated that bees use a coarser food for the worker-larvæ, after they are a few days old, and also for the drone - larvæ, during the whole of their larval state. What I mean by a coarser food is, a food not so perfectly digested; in fact, drones are said to be fed on a mixture of pollen and honey, in a state nearly natural. This may be so, but I have no means of proving it to my satisfaction. It has also been said, that the queens receive the very finest, most perfectly digested, and concentrated food that they can prepare. This I can readily believe, for the royal jelly has a very rich taste—something between cream, quince jelly, and honey—with a slightly tart and a rank, strong, milky taste that is quite sickening, if much of it be taken. I am much inclined to think that the same food that is given the young larvæ at first will form royal jelly, if left exposed to the air, as it is in the broad, open queen-cells. After a queen has hatched it is sometimes found dried down hard, and looks much like stiff fruit-jelly. Whether this is the product of the milky food when allowed to stand, as I have suggested, is a question to be decided. The bees, when rearing queens, furnish this food in profusion, and I have seen, during the swarming time, single combs that contained a good spoonful, deposited, of course, in queen - cells. See Anatomy of Bees.

WHAT DOES THE QUEEN DO WHILE SEALED UP?

Candidly, I do not know very much about it, although I have opened cells at every stage after they were sealed, until they were ready to hatch. One day after being sealed, they are simply ordinary larvæ, although rather larger than worker larvæ of the same age; after two or three days, a head begins gradually to be "mapped out," if that is the proper expression, and later, some legs are seen folded up; last of all, a pair of delicate wings come from somewhere, I hardly know how. Two days before hatching I have taken them out of the cell, and had them mature into perfect queens, by simply keeping them in a warm place. I have also taken them out of the cell before they were mature, held the white, still, corpse - like form in my hand while I admired it as long as I chose, then put it back, waxed up the cell by warming a bit of wax in my fingers, and had it hatch out three days after, as nice a queen as any. Mr. Langstroth mentions having seen the whole operation by placing a thin glass tube, open at both ends, into the cell, so as to have it inclose the queen, the bees being allowed to cap it as usual. If I am correct, this experiment was first made by Huber. With several such glass queen-cells, and a lamp nursery, I presume the whole operation could be watched from beginning to end.

DAVIS' TRANSPOSITION PROCESS.

In the month of August, 1874, after I had discovered how to send larvæ for queen-rearing safely by mail for short distances, our friend J. L. Davis, of Delhi, Ingham Co., Mich., wrote that he should get a large number of queens from the piece I sent him, for he was going to remove the larvæ from the cells and place them in queen - cells already started in his hives; of course, removing the original larvæ first. I caught at the idea at once, and went to some hives of hybrids that had persisted in tearing down all the cells given them, and building others from their own brood, and removed the larvæ from all the cells, substituting larvæ from the imported queen in its stead. I used a quill toothpick for making the transposition. Almost every cell was built out and capped, just as well as if they had kept their own black stock. In due time I had as nice a lot of fine yellow queens as I ever reared. We have practiced this method almost every year since.

Mr. Davis described his invention in the Sept. No. of Gleanings for 1874, and it has been commented on, and suggestions added, in almost every volume since. From letters received from other parties, it seems that he may not have been the first person to make the discovery that larvæ could be thus safely transposed: but as he was the first one who made the discovery known to the public, and put it into practical and profitable use, he certainly deserves all credit and honor for his discovery, and a vote of thanks for generously giving it to the world at once, without any thought of reserving it for his own private benefit, as he might have done.

We have used a tiny silver spoon, made on purpose for removing the larvæ, and as much of the milky food as possible.[161] I need hardly caution you that these small larvæ are very tender and delicate, and will hardly bear so much as a touch, without injury.

WHAT BECOMES OF THE QUEEN AFTER SHE LEAVES THE CELL?

I am glad to say, that I can tell you, by personal observation, pretty nearly what a queen does after she pushes open that hinged door that I told you of, and which you will find illustrated under the head of QUEEN-REARING. She generally begins to put her head into the cells until she finds one containing unsealed honey, from which she takes a sup that, at least, indicates that she likes that kind of provision. May I digress enough here to ask, if it does not almost seem proper to say that she *remembers* where honey is to be had? *She* never existed before, it is true; but are you sure she does not remember at all what her mother and grandmother did ages and ages before her? It may be as well to say she does it by instinct, but I confess that term hardly satisfies *me*.

After she has had her supper she begins to crawl about, partly to enjoy using the long strong legs God has given her, and perhaps because she "remembers" that it is her allotted task to tear down the remaining queen-cells, if such there are. If other queens have hatched before her, it is one of her first and foremost duties to look them up, and either reign supreme or die in the attempt.[162] If all the other cells have been removed, as they usually are where queens are wanted for other purposes, she has nothing to do but to promenade over the premises, monarch of all she surveys. If she ever sits down to take a rest, or takes a rest in any other position, during the first week of her life, I have never been able to discover it. She is always traveling about, and this is one reason why I am averse to caging young queens, in order that we may allow several to hatch in the same hive. It seems to be natural for them to run about, and I believe it is necessary for their well-being. Several years ago I thought I had made a brilliant discovery when I succeeded in hatching all the queen-cells in the hive, under cups made of wire cloth. The first hatched was allowed to run until she became fertile, and began laying; she was then removed, and the next released, and so on. I think I succeeded in getting four laying queens from the single lot of cells, all in the one hive, but the bees made such desperate efforts to get the obnoxious cages out of the way, and the inmates of the cages to get out, that I gave up the plan, after seeing several fine queens die of nothing else, so far as I could see, than confinement.

But suppose she does find another cell; what then? Well, she sometimes runs around it awhile; sometimes the bees tear it down, and sometimes she tears it down herself, with the same strong mandibles that she used to cut her way out of the cell at first. She usually makes the opening in the side of the cell, as shown at E in cut on page 227.

Now, it is said that the queen immediately stings her helpless immature sister, to make a sure thing of her destruction; but of this I am not certain, for I never saw her in the act of so doing. I have seen spots in the side of the queen that looked much as if she had been stung, but I have also rescued cells and put them in the lamp-nursery after they had been torn open, and had them mature into nice queens. As these immature queens are very soft, the workers will soon pick them out of the cell, piece by piece, and I have sometimes placed them in the lamp-nursery and had them mature, minus a wing or leg, or whatever portion the mischievous worker had pulled away. I judge from many such observations that the queen generally tears a hole in the cell, or bites into it in such a way that the workers take hold of it, and tear it all down, much in the way they do any mutilated or broken piece of comb.[163] When queen-cells have been cut out, all the larvæ that are in any way injured are at once thrown out, and none but the perfect cells preserved. Bees never fuss with cripples, or try to nurse up a bee that is wounded or maimed. They have just the same feeling for their fellows that a locomotive might be expected to have for a man whom it had run over. They battle against any thing that threatens the extinction of the colony, it is true; but I have never been able to discover any signs of their caring for one of their number, or even having compassion on their helpless brood, when it is wounded and suffering. If a hole is made in a queen-cell, by the queen or anybody else, they are very likely to tear it down and throw it away. When a queen hatches, the remaining cells are very soon torn down, as a general thing, but there are many exceptions. When two queens hatch out at about the same time, they also generally attempt to kill each other; but I have never heard of both being killed. This probably results from the fact that they can sting their rivals only in one certain; way and the one that, by strength or accident, gets the lucky position in the combat, is sure to come off victor. This explains how a very inferior virgin queen, that has got into the hive by accident, may sometimes supplant an old laying queen. Two queens, when thus thrown together, generally fight very soon, but this is not always the case. Several cases are on record where they have lived in peace and harmony for months, even when hatched at about the same time, and it is quite common to find a young queen helping her mother in the egg-laying duties of the hive, especially when the mother is two or three years old. If the season is good, and the hive populous, very often, instead of a fight, they divide up their forces in some way, and we have AFTER-SWARMING, which see.[164]

Sometimes the queen will pay no attention to the remaining cells,[362] but will let them hatch out, and then their "little differences" are adjusted afterward, either by swarming or by the usual "hand-to-hand" conflict "until death." I once looked for a queen, and, not finding her, concluded she was lost. Another cell was inserted, and in due time hatched out. I was much surprised to find my new queen laying when only one day old; but a little further looking revealed the two, both on the same comb. Many losses in introducing queens have resulted from two queens being in the hive, the owner being sure his hive was queenless, because he had removed one.

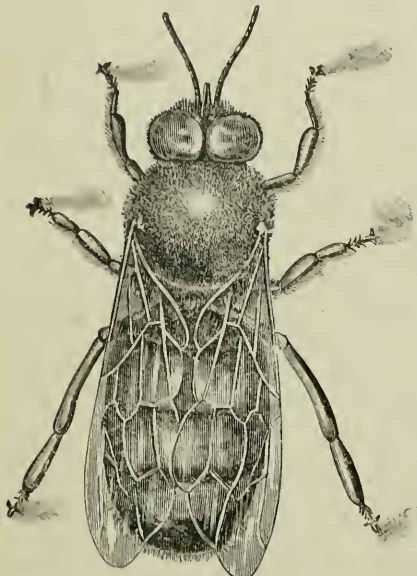
QUEENS' VOICES.

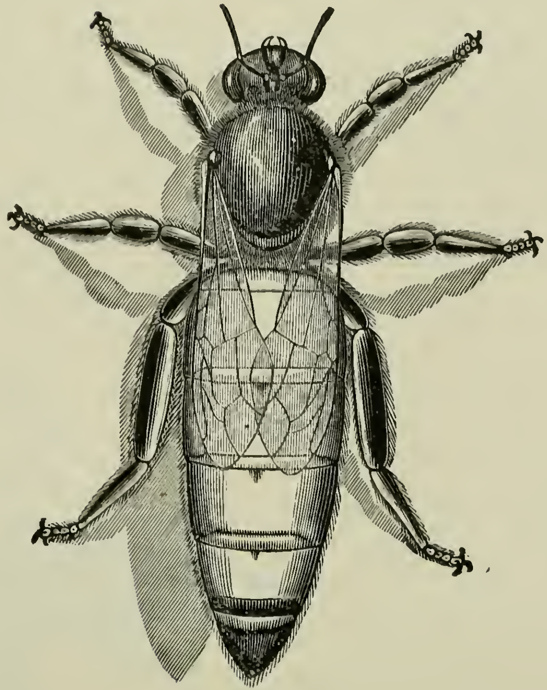
When a colony swarms naturally, the young queens of the after-swarms have a queer way of calling to each other, when about to hatch out, I suppose, or when they have their cell-doors open, and are afraid to emerge.[165] The note they utter is more like "zeep, zeep, zeep," than any thing else I can spell, and their tones are so different that it is really amusing to hear them call.[363] It is common to hear them where there are two queens in the same hive, in a fighting mood, or stirred by jealousy; and I often hear this call when simply passing by the hives in swarming season. The queen sometimes utters this call at other times, though not often. When a young queen is being introduced she will frequently utter a similar note of alarm, and some of our friends have called it "squealing." The bees are almost always stirred by these notes of the queen, and they will often turn and run after her and cling around her like a ball, when they would have paid no attention to her had she not uttered this well-known note. After you have once heard it, you will recognize it ever afterward. Queens, when placed near together in cages, will often call and answer each other, in tones that we have supposed might be challenges to mortal combat.

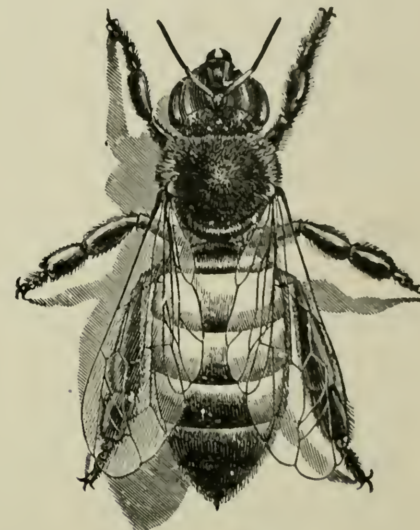
Some queens received one summer from W. P. Henderson, of Murfreesboro, Tenn., called so loudly, when placed on our table, that they could be heard clear across a long room. One voice would be on a high, shrill key, and another a deep bass, while others were intermediate. On watching closely, a tremulous movement of the wings was noticed while the queen was uttering the note, from which I infer that the sound is produced by the wings, in a manner similar to that in which katydids and locusts produce their peculiar notes. The fact that a queen may be prevented from "squealing" while being introduced, by daubing her wings with honey, is also conclusive that the sound is produced by the wings.[164] That these sounds from the queen have the power of controlling certain movements of the bees I am well aware, but I do not know just how or to what extent this influence works.

VIRGIN QUEENS.

The newly hatched queen is termed a virgin queen to distinguish her from queens that have been fertilized by the drone, and are laying. Virgin queens, when first hatched, are sometimes nearly as large as a fertile queen, but they gradually decrease in size; and when three or four days old they often look so small and insignificant that a novice is disgusted with their appearance, and, if he is hasty, pronounces them good for nothing. For the first week of their lives they crawl about much as an ordinary young worker does, and it is often very difficult, if not almost impossible, to find them, unless an amount of time is taken that is more than a busy apiarist can well afford to spare. In QUEEN-REARING I have advised not to look for them, but to insert a small piece of comb containing larvæ, and, if no cells are started, you can decide the queen is there, without looking. This piece of larvæ answers a threefold purpose. It tells at a glance whether the queen is in the hive all right or not; for the very moment she is lost, they will start more queen cells on it; it enables the bees to start another queen, in case the queen is lost by any accident in her wedding-flight, which is frequently the case; and, lastly, it serves as a sort of nucleus to hold the bees together, and to keep them from going out with the queen on her wedding-trip, which they are much disposed to to do, if in a small nucleus containing no brood. Unsealed brood in a hive is a great safeguard against accidents of all sorts, and I have often started a young queen to laying by simply giving the bees some eggs


DRONE.


QUEEN.


WORKER.

and unsealed brood. Whether it caused her to rouse up and take her wedding-flight, or whether she had taken it, but was for some reason idle, I can not say; but this I know, that young queens that do not lay at two weeks of age will often commence, when eggs and larvæ are given to their colonies. It may be that the sight of eggs and larvæ suggests to them the next step in affairs, or it may induce the workers to feed them, as they do a laying queen, an unusual quantity of food.

AGE AT WHICH VIRGIN QUEENS TAKE THEIR WEDDING-FLIGHT.

Our books seem to disagree considerably on this point, and I am afraid that many of the book-makers find it easier to copy from the sayings of others than to make practical experiments. It has been variously stated, at from two to ten days: some go as far as to say that the queen goes out to meet the drones the day after leaving the cell. It is quite likely that some difference arises from the fact that queens often stay in the cell a day or two after they are strong enough to walk about.* Sometimes a queen will be found walking about the combs when she is so young as to be almost white; I have often seen beginners rejoice at their beautiful yellow queens, saying that they were yellow all over, without a bit of black on them; but when looked at again, they would be found to be as dark as the generality of queens. At other times when they come out of the cell they will look, both in color and size, as if they might be three or four days old. The queens in our apiary generally begin to crawl about the entrance of the hive, possibly looking out now and then, when 5 or 6 days old. The next day, supposing of course we have fine weather, they will generally go out and try their wings a little. These flights are usually taken in the warmest part of the afternoon. I know of no prettier or more interesting sight to the apiarist than the first flight of a queen. Perhaps a few hours before he had looked at her, and been disappointed at her small and insignificant appearance; but now, as she ventures out cautiously on the alighting-board, with her wings slightly raised, her tapering body elongated and amazingly increased in size, he looks in wonder, scarcely believing she can be the same insect. She runs this way and that, something as does a young bee, only apparently much more excited at the prospect of soaring aloft in the soft summer air. Finally she tremblingly spreads those long silky wings, and with a graceful movement that I can not remember to have seen equaled anywhere in the whole scope of animated nature, she swings from her feet, while her long body sways pendulously as she hovers about the entrance of the hive. When I first beheld one on the wing there was a queer feeling of having seen something similar, years ago, and I might have reasoned that I was remembering something my father or grandfather had seen, did I not know that none of them were ever bee-keepers. Below I have tried to give you a picture of

A VIRGIN QUEEN UPON THE WING.

A worker-bee hovers about the entrance and carefully takes his points when he tries his wings for the first time; but she, seeming to feel instinctively that she is of more value to the colony than many, many workers, with the most scrupulous exactness notes every minute point and feature of the exterior of her abode, often alighting and taking wing again and again, to make sure she knows all about it. I remember that, when I saw one for the first time go through with all these manœuvres, I became impatient of so much circumlocution, and if I did not say, I felt like saying,—

"There! there! old lady; you certainly know where you live now; do you suppose a fellow can stay here all the afternoon, neglecting his business, just to see you start off on your first journey in life?"

By and by she ventures to circle a little way from home, always bringing back soon, but being gone longer and longer each time. She sometimes goes back into the hive satisfied, without going out of sight at all; but, in this case, she will be sure to take a longer flight next day, or a half-hour later in the same day. During these seasons she seems

* Recent reports state that queens were confined in cells 4 or 5 days after they should have hatched.

to be so intent on the idea she has in her little head, that she forgets all about surrounding things, and, instead of being frightened as usual at your opening the hive, she will pay no attention to you; but if you lift up the comb she is on she will take her flight from that as well as from anywhere else. I have caught them in my hand at such times, without their being frightened at all; but as soon as they were allowed to go, they were off as if nothing had happened. After she is satisfied that she will know the place, she ventures out boldly; and from the fact of her circling right up in the air, we have, until lately, supposed that fertilization took place above the ken of human eyesight. This has recently been shown to be a mistake, I think. After a successful flight, she returns with the organs of the drone remaining attached to her body. See DRONES. This is a white substance, and is frequently so large as to be plainly seen while she is on the wing. I should think a queen is usually gone half an hour, but I have seen them return fertilized after an absence of not more than 10 or 15 minutes. This accomplished, she goes quietly into the hive. The bees are much inclined to chase after her, and they sometimes pull at the protruding substance as if they would drag it away, but I am inclined to think it is eventually absorbed into the body of the queen. In looking at her the day after, all the trace of it you will observe will be possibly a shriveled thread. In one day more you will, as a general rule, find her depositing eggs. I presume the average age at which our queens are laying is about 9 days; we generally wait 10 days from the date of hatching, and are then pretty sure of finding them ready to send off. Between the fertilization and the time the first egg is laid a remarkable change takes place. After the queen has been out and fertilized, her appearance is much the same as before. She runs and hides when the hive is opened, and looks so small and insignificant, one would not think of calling her a fertile queen. A few hours before the first egg is laid, however, her body increases remarkably in size, and, if an Italian, becomes lighter in color, and, instead of running about as before, she walks slowly and sedately, and seems to have given up all her youthful freaks, and come down to the sober business of life, in supplying the cells with eggs.

HOW OLD A QUEEN MAY BE AND STILL BECOME FERTILIZED.

As I have said before, our queens usually begin to lay when 8 or 10 days old, on the average; but, during a dearth of pasturage, or when drones are scarce, they may fail to lay until three weeks old. The longest period I have ever known to elapse between the birth of a queen and laying, when she produced worker-eggs, was 25 days. I think I would destroy all queens that do not lay at the age of 20 days, if the season, flow of honey, flight of drones, etc., is all right. There is one important exception to this. Many times, queens will not lay in the fall at all, unless a flow of honey is produced either by natural or artificial means. Queens introduced in Sept. and Oct. will often not lay at all until the ensuing spring, unless the colony is fed regularly every day for a week or 10 days. Also young queens that are fertilized late in the season will often show no indications of being fertilized until the colony is fed as I have indicated. A lot of young queens that I thought might be fertilized but did not lay, I once wintered over, just to try the experiment; and although they went into winter quarters looking very small, like virgin queens, they nearly all proved fine layers in the spring.

DRONE-LAYING QUEENS.

If a queen is not fertilized in two weeks from the time she is hatched, she will often commence laying without being fertilized at all. She is then what we call a drone-laying queen. Usually her eggs are not deposited in the regular order of a fertile queen, neither are there as many of them; but, by these marks, we are able only to guess that she may not be all right, and so keep her until some of the brood is capped, when the extra height of the cappings, as I have explained under DRONES, will tell the story. At times, however, the eggs are deposited so regularly that we are deceived, and the queen may be sold for a fertile queen, when she is only a worthless drone-layer; but we always discover it after the brood is capped, and send our customer another queen. Such a case occurs, perhaps once in a hundred. Whether these drone-layers are just as good to furnish supplies of drones for the apiary as the drones reared from a fertile queen, is a point, I believe, not fully decided; but if you care for my opinion, I should say, if the queen lays the eggs in drone-comb, and the drones are large, fine, and healthy, I believe them to be just as good. I should not want to use drones reared from fertile workers, or drones reared in worker-cells, as those from drone-laying queens sometimes are.

THE MEETING BETWEEN THE QUEEN AND DRONE.

It seems that the drones soon spy out the queen as she is circling about among them, and pursue her, much in the way you have seen bumble-bees chase each other about in the air. As the queen starts out, she curves her body backward in a rather unusual way, as you see by the cut of the queen upon the wing. I have long supposed that there was some especial purpose in this, and recent events seem to corroborate the idea. The meeting of the two insects takes place while they are on the wing; and as they are always seen whirling rapidly about each other, it seems rather difficult to determine just how fertilization is accomplished, unless the bodies of both are curved considerably out of the usual position. The drone probably takes much the attitude of a worker-bee in the act of using his sting, the peculiar curve of the lower part of the queen's body favoring this. The act accomplished, both insects use their wings in such a way that they revolve in opposite directions, and the separation is thus effected in much the same way as a worker-bee withdraws his sting, when allowed to do so at his leisure, by twisting around continuously, as if he were unscrewing it from a board. The organ of the drone is so firmly implanted in the body of the queen that it is torn from his body, with all attachments, very like the way in which a bee loses i's sting.

Now, n iture has provided two queer-shaped horns that project from the male organ, fitting the interior organ of the queen; these are seen distinctly when the drone is pressed, as mentioned under DRONES. These horns alone would seem to be enough to prevent withdrawal; but nature, to make sure, has furnished them on their outer surfaces with a sort of horny scales, or minute hairs, that stand something like the beard on a head of wheat; they can go forward but never backward, and therefore there is no way but for the poor drone to lose his life by having it torn out of him, in an instant. Nature has also made provision for the easy separation of these organs by placing them loosely in his body, and so that after they are thrown out by a no very great pressure, the attachments, which are only a membrane, give way readily, by the twisting process I have described.

Why is nature thus, as it would seem to us, needlessly cruel? Well, I presume there is some very good reason, even if we can not now see it. The single fertilization of the queen must, for very good reasons, last for years, if not for the whole of her life. This being the case, it would not be strange if such a draft on the constitution of the male were greater than he could stand, and be serviceable afterward for the purpose for which he was created. Nature, to make all things sure, seems to have found it fitting that he should expire in the act: as he has no other purpose of existence, so far as we know, is it not just as well?

The following article, wh'c'i appeared in *Gleanings in Bee Culture* for Nov. 1, 1889, is so valuable that I have thought best to reproduce it here. In addition to the testimony under DRONES, which see, it will also be found to contain supplementary information. It is as follows:

In 1883 I gave a mature queen-cell to a small nucleus of about 100 bees. With so small a nucleus I could more easily see the quee i go out and return, and could witness her manœuvres better. On the eighth day after emerging from the cell she came forth arrayed for her wedding-trip, about 4 P. M. She went through the general manœuvres to lo ate her home, then flew away. I could follow her with the eye for some time, as she hovered over the apiary. In eight minutes she returned without accomplishing her purpose. Next day she came forth at 2 P. M. There were thousands of drones flying at this time. She slowly circled over the apiary a while, about fifteen feet high. Three or four drones followed. They finally clinched and gradually settled to the earth, dropping into a piece of sweet corn in the garden. I was there as soon as they dropped. The queen had clung to a fallen cornstalk, while the d-one was trying to get away. They finally separate l, the drone dying instantly. I went back to the hive, and in about two minutes the queen returned, with the drone organs attached. The bees on the alighting-board spread their wings in glad delight that she had returned.

Again, this past season, 1889, I was passing a hive, No. 29, which contained a very prolific queen one year old. What should I discover but two bees slowly settling downward, going back and over? When they got on a level with my face I saw it was a virgin queen and a drone. The queen was trying with all her might to gain the entrance of the hive, and the drone was going the other way with all his might. The queen being the stronger, she drew him down to the alighting-board. She grabbed on with her feet, crawling toward the entrance. They then broke apart, the drone dying instantly.

Two days before basswood ceased to yield honey, as I was passing a hive I noticed a large bee trying to fly from the alighting-board; but every time she rose two feet in the air, down she came again. It proved to be a virgin queen. Her wings were too short to carry her body. They were perfect in every way, with the single exception of being shorter than the wings of a virgin queen usually are. She would get perhaps four feet from the hive, and crawl back into the hive, and immediately come out again and try again to fly away. I watched her manœuvres for two days. I then thought of a plan to have her fly and not get scared by handling. I made a cone of wire screen around the hoe-handle, a foot in length. I plugged up one end, and tied it to the tip end of an eighteen-foot cane fish-pole. At two o'clock, when thousands of drones were flying, I gently dropped her into the cone and quickly raised it high in air, and kept watch of the tip of the pole. In about two minutes she took wing and slowly circled over the apiary, gradually settling downward. When within nine or ten feet of the ground, several drones rushed after her, and clinched, and immediately dropped to the ground. I was on hand instantly. The queen and drone were in a seemingly deadly embrace. After two or three minutes they tore asunder, but the drone died instantly. I returned the queen to her hive, and in due time she filled her hive with brood. I had supposed this hive had a fine queen. J. R. REED.

Milford, Wis., Oct. 7, 1889.

Instances have been observed when the meeting took place where the insects were confined, yet had liberty enough so they could buzz about or whirl about each other; but as a general thing, unless the parties have the liberty of the open air, and have perfect wings, fertilization is impossible. Where you have reason to think the wings of a queen are not absolutely perfect, you can test the matter by throwing her up in the air in front of her hive. I have done this many times with queens that did not lay when about two weeks old, and they are almost invariably found to be unable to rise easily in the air. It has been said, that queens with bad wings are sometimes found producing worker-brood. I have never found such a case, but the testimony from careful and reliable parties seems to indicate that it does sometimes happen. One who is inexperienced in these matters would hardly think of the many chances there are to be mistaken: it is now found to be a rather common occurrence for two queens to be in the same hive, and the worker-brood credited to the queen with imperfect wings from birth may easily belong to another. Again, the bees often attack a queen when returning from her bridal-trip, and, if they do not kill her, maim her by biting off a wing, a leg, or perhaps both. If you should find a young queen with half a wing, or perhaps only a stump, producing workers, how many of you would not decide at once that she must have been fertilized in the hive? I once had an Italian queen nearly black, that produced beautiful yellow workers. She was missed, and finally turned up in a neighboring hive, which, to my astonishment, was found to be Italians, instead of hybrids. She was found busily at work, but possessed scarcely the vestige of a wing. Bees often mutilate the wings of queens which are being introduced, and sometimes, during a scarcity of honey, attack their own queens, and mar their appearance in this way. I think, before deciding it will be well to await further facts and investigation. See ARTIFICIAL FERTILIZATION.

SHALL WE CLIP THE QUEEN'S WINGS?

At one time I was strongly in favor of clipping the wings of all queens, just as soon as they were found laying. As they often got out in the grass during swarming-time, and got lost, when they would probably have been saved if they had had their wings, I afterward concluded that I did not want the wings of my queens clipped. In selling queens since then, very many of them have flown away while being introduced, and I have begun to decide that clipping them is perhaps the lesser of the two evils. To prevent them from flying, it has been suggested that they be daubed with honey, which the bees will soon lick off; this did very well until some one reported a queen that had to be re-caged. The honey dried on her body, and killed her. It has also been a query as to whether a laying queen ever leaves the hive for a second fertilization. The facts indicate very strongly that imported queens, and others that have been a long time confined so that they can not lay, sometimes do this. Clipping will certainly prevent this, although it may result in the loss of the queen. I think I prefer the chance of loss, rather than that of a tested queen turning hybrid; but I dislike the idea of clipping a queen just before starting her off on a journey. To make it sure that there can be no flying, I would clip the greater part of both large wings; the small wings being perfect, although smaller, will give her a symmetrical appearance, while cutting off both wings on one side always makes her look ever afterward very much like a cripple.[365] If a queen is ever so fine, few people can see her beauty when she has two long wings on one side and none on the other.[169]

CLIPPING QUEENS' WINGS.

For this purpose you want a pair of slender-pointed embroidery scissors. They must be just as keen and sharp at the points as they can be made; for it will never do to have the wing of a valuable queen double up, or catch so as to frighten her out of her little senses. With good scissors you can lift a wing and clip it off without her hardly knowing it; but where two are to be clipped, it may be well to adopt the plan given by one of our lady contributors (especially if you are nervous, and inclined to be fidgety in doing such work), as follows:

CLIPPING QUEENS' WINGS.

While it may be easy for *you* to open the Simplicity hive, lift the right tin-cornered frame, and clip the queen before she knows you are around, I believe most of your readers, especially those who have other hives, other frames, and less steady hands, would, 99 times in 100, by some slip or jar, apprise her majesty of danger. Then, by following your advice, to close the hive and be more careful next time, I believe they would still fail 98 times in 100. At this rate of progress, how many times would 100 hives need to be opened to clip 100 queens?

After the queen has taken alarm, she can be clipped by following her with the open scissors all about the comb, all over your lap, all up your sleeve, etc., till, in some favorable instant, you dare to close the scissors upon the coveted lace wing. But this operation is the most trying to the nerves of any that I ever did, and I could not advise beginners to practice it. Because my queens *must* be clipped, I had to find a better way; and because I pinched and maimed my first queen while clipping her, so that she was useless and had to be replaced, I have never *touched* another. How many queens have been injured by handling no one knows. I like to *know* that mine are *not* thus injured, because absolutely untouched. I set a small wire cage over the queen on the comb; when she runs up into it (she will sooner run up into a small cage than a large one) I lift it, pick off two or three bees by the wing and put in for company, carry them into the house, and let them loose on a clean window.[366] She can be clipped here, in motion, better than on the comb; but after allowing them to run awhile, guide them near each other, and the bees will feed the queen, when the work can be easily done. I have since found out a more expeditious way. While the queen is passing from the cage to the window, let her back or wing gently brush a drop of honey on the end of the finger, and she will soon stop to clean it off. I have had queens fly after being clipped; but when I cut off the large wing on only one side, just deep enough to take the tip of the small one in the same clip, she never flies again. It wounds her but little, as I give a slanting cut, taking more of the lace than of the fleshy part. Set the cage over her as before, carry her to the hive at once, and let her run down among the combs, not in at the entrance. If all the mum old bee-keepers have known all about this, all these years, you are not the only man that *ought* to have a troubled conscience.[170] MRS. A. L. GOULD.

Ridgeville, Iroquois Co., Ill., April 13, 1878.

How to manage during swarming-time with clipped queens, will be considered under SWARMING.

CAUTION ABOUT CLIPPING QUEENS' WINGS.

Although it would seem, after what has been said, that nobody would ever think of clipping a queen before she has begun to lay, I am sorry to say that several of the A B C class have been so thoughtless as to clip virgin queens. Of course, such a queen would be about as worthless as if it had been her head instead of her wing that was clipped off; for she could never meet the drones at all. It has usually been done where a queen of an after-swarm has been caught, and it should be remembered that such are always virgin queens.

HOW QUEENS LAY TWO KINDS OF EGGS.

That they do lay two kinds of eggs, I think few are inclined to dispute, since the experiments with the microscope have decided the matter so clearly, as given under DRONES. Suppose a young queen goes out to meet the drones so late in the fall, or so early in the spring, that there are none; what is the consequence? Well, sometimes she will never lay at all; but frequently she commences to lay when 3 or 4 weeks old, and her eggs produce only drones. In fact, she can produce no other eggs, having never been fertilized. How shall we distinguish such queens from fertile ones? You can not decide positively concerning them, by any means that I know of, until their brood is ready to seal up; then you will know by the round, raised caps of the brood, like bullets laid on a board, as I explained under DRONES. You can give a pretty good guess, by noticing the way in which she lays the eggs; if they are few and scattering, and sometimes, or often, in drone-cells, coupled with the fact that she did not commence laying until two weeks or more old, you would better not send her off as a dollar queen, until some of her brood is sealed over. A young queen, if properly fertilized, never, or very rarely, lays an egg in a drone-cell; and when she commences to lay, she fills cell after cell in regular order, as men hoe a field of corn; her work also has a neat and finished appearance that says at once to the practiced eye, "You are all right."

Now, my friends, do not think me contradictory when I tell you that a young queen sometimes commences with all, or nearly all, drone-eggs, and, after awhile, lays entirely worker-eggs as regularly as one might wish. I do not know why this is: perhaps she has not yet got used to the "machinery," or does not "remember" distinctly just how her grandmother did it.[367] Once more, my friends: you must bear with me when I tell you that any queen, the best one you ever saw, is liable, at any day of her life, to commence, on a sudden, laying drone-eggs altogether, or only in part. I wish you to remember this, that you may be more charitable toward each other in your dealings. A nice laying young queen, taken from a hive, and shipped to a distance, may prove to be a drone-layer shortly after, or immediately after, she is received. Such things are not very common, but they do occur. In an apiary of 50 or 100 hives I should expect to find one drone-layer, on an average, each spring. During the summer, perhaps one more will be found. It may be that the queen was not fertilized sufficiently, if I may use the term, and that the supply of spermatozoa gave out while she was in full vigor, thus reducing her to the condition of a virgin queen. Microscopic examination has shown an entire absence of spermatozoa in at least one or two instances, where queens of this kind were killed and dissected. Similar experiments, given by Langstroth, show that the spermatozoa may be chilled beyond recovery, by chilling the queen, and yet the queen herself may be resuscitated. I think it likely that hardship and being shipped long distances may produce the same results. Do not think I am going to excuse those who sell queens, and let the blame for unprofitable queens slip off their shoulders; on the contrary, I think they had better make up their minds to render a full equivalent for all the money they receive. If a queen proves a drone-layer before the purchaser can receive any benefit from her, I think another should be sent. Of course, I can not give a rule for settling all such matters, but I would most earnestly advise that you all try to do as you would be done by, and be each one *ready* to bear a little more than your share of such losses as may come up. Try to feel for each other, and beware of that great besetting sin of all mankind, selfishness. It is certainly one of my great besetting sins, if I do not look out.

Well, queens not only turn suddenly to drone-layers, but they sometimes produce about an equal number of each kind of eggs. In all these cases, where the queen lays drone-eggs when she evidently intended to lay worker-eggs, they are in worker-cells; also the number of eggs laid, usually rapidly decreases. The bees, as well as queen, evidently begin to think that something is wrong; queen-cells are soon started, and after the young queen is hatched she becomes fertile, and begins to help her mother. All hands evidently think that any kind of a queen is better than no queen, hence a queen is seldom dragged out of the hive, as a worker-bee is, because she is ailing.

Very early in the spring, or late in the fall, or at any time when forage is not abundant, a queen will pass right by drone-cells, taking no notice of them. I have often tried to get eggs in drone-cells by feeding, and can but conclude that the queen knows when an egg will produce a drone, and knows just what "wires to pull" to have every egg laid in a drone-cell produce a drone. I think it very likely the workers have something to do with this matter, but I have never been able to make out by what means they signify to the queen that some eggs in drone-cells, or even queen-cells, would be desirable. There seems to be a constant understanding in the hive as to what is going to be done next, and consequently there is no clashing. I wish, my friends, the human family could understand each other as well. In our apiary, there seems to be, in strong stocks, a kind of understanding that eggs shall be laid in drone-cells about the last of March, and we have drones, therefore, some time in April, ready for the first queens that may, by any accident, make their appearance. Those who insist that there is only one kind of eggs can satisfy themselves easily, by cutting out a piece of comb, eggs and all, from either a drone or worker cell, and setting it in the bottom of a cell of the other kind. They will get a drone in a worker-cell, or a worker in a drone-cell. Again: If you give a young laying queen a hive supplied only with drone-combs, she will rear worker-brood in these drone-cells. The mouth of the cells will be contracted with wax, as mentioned in HONEY-COMB.

When they get ready to swarm they build shallow queen-cells, and the queen then lays a worker-egg in these queen-cells. Although I never saw her lay an egg in a queen-cell, I am satisfied that she does it, from the way in which it is put in. Like the rest of the eggs, it is fastened to the center of the bottom of the cell by one of its ends, and I suppose, when first deposited, it is covered with a sort of glutinous matter that makes it stick firmly, where it first touches. I know that bees have the skill to remove both eggs and larvæ, for I have several times known of their taking eggs and brood to an old dry comb, when no queen was present in the hive. Occasionally a queen is found that will never lay at all; again, queens that laid eggs which never hatched into larvæ, have been several times reported. We have had several such, and they were in appearance fine nice-looking queens.

After having told you thus much of the faults and imperfections of queens, I would add, for their credit, that when once properly installed in a strong colony they are about as safe property as any thing I know of, for, in the great majority of cases, they live and thrive for years. I have never heard of any disease among queens, and, while a worker lives only a few months, they often live 3 or 4 years. One that was imported from Italy by Dadant furnished us brood and eggs for queen-rearing, for four summers. I then sold her for $2.00, and she died in being sent less than 50 miles. She was very large and heavy, and, probably, being so old could not cling to the sides of the cage like a younger one. I have never heard of queens being troubled with any thing but an Italian parasite, and these quickly disappeared when they were introduced into our own apiaries. See Enemies of Bees.

LOSS OF QUEEN.

It is a very important matter, to be able to know at once when a queen is lost. During the months of May and June, the loss of a queen from the hive a single day will make quite a marked difference in the honey-crop. If we assume the number of eggs a queen may lay in a day to be 3000, by taking her away a single day we should, in the course of events, be just that number of bees short, right during a yield of honey. To put it very moderately, a quart of bees might be taken out of the hive by simply caging the queen for a single day. Beginners should remember this, for their untimely, or, rather, inconsiderate tinkering, just before the flow of honey comes, often cuts short their income to a very considerable degree. Whatever you do, be very careful you do not drop the queens off the combs when handling them at this time of the year, and do not needlessly interrupt the queen in her work by changing the combs about so as to expose the brood or upset their little household matters in the hive. With a little practice you will be able to detect a queenless hive, simply by the way the bees behave themselves on the outside. Where they stand around on the alighting-board in a listless sort of way, with no bees going in with pollen, when other colonies are thus engaged, it is well to open the hive and take a look at them. If you find eggs and worker-brood, you may be sure a queen is there; but if you do not, proceed at once to see if there is not a queen of some kind in the hive, that does not lay. If you do not find one, proceed at once to give them a frame containing brood and eggs, and see if they start queen-cells. You ought to be able to find incipient queen-cells in about 12 hours, if the bees have been some little time queenless. As soon as you see these, give them a queen if possible. If no queen is to be had, they may be allowed to raise one, if the colony has bees enough. If it has not, they had better be united with some other stock.

ODOR OF A LAYING QUEEN.

After bees have been some time queenless, they usually become, if no fertile workers make their appearance (see Fertile Workers), very eager for the presence of a queen; and I can in no way describe this eager behavior, if I may so term it, so well as to describe another way of testing a colony you have reason to suspect is queenless. Take a cage or box containing a laying queen, and hold either the cage, or simply the cover of it, over the bees, or hold it in such a way as to let one corner touch the frames. If queenless, the first that catch the scent of the piece of wood on which the queen has clustered will begin to move their wings in token of rejoicing, and soon you will have nearly the whole swarm hanging to the cage, or cover. When they behave in this manner I have never had any trouble in letting the queen right out at once. Such cases are generally where a colony is found without brood in the spring.

There is something very peculiar about the scent of a laying queen. After having had a queen in my fingers, I have had bees follow me and gather about my hand, even when I had gone some distance from the apiary. By this strange instinct they will often hover about the spot where the queen has alighted even for an instant, for hours, and, sometimes, for a day or two afterward. Where clipped queens get down into the grass or weeds, or crawl sometimes a considerable distance from the hive, I have often found them, by watching the bees that were crawling about, along the path she had taken. When cages containing queens are being carried away, bees will often come and alight on the cage, making that peculiar shaking of the wings, which indicates their joy at finding the queen.

QUEENS' STINGS.

There is something very strange in the fact that a queen very rarely uses her sting, even under the greatest provocation possible, unless it is toward a rival queen. In fact, they may be pinched, or pulled limb from limb, without even showing any symptoms of protruding the sting at all; but as soon as you put them in a cage, or under a tumbler with another queen, the fatal sting is almost sure to be used at once. There seems to be a most wise provision in this: for if the queen used her sting at every provocation as does the worker, the prosperity of the colony would be almost constantly endangered. It is true, that instances are on record where queens have stung the fingers of those handling them; but these cases are so very rare it is quite safe to say queens never sting. I am inclined to think the cases mentioned (although, of course, it must be only a surmise) were with queens that were not fully developed; for I have often seen the dark half-queen and half-worker, mentioned some time back, show its sting when handled as we usually handle queens. It is said, that a queen has been known to lay eggs after having lost her sting; but as they never lose their stings, so far as I know, at least, when they sting rival queens, we must consider this as a very unusual occurrence. When you wish to pick queens from a comb, you can do it with just as much assurance of safety as if you were picking up a drone. It is true, the queen often bites with her powerful mandibles, and she does this so viciously that a novice might be almost excusable for letting her get away in affright.

CAUTION IN REGARD TO DECIDING A STOCK TO BE QUEENLESS.

As a rule, we may say that absence of brood or eggs is a pretty sure indication of queenlessness; but it should be borne in mind that all hives, as a rule, are without eggs and brood in the fall and early winter months, or, in fact, at any time when there is a considerable dearth of pasturage. At such seasons, beginners are more apt to think their hives are queenless, because the queens are much smaller than when they are laying profusely. In weak colonies queens often cease laying during the whole of the winter months.

QUEEN - REARING. It has been said, that wax and honey are the merchantable products of the apiary, but ever since the advent of the Italians there has been a constant call for queens, far ahead of the supply; and if we were asked what product of the apiary would bring cash quickest and surest, I would unhesitatingly say, untested queens. It may be well to explain here that an untested queen is one that has been reared from a pure mother, and has just commenced to lay. She may prove to be purely fertilized, and she may not; but the apiarist, for this low price, guarantees nothing more than that she has been raised from a pure mother. The transaction of the sale is supposed to be something as if you were standing by his side, and he should open a hive and say:

"There is a queen that was reared from brood from a pure mother; she has commenced laying, as you see, but I know nothing of the kind of bees she may produce. You can take her just as she is for $1.00, but at that price I can be in no way responsible further."

As the demand is usually far in advance of the supply, the conscientious apiarist can fill orders only in their turn, and this has been another cause for dissatisfaction, on account of the delays that seem unavoidable, especially in the spring, when everybody is wanting them right away. I do not mean to blame those who want them at once, for it is my disposition exactly, to want a thing as soon as I have paid for it.

If you can raise good untested queens, you can certainly raise good tested ones, for a tested queen is nothing more than one that has proved herself prolific and purely fertilized. The test of purity generally recognized is, that the workers show plainly the three yellow bands that are characteristic of the Italians, and are gentle. Queens themselves may be all the way from a black to a light yellow.

There are ever so many ways of forming nuclei for queen-rearing, but, after having tried pretty thoroughly almost or quite all of them, I shall advise separate hives for each nucleus. If you are simply increasing your stock, use a new hive for each colony; but if you wish to add to your income by rearing queens for sale, I would advise a two-comb hive for the purpose. These are made much like the Dovetailed, only that they are 3¼ inches wide inside instead of 12½. For lightness, we will make the sides of ⅜ stuff. For reasons to be explained we will have the cover shut over the hive like the cover of a tool-chest, and loose enough to slip over the bottom also, without sticking, for we can have no pulling and jerking about bee-hives, even though they are "little ones."

Those who have tried queen-rearing have perhaps found it tiresome business to stoop so much as is required in looking over so many little hives. To remedy this we will have them fastened to the grapevine trellises, or, better, elevate them on a hive-stand. These can be made very cheaply.

This brings them at a convenient height to work easily: we certainly would not wish to encourage any one in being lazy, but apiarists do sometimes get tired, and find it quite a relief to sit down for a moment or two, and the hive right below the nucleus, we find very convenient.

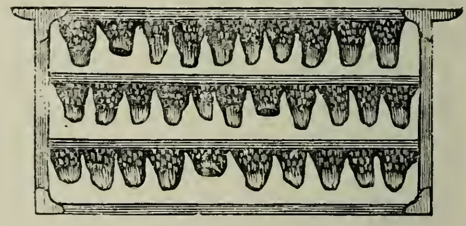
In inserting queen-cells, putting in brood, etc., we also find the top of the hive quite a convenience. These nuclei are shaded by the broad leaves of the grapevines, and are held from being blown down by the wind by a screw put through the upper strip into the side of the hive.

When you have your nuclei all fixed, each one neatly painted white, and supplied with a queen-register card, or a little slate, you are to set about peopling the little boxes. If you commence this work during a good yield of honey, you will very likely get along finely; but if at a time when the bees are disposed to robbing, you may have all sorts of trouble. You can have your queen-cells raised in these little hives if they are well peopled with bees; but as a general thing I would prefer having it done by a strong colony.

HOW TO GET GOOD QUEEN-CELLS.

To rear good, healthy, long-lived queens, we want the larvæ to have an abundance of the milky food prepared by the nurse-bees, and we wish them to have it from the time they are first hatched from the egg, until they are sealed up as a queen-cell. If you will examine the minute larvæ of different hives, you will discover a vast difference in the amount of food given to the infant bees. With a new swarm, we will find the first larvæ that hatch are fed so profusely that they look almost like the inmates of queen-cells, because the nurse-bees are far in excess of the work that is to be done by them; but after the combs are filled with eggs, such is not the case.[172] We can bring about this result at any time by taking all the brood away from any colony, and giving them only one comb containing these small larvæ, and this is just what we want for queen-rearing. The secret of being able to send larvæ for queen-rearing safely by mail, consists in sending such as have this excess of food in the cells; for if the weather is not too cool they will grow and thrive for two or three days, just as well, for aught I know, as if they were in the parent hive: when the food is all consumed they must starve, and this illustrates the necessity of getting them into a hive of bees just as soon as they are received. It has been said, that queens reared during the time of natural swarming are superior; but I think, by securing this abundance of food in the way indicated, we can have them equally good at any season when bees are flying freely. True, it is some trouble to remove all the brood-combs from a strong colony, and we therefore move the colony, hive and all, putting a new hive with our choice larvæ in its stead.[368–173] This plan has never failed to give us fine queen-cells, and queens that were prolific and long-lived; and it is so quickly done that a lot of cells may be started every few days during the season. Unless the new hive looks much like the old one, the bees may but few of them go into it, especially if the old one is set so near at hand that they succeed in finding it. This is an additional reason for having your hives all just alike. We usually place the removed hive at an opposite side of the apiary.

Bees usually prefer to rear queen-cells around the bottom edges of a comb. If it has a hole in it, or is deformed in some way, they are pretty apt to build cells along in these places. Taking advantage of this fact, we have frequently secured a large number of cells by mutilating a frame of unsealed larvæ. When we have larvæ from an extra choice queen, and desire to get as many cells as possible, we cut longitudinal strips, one inch wide, and an inch apart throughout the whole comb. In the comb mutilated there will be a large number of cells built. The longitudinal strips cut out are next cut into strips about ½ inch wide. We then destroy



HOW TO RAISE GOOD QUEEN-CELLS.

all the eggs or larvæ except those where we want cells built, in order that we may get them in shape to cut apart. To do this we fasten two horizontal strips of wood, ½ inch thick and ¾ wide, lengthwise of the frame, as shown above. We now take the narrow strips of comb and fasten them by means of several large pins to the under side of the top-bar and of the two lengthwise strips. We have tried this plan, and have secured a very large number of cells, and the plan works perfectly. We thus secure a large number of cells, both from the comb and from the frame. To get a frame full of cells like the cut, we succeed best with a colony having a dash of Holy-Land blood. See Holy Lands, under Italians.

DOOLITTLE'S METHOD OF REARING CELLS IN COLONIES NOT QUEENLESS.

It is well known, that stocks about to send forth a swarm will rear queen-cells. Mr. G. M. Doolittle, of Borodino, N. Y., however, has perfected a method of rearing cells in colonies already having a queen, not under the swarming impulse. It is as follows:

He takes an ordinary wooden rake-tooth, and whittles and sandpapers the point so that it is the size and shape of the bottom of a queen-cell. After dipping this into a cup of water he plunges it to a depth of about half an inch into a small vat of wax brought to the melting-point. It is next dipped again, but at a trifle less depth.* After each dipping it is cooled, and the process is continued some seven or eight times. At the next to the last dip he loosens the little wax cup so that it just adheres to the rake-tooth. He then dips again, and immediately sticks it on to a top-bar. Another cell-cup is made and deposited a short distance from the first one, and so on until he has a couple of rows of cell-cups, each cell being far enough apart so that it can be easily removed when capped over by the bees. Into each one of the cups he now deposits a little of the milky part of royal jelly, and in this milky fluid he sets a little larva, from 24 to 36 hours old; or, in other words, he grafts each cell, as described elsewhere.

From the center of a comb more or less disfigured he cuts out a longitudinal strip about two inches wide, and in its place fastens the top-bar in a horizontal position, with the cell-cups pointing downward. This comb, instead of being put into a queenless colony, to carry on and complete the cells that have been started, is put into the upper story of a strong populous stock, with a queen-excluding honey-board in between the upper and the lower stories. Two combs containing larvæ should be put into the upper story, and the prepared frame placed between them, so that *many* nurse bees may come up to take care of them. The queen, of course, is kept below by the perforated metal. The bees, strange as it may seem, will complete the cells. They may then be removed, and another similar frame be given, and the operation be continued several times.

The principal advantage of this plan is, that colonies may be kept rearing queen-cells which already have a queen, and a large number of cells can be reared without a single colony being queenless. There are a number of features that commend themselves to the practical apiarist. Our boys have so far tested them two seasons with success.

* While cooling, it should be whirled horizontally.

Perhaps, while I am about it, I should remark that Mr. Doolittle has partially succeeded in having queens fertilized in the upper story of one of these strong colonies over perforated metal, while an old queen reigns below. Dr. G. L. Tinker, of New Philadelphia, Ohio; H. Alley, of Wenham, Mass., and others, have likewise attained some success in the same direction. For particulars you are requested to see Doolittle's work on the subject. However, I am inclined to think this method of fertilization more labor than having individual nuclei where queens can be fertilized, because a good many who have tested the thing have reported failure.

WHEN TO CUT OUT THE QUEEN-CELLS.

A queen is hatched in just 16 days from the time the egg is laid, as a general rule; therefore we must take measures to have the cells cut out before this time. The eggs hatch into the minute larvæ in just about three days, and, if you have used these, you are to cut out your cells on the 12th day after you moved the colony. If you use a comb containing larvæ of all ages, the bees will be pretty sure to use some that are 6 days old, in which case you may have queens hatching by the 10th after the larvæ were given them, and they *may* get out a young queen as soon as the 9th. It is these queens that are hatched on the 9th or 10th day that we have reason to fear may be short-lived; hence our warning to give them nothing for starting queen-cells but larvæ so small as to be just visible to the naked eye.[369]

HOW TO CUT OUT THE QUEEN-CELLS.

Provide yourself with a very thin, narrow-bladed penknife, and be sure that it is just as sharp as you can make it. If you have a dull knife, and it is necessary to cut between two cells that are very close, you will very likely break one or both open, and then the bees will be very apt to tear them down.[177] Cut them all out but one, and do it nicely. If they are not too close together, give considerable room around the base or part that is attached to the comb.

We will suppose you have secured a fine lot of cells, have succeeded in cutting them out nicely, and have them all shut up in a little box where robber-bees may not be trying to steal the honey that may have been started running in the operation of cutting them out. Do not let the robbers discover that honey may be pilfered by following you around, or you may receive some stinging lessons as a punishment for not being neat and cleanly in your work.

HOW TO FORM THE NUCLEI.

Go to any strong good colony and gently lift out one of the central combs. This you can do by sliding the frame on each side a little away from it, or, if the combs are crammed with honey, you may find it necessary to push a second or a third one back a little. You can make room to take out the first one quietly, in almost any hive, if you manage properly. Now, we rather wish to find the queen, if we can by not taking too much time, and so we carefully look over every comb as we lift it out. If you do not find her on the first comb, put it in one of the nucleus hives and take another. Proceed in this way until you have removed all the brood-combs. As soon as you have found the queen, you are to put her with the comb she is on, in an empty hive. If the comb contains hatching brood, the one will be sufficient; but if the brood is partly unsealed you had better put another beside it, or the brood may be chilled during cool nights.

You will probably make 4 good nuclei out of a fair colony, the bees that are in the fields will make another good one, and the old queen with her one comb still another. The old original stand should be given one frame of brood, and that unsealed larvæ or eggs To this should be added two or three, possibly four, empty combs or frames of foundation. The flying bees returning from the fields and from the other nuclei will make plenty of bees, so that it will not be necessary to give any bees in the first place as you did the rest.

If you do not find the old queen, divide the hive all the same, but do not insert any queen-cells until you find her. If you are so unlucky as not to find her at all, wait until the next morning, and then insert queen-cells in all that have started some of their own, for it is a sure indication of queenlessness to find a nucleus building queen-cells. Mark this, for I shall refer to it again. Whether you find her or not, it is a little safer to insert the cell 24 hours after you made them queenless, although I have done so a great many times without having them torn down, immediately after removing the old queen. It is better to let the bees become thoroughly aware of their queenlessness, and consequently to start small spurs of cells. When these are started, the bees will usually accept the cells given them. Perhaps it should be remarked, that, at certain seasons of the year, during a dearth of honey, for instance, the bees will tear down the first one or two cells, no matter how you treat them. Hybrids and blacks are more apt to behave this way than pure Italians.

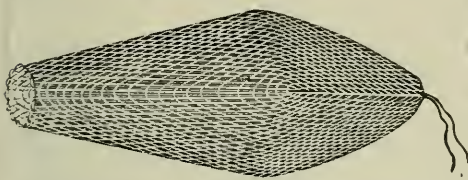
HOW TO INSERT QUEEN-CELLS.

Some years ago we practiced and advocated fitting a cell into a hole previously cut out of a selected comb. This not only took a good deal of time, but it mutilated brood and otherwise nice combs. Cutting into the brood, I imagine, sometimes caused the bees to regard the foreign cell with disfavor, and consequently it was sometimes torn down. My neighbor, Mr. Harrington, who is an extensive queen-breeder, thinks that the cells so inserted are more likely to be torn down than if inserted in the manner which I shall now describe. In the first place, I assume that you have cut out a number of cells. Having queenless colonies into which you now propose inserting these cells, you approach a hive and remove the cover. With the smoker in the right hand, puff a few whiffs of smoke over the bees, while you proceed slowly with the other hand to lift up the enamel sheet or quilt. When rolled about half way back, space the two ends of the two central combs, not covered by the quilt, as far apart as you can conveniently. Having done this, place a cell between the forefinger and the middle finger, and insert it point downward between the two frames which have been spread a little at the ends. Push the cell down as near the center of the cluster as you can reach with the two fingers. Hold it in position, then with the other hand draw together the two ends which have been spread, until both combs hold the cell suspended. Be careful not to crowd together too hard, otherwise you will crush the cell. Roll back the enamel sheet, put on the cover, and the operation is completed, and without any mutilation of combs.

There is one other way of giving a cell, and that is, laying it on top of the brood-nest, between the frames. With nuclei, however, this would not do as well, and I should therefore recommend inserting cells in these, as I first described. With strong colonies it does not matter so much either way. The latter plan has this advantage: It is very easy to see whether a cell is hatched—simply raise the enamel cloth, and the cell is before you. A glance tells you very quickly whether her majesty has emerged.

THE DOOLITTLE QUEEN-CELL PROTECTOR.

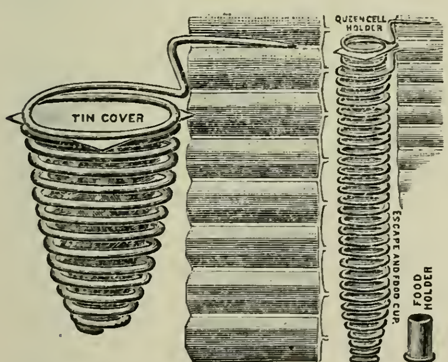
Some time ago G. M. Doolittle got out what is called his queen-cell protector. The accompanying engraving represents a cone made by forming a square piece of wire cloth over a wooden cone.



DOOLITTLE'S QUEEN-CELL PROTECTOR.

At the apex a hole is made, large enough to permit the passage of a hatched queen. A cell is put into one of these protectors, the apex of the cell closing the mouth of the protector. The four corners of the wire cloth are gathered together, and the strands of wire are twisted. This closes the cell entirely in wire cloth, leaving only the end of the cell exposed.

The accompanying engraving is one that was made on the plan of a spiral spring, and it is the invention of Mr. N. D. West. of Middleburg, N. Y.



WEST'S SPIRAL QUEEN-CELL PROTECTOR.

This is. perhaps, superior to Doolittle's, in that this protector adapts itself more readily to the size of the cell, the spirals stretching or contracting as the case may be. A little square tin slide slips between the spirals at the top, as shown in the illustration. One trouble we experienced with the Doolittle queen-cell protector, was, that the bees would sometimes push the cell up, get behind it, and gnaw into the sides of the cell. In the West protector, the little square of tin crowds the cell so that the apex is pushed against the apex of the spiral cone.

It is a well-known fact, that bees, when they tear down cells, make their openings at the side, but rarely if ever cut through the end of the cell. The protector completely protects the *sides* of the cell; and when the young queen hatches she simply emerges in the natural way; and the bees that would have torn down the *cell* will now let *her* go unmolested. During certain times of the year, when bees are disposed to tear down cells we give them, we put them in the protectors and all is well. Sometimes when a cell unprotected is pushed down between two combs, and left there for a day or so, it becomes attached to both, which, on being separated for the purpose of examination, tear the cell open; and if the young queen is not hatched it destroys her. The protector prevents any mishaps of this sort.

Mr. West is one of those bee-keepers who believe in requeening an apiary every two years—that is, that the average queen, after two years, should be removed, and a young queen take her place. During the swarming season, when cells are plentiful, while Mr. West is working among the bees he cuts out the cells as fast as he comes to them from his picked colonies, and inserts them in the protectors. Then he goes around to colonies having two-year-old queens, pinches the queen's head off, and affixes the protector containing a cell on the side of the comb. All this is done during swarming time, when the bees can best spare the queen. At the same time, it prevents swarms from going off in the absence of a queen or until one hatches, and this checks increase at a time of year when least desired, and at the same time requeens the apiary with young queens at practically little expense.

HUNTING FOR YOUNG QUEENS A WASTE OF TIME.

When I first commenced queen-rearing I thought it necessary to hunt up the young queens every time a cell was found open, or every time I looked into their hives, which, by the way, was about every day, and sometimes oftener. If you are keeping bees just for the fun of it, it may do to spend a quarter of an hour looking for a queen just to see if she is a nice one; but if you are trying to show your friends who worry about the time you "fuss with your bees" that there are dollars in the business, you need never see your queens at all until you wish to send them off. After inserting the cells you have nothing more to do with them for about three days, and then you should provide yourself with a fresh lot of cells, and also with some pieces of comb containing larvæ just right for queen-rearing. Take the hives in regular order, and do not skip about. If you find a cell open at the end, your queen is probably all right, and if there are no larvæ in the hive, insert a piece;[179] as soon as any thing happens to a queen they will start queen-cells on this brood, and therefore we always look at this piece of brood instead of looking for the queen. Should they by any possibility rear a queen of their own, it will always be from your choice brood. When in your examinations you find eggs in the cells—your eyes will soon become sharpened for these indications of greenbacks—you will turn the queen-register to laying, and use her the first time you send off queens. As we wish to keep up the population of these little hives, it may be well to allow her to fill up her two combs pretty well before taking her out. When she is removed, insert a cell, and if all goes well you may have another queen in the hive the next morning. Always keep your queen register set, that it may show the state of affairs within, and be sure the bees always have brood in their combs, by giving them a fresh piece every three or four days. If you are faithful in this, you will never know any thing about *fertile workers*, those pests of queen-rearing.

CAUTION.

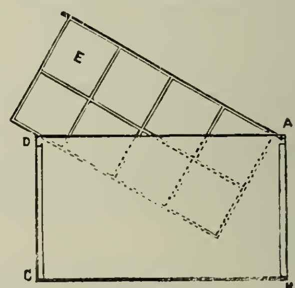
In selecting brood for queen rearing, be sure you have no drone larvæ, for the bees, by some strange perversion of instinct, will very often build queen-cells over them, resulting usually in nothing but a dead drone. The poor drone seems unable to stand the powerful dose of concentrated food that is required to perfect a queen from a worker larva, and so dies when he is about half grown. Should a queen-cell have been started over a drone larva, you can always tell it from a good one by its smooth exterior, while a genuine cell has a roughened surface like the drawing we have given.

If you suspect a cell is not going to hatch,[180] do not tear it down, but insert another one beside it. If you have two or more cells so close together that they can not be separated, insert the whole, and look often to them: you can very often find the first one while she is biting out, or so soon after she has come out as to save the others. We have often, by this means, saved all of three that were built close together.

For convenience in inserting brood so many times, we use a square "cake-cutter," as it were; this is made of tin, with the edges very sharp. Press it into the comb far enough to mark it, and then you can cut out pieces all of a size. As one piece always goes in where another comes out, you can keep all unsightly holes in your combs closed up, and have no odd bits of comb lying about the apiary.[181]

HOW TO CAGE THE BEES AND QUEEN.

Open your hive without smoke if you can; if you can not, use as little smoke as possible. When the bees have become quiet, lift out the frames until you find the one containing the queen, and stand it in the hive in the position shown in the diagram.



Set the frame so that the queen is on the part projecting out of the hive. Open the cage enough to let one bee in at a time, and hold it in your left hand, while your thumb covers the entrance. Now pick the queen up by both wings, or by her shoulders, while you put her into the cage. Put your thumb over the entrance at once, or she will crawl out in a twinkling. Now, we want none but young bees to put with her, so we will look on the frame for those that are dipping their noses into the unsealed honey. As their bodies are bent, we have an excellent opportunity to pick them up by the wings, and with a little practice you should be able to put them into the cage about as fast as you would grains of corn. Young bees will never sting your thumb, unless they happen to be very bad hybrids; but old ones will sometimes venture to do so, if you happen to handle them too roughly.

R.

RAPE (*Brassica*). This plant is a near relative of the turnip, cabbage, mustard, etc. All of them yield honey largely, where grown in sufficient quantities. As rape is the only one of which the seed is utilized for purposes other than for increase, it should play a prominent part on the honey-farm. It would seem, in fact, that it is almost the only plant that should stand beside BUCKWHEAT, or rather, perhaps, above it, for the honey from the rape is very much superior to buckwheat honey. The great drawback is the lack of hardiness of the young plants, when they first come up. In our locality the black flea is almost sure to eat the tender green leaves when they first make their appearance. Our neighbors have several times tried considerable fields of it; but though it would come up nicely, this flea would take off almost every plant. In other localities we have had reports of bountiful crops of seed, and honey enough so that the bees worked beautifully in the surplus receptacles. Like buckwheat, it commences to blossom when quite small, and continues in bloom until the plant has gained its full height. As it will bloom in 20 days after sowing, it may be sowed almost any time in the summer; and it is said to escape the ravages of the flea best, when sown late. We have had it yield *honey* finely when sown the first of August. The ground should be very finely pulverized, for the seeds are very small. It is sown broadcast, three pounds of seed to the acre. There is a steady and good demand for the seed, for feeding canary birds, as well as for the manufacture of oil. Bee-keepers should contrive to induce seedsmen to have all these seeds raised near them, or on their own grounds. Dealers in bird-seed should also be furnished in the same way, for these things are often raised in large quantities, where there are few, if any, bees to gather the honey. From what I have said on POLLEN, you will understand that both parties would be benefited by the arrangement.

RASPBERRY. Where this fruit is raised largely for the market, it is quite an important honey-plant; but it would hardly be advisable to think of raising it for honey alone. The bees work on it closely in our locality, but we have not enough of it to judge of the honey. If bee-keepers and growers of small fruits could manage to locate near each other, it would probably be an advantage to both. Langstroth says of the raspberry honey: "In flavor, it is superior to that from white clover, while its delicate comb almost melts in the mouth. When it is in blossom, bees hold even white clover in light esteem. Its drooping blossoms protect the honey from moisture, and they work upon it when the weather is so wet they can obtain nothing from the upright blossoms of the white clover."

In our locality it comes in bloom just after fruit blossoms, and just before clover, so that large fields of it would be a great acquisition indeed. The red varieties (especially the Cuthbert) are said to furnish most honey. We have now (1886) about two acres of the best raspberries for honey on our honey-farm.

RATAN. This plant has been several times spoken of by our Southern friends, and it is probably quite an important honey-plant. Some seed has been sent me, but no plants have as yet been raised.

RECORD-KEEPING OF HIVES. Almost every apiarist has a plan of his own, whereby he can record the condition of the hive at the time of the examination, so that, in future, without depending on memory, he may tell at a glance what was its condition when last examined. There are several good systems, but I will describe only two or three of the best.

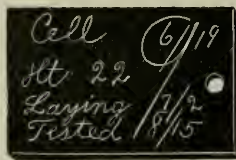
Many of the large honey-producers, Dr. Miller among them, have what they call a "record-book." This book has a page for each colony, the number of the page corresponding with the number of the colony.

The book should be small and compact, just about right to carry in the hip-pocket, and securely bound. It should always be carried when at work among the bees. On each page is supposed to be a record of each colony's doings within a year—when it became queenless, when it had cells or brood, when it swarmed, and, toward winter, strength and quantity of stores it had when last examined. The page may contain a very few memoranda, but nothing else should be put on that page.

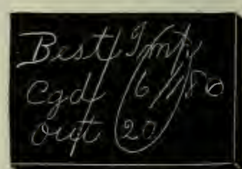
There is an advantage in the book method—that is, the book can be consulted in the house, and the work can be planned beforehand for the day. If the record-book be for an out-apiary, the work can be planned while riding to the yard; and upon arrival, the plans formulated can be executed. You will know in advance just where you are going to get cells to give to queenless colonies; just what colonies will be likely to have laying queens; what ones may cast swarms, and what ones will be likely to need more room in the way of sections or surplus combs. There is an objection to the record-book, however. It is liable to be lost, or to be left out in the rain; for if the book is lost, the whole knowledge of the apiary, except so far as the apiarist can remember, is gone. Another thing, only one can use the book at a time. If there are two in the yard this will sometimes be quite an inconvenience.

RECORD-KEEPING WITH SLATE TABLETS.

The plan we prefer is to attach the record right on the hive itself, or, what is better, to a slate belonging to the hive. These are made expressly for the purpose, and cost only $1.25 per 100, and they are large enough, if the records are abbreviated, to give the history of the colony for a year. Still further, the position that these slates occupy on the cover or on the side of the hive indicates at a distance the general condition of the colony, without so much as even reading the record on the slate. These slates are 2¾ by 1¾ inches, and they have a hole punched near one end, so as to admit of their being hung on the side of the hive. The accompanying cut shows one of these little slates.



For writing the records, a slate-pencil, a common lead-pencil, or a red lead-pencil, may be used. The slate-pencil marks wash out a little too easily by the rain, so we prefer, as a general thing, a lead-pencil, which does not erase, except when you rub the slate with moistened fingers. By tilting it a little to the light, the marks show quite plainly. In the slate above I have given an example of the records we put on. Perhaps it may not appear very intelligible to you. Cell 6/19 means that, on the 19th of June, a best imported queen was given them. "Ht 22" means that the queen hatched on the 22d of that month. July 2d she was laying, and August 15th she was found to be a pure tested Italian queen. You will notice a large 9 inscribed over the whole. This means that, on the 9th of September, the queen was sold. The accompanying cut illustrates still another slate, which, interpreted, signifies that, on the 18th of June, a best imported queen was caged. On the 20th she was out and laying; and on the 10th of the following month she was sold.



Every apiarist can formulate a system of short longhand that will be intelligible to himself and workmen It takes too much time to write the whole history of the affair, so it is better to use a system of abbreviations; and, besides, it saves room.

Now, in order to save time in running up to a slate to see what it says, it is desirable to indicate, so far as possible, the last record on the slate by its position on the cover.

The accompanying diagram shows a few of the positions that may be used; and this number may be extended indefinitely by putting the slate cornerwise, endwise, etc., in the different positions shown. But it is desirable not to have too many, or else you or your help will be confused.

POSITION OF SLATE TO INDICATE THE CONDITION OF THE COLONY.

1. Queenless; 2. Cell; 3. Hatched virgin; 4. Laying queen; 5. Tested queen; 6. Caged queen to be introduced; 7. Caged queen out; 8 Something wrong; 9. Hive needs supers and more room; 10. No slate—hive with empty combs, ready for a swarm.

The code above is one we use in our apiary, and it is one that can be used in most apiaries. To make it really valuable, it will be necessary to memorize the meaning of each position. In the diagram above, 10 positions are shown; and these have been proved by actual practice to answer our requirements. To aid the memory we will make use of a simple analogy. You have heard about cross-grained people—people who are always out of sorts, and with whom something is always wrong. For convenience we will call a colony not in its normal condition, "cross-grained." A colony that is queenless is apt to be crosser than one having a queen. Such a colony, as a rule, never does as well as one that has a queen. It is true, also, to a lesser extent, that a colony having a virgin queen is not doing as well as one having one that is laying. Well, now we start with No. 1, in the diagram as above. The slate is put *across* the *grain*, in the center of the hive. This means that it is queenless. No. 2, the slate is still across the grain, but near the *edge* of the hive; but this one has a cell. No. 3, the cell is hatched, and has a virgin queen; but as the colony has not yet reached its normal condition, the slate is still laid across the grain at the *end* of the cover. In eight or ten days, if all goes well, the virgin will be laying, and then we turn the slate *parallel* with the grain, as shown at 4. If the virgin queen should be lost, the slate is put back as shown in No. 1—across the grain. But we will suppose that our queen is laying, and in a month's time she proves to be tested, and an Italian. The condition of the colony has improved, as regards the value of the queen, so the slate is moved to the center of the hive, parallel with the grain.

So far the first five positions would cover the time of queen-rearing. But suppose we wish to introduce a queen—how shall we indicate it? The colony with a caged queen is neither queenless nor is it possessed of a queen, because they may take a notion to kill her as soon as she is released. To carry out the figure, the colony is about half way between the normal and abnormal condition. So we turn the slate to a diagonal. Position 6 means that the colony has just had a queen caged. No. 7 means that, a day or two afterward, she was found to be out. A few days later, if she is laying, the slate is put in position 4. But, suppose she is missing. Then the slate is turned in the position of 8. In general, position 8 signifies that there is something radically wrong with the colony. It may mean that it has a fertile worker, or that it is very short of stores, and will require to be fed at once.

We have so far covered the history of a colony as touching the rearing and introducing of queens. When honey is coming in, it is desirable to know by the slates which ones will be likely to need supers soon. In 9, again, the slate is parallel with the cover. This means that it is overflowing with bees and honey, and will need, in a day or two, if not immediately, more room in the shape of sections or surplus combs. No. 10, without any slate on the hive, means that the hive in question is empty, having only frames of foundation or empty comb, and is, therefore, ready for the reception of a swarm.

We used to hang the slates on a nail on the side of the hive. Then when we desired to find a select tested queen, we will say for an order, we were required to read the writing on the slates of a good many hives before we found what we wanted. What do we do now? We stand upon a hive, take a bird's-eye view of the hive-covers, and then make a bee-line for the hive we want.

The code above can be extended indefinitely, or be slightly modified, to suit the requirements of different bee-keepers. Bearing in mind the "cross grained" analogy, I think there will be no trouble in memorizing the few positions. It should be observed, that a good many use bricks to indicate the condition of the colony. Of course, instead of slates you may use bricks; but in that case you can not very well indicate the date, besides other memoranda that you can not readily indicate by position.

One great feature of having slates on the top of the hive, to indicate its condition, is, that, just as soon as we go out into the apiary, we can single out colonies that need attention first; and that, too, without hunting for them. For instance, to-day, June 19, I noticed that the bees were hanging out of a large chaff hive. "I wonder whether they will swarm," I thought. The hive was perhaps thirty yards from where I stood. Glancing at the top of the hive, the slate across the grain, on the edge of the cover, showed that the colony had only a queen-cell, and there was not much danger that it would cast a swarm that day. By standing upon one of our hives I can read the condition of every colony in our apiary of some 300 queen-rearing colonies, and that without moving a step.

Some bee-keepers, instead of using slate tablets, write with a lead-pencil on the top of the cover: then as the cover is to be painted about every two years, the records are obliterated, and new ones are started. To indicate the condition of the colony at a glance, bricks are used in much the same way as the slates are above—that is, by placing them in various positions on the cover of the hive.

QUEEN-REGISTER CARDS.

Another system of record-keeping that is popular with some is what are called register-cards. The accompanying cut shows

1 2 3 4 5 6 7 8 9 10 **Queen Register.**
31 11 EGGS.
30 12 No ....
29 O 13 MISSING. BROOD.
28 14
27 15 TESTED. O CELL.
26 16
25 24 23 22 21 20 19 18 17 SELECT Tested. Hatched.

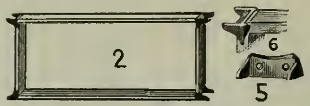
MARCH. LAYING.

OCT. APRIL.
SEPT. O MAY.
AUG. JUNE.
JULY.

DIRECTIONS.—Tack the card on a conspicuous part of the hive or nucleus; then, with a pair of plyers, force a common pin into the center of each circle, after which it is bent in such a manner that the head will press securely on any figure or word.

how they are used. To indicate the date, the pin-points are revolved so as to point to the proper place. There is no writing, and nothing to do except to turn the pointers to the right place. This is preferred by W. Z. Hutchinson and others.

REVERSING. This, as the term signifies, is the process of inverting, or turning over, the combs. The subject began to be discussed in earnest in '84. Its object is twofold: First, by so taking advantage of the natural instinct of bees as to cause them to complete combs only partially built out, or to fill said frames completely with comb; second, to force the bees to carry the honey from the brood-chamber into the surplus-receptacle above, where it is wanted. Reversing is accomplished by inverting the combs singly or collectively. By the latter method the whole hive with contents is inverted at one operation. By the former, each frame is provided with reversible supports, so that the frame can be placed in the hive bottom upward, and *vice versa*. Perhaps a score or more of devices for the reversing of frames have been submitted to me. The one figured above is a good one, and it is also a fixed frame. The cut given will make its use plain when it is understood that it is a standing frame. It rests on strips of tin nailed to the bottom inside edge of the ends of the hive.



THE VAN DEUSEN REVERSIBLE FRAME.

These frames are used quite extensively by Captain J. E. Hetherington (see Biographical Sketches at the back of this volume); also by his brother, O. J. Hetherington. They are really an excellent frame, and have several good features aside from reversing.

THE PHILOSOPHY OF REVERSING.

It is a natural instinct of the bees to store their honey next to and just above their brood-nest. The consequence of this is, that the upper part of the combs is bulged out, often full of honey, while the lower part, or that just below the brood, is apt to be built out sparingly, and oftentimes not touching the bottom-bar. If the frame be now reversed, the energy of the bees will be equalized, in a certain sense, and the comb will entirely fill the frame, the result being an even card of comb. Now, by the process of reversing, the honey which was placed below the brood-nest, according to the votaries of inverting, will be stored in the sections, where it is wanted. I believe, however, that this practice is not always profitable, as dark honey sometimes by this means is put into sections. Another advantage is claimed by the advocates of inversion; namely, the completing of sections only partially filled out. Many times the upper part of sections is filled out when the lower part is only partially so. To force the bees to finish the sections, top and bottom alike, the whole super is inverted at the proper time to secure these results.

The majority of large honey-producers do not practice inverting, because it is argued that the advantages derived therefrom are not sufficient to cover the additional expense incumbent on supers, frames, hives, etc., made reversible; but as the majority of honey-producers have been using the loose frame (*i. e.*, frames not fixed), no wonder they would look with disfavor on reversing, for the simple reason that *loose* frames can not very well be inverted; but where hives with fixed frames are used, such as the Hoffman or the closed-end, hives may be inverted as a whole.

The principal and foremost advantage of reversing, in my mind, is the securing of perfect combs—combs built out solid to the bottom-bar; and this can be accomplished in no way so perfectly as by reversing. It is a great nuisance to have combs built down to within a quarter of an inch or so of the bottom-bar, and there left, season after season. It is a nuisance, because queens hide in these places, and because, in shaking frames for extracting, it is a good place for the bees to cling. It is desirable to have all our combs as straight and true as boards. This is a decided advantage in uncapping.

A hive with the Hoffman frames may be reversed very easily. Take one of the eight-frame hives containing this kind of frames, described under HIVE-MAKING, and lay a couple of ½-inch-square strips on top of the frames, and as long as the hive is wide inside. Instead of putting on the hive-cover, put on an extra bottom-board. Now turn the hive upside down, and put on the cover. Leave the hive this way during the honey season for a few days, or while they are being fed, until they build the combs up to the bottom-bar once, now uppermost; then put the hive back in its normal shape—bottom-bars downward.

I do not believe it pays to go to the expense of having reversible hives or reversible frames *on purpose* for reversing. With the Hoffman frames it assuredly does pay to practice it once, at least, to get the combs filled out clear to the bottom-bars, because there is no additional expense for fixtures.

ROBBING. Paul says, "The *love* of money is the root of all evil." I should be inclined to state it in this way: The disposition to get money without rendering an equivalent, is the root of all evil. Well, the root of a great many evils in bee-keeping is the disposition of the bees to gain honey without rendering any equivalent. Some one of our A B C class has said that he found bees making visits to over 100 clover-heads before they obtained a load sufficient to carry to their hives. I think it very likely, that during a great part of the season a bee will be absent a full hour, or, it may be, during unfavorable spells, as much as two hours, in obtaining a single load. Is it at all strange that a bee, after having labored thus hard during the fore part of the day, should, in the afternoon, take a notion to see if he could not make a living in some easier way? Would he be very much worse than many types of humanity? Well, as he passes around to other hives, he catches the perfume of the clover honey they have gathered in a like manner, and, by some sort of an operation in his little head, he figures out that, if he could abstract some of this, unperceived, and get it safely into his own hive, he would be so much the richer. I presume he has no sort of care, whether these other folks die of starvation or not. That is no concern of his.

With all of their wonderful instincts, I have never been able to gather that the bees of one hive ever have any spark of solicitude as to the welfare of their neighbors. If, by loss of a queen, the population of any hive becomes weak, and the bees too old to defend their stores, the very moment the fact is discovered by other swarms, they rush in and knock down the sentinels, with the most perfect indifference, plunder the ruined home of its last bit of provision, and then rejoice in their own home, it may be but a yard away, while their defrauded neighbors are so weak from starvation as to have fallen to the bottom of the hives, being only just able to feebly attempt to crawl out at the entrance. Had it been some of their own flock, the case would have been very different indeed; for the first bee of a starving colony will carry food around to his comrades, as soon as he has imbibed enough of the food furnished to have the strength to stagger to them.

Well, suppose the bee mentioned above, in prowling around in the afternoon or some other time, should find a colony so weak, or so careless, that he could slip in unobserved, and get a load from some of the unsealed cells, and get out again. After he has passed the sentinels outside he will usually run but little danger from those inside, for they seem to take it for granted that every bee inside is one of their number. There is danger, though; for should he betray too great haste in repairing to the combs of honey, they will often suspect something; so he assumes an indifference he is far from feeling, and loiters about very much as if he were at home, and finally, with a very well-assumed air of one who thinks he will take a lunch, he goes to the cells, and commences to fill up. Very often, when he gets pretty well "podded out" with his load, some bee approaches, apparently to see if all is right. When the robber once gets his head into a cell, however, he seems to have lost all sense or reason; and if he is discovered at this stage to be a stranger and a thief, he is often pounced upon and stung with very little ceremony. How do they know a stranger from one of their own number, where there are so many? It is said, they know by the sense of smell; this may be the principal means, perhaps, but I think they depend greatly on the actions and behavior of a bee, much as we do when judging of the responsibility of a man who asks to be trusted. We can give a very good guess, simply by his air or manner, or even by the sort of letter he writes. If a robber is suspected, and a bee approaches for the purpose of satisfying himself, it is a very critical moment, and one becomes intensely interested in watching the performance. The robber will stand his ground, if he is an old hand, and permit himself to be looked over with a wonderful indifference; but one who has watched such scenes closely will detect a certain uneasiness, and a disposition to move slowly toward the entrance, that he may be the better able to get out quickly, when he discovers things to be too hot for him inside. If the bee who first suspects him concludes he is an interloper, he begins to bite him, and grab hold of his wings to hold on until others can come to help. The thief has now two chances to escape, and sometimes he seems meditating which to adopt; one is to brave it out until they shall perhaps let him alone, and then slip out unobserved. The other is to break away, and trust to his heels and wings. The latter plan is the one generally adopted, unless he is a very old and "hardened sinner" in the business. One who has been many times in such scrapes will usually get away, by the latter plan, by an adroit series of twists, turns, and tumbles, even though three or four bees have hold of him at once. Some of these fellows, by a sudden and unexpected dash, will liberate themselves in a manner that is also wonderful, and then, as if to show their audacity, will wheel about and come back close to the noses of their retainers of a minute before.

But in case the bee gets his load, and makes his way out unobserved, he gets home very quickly, you may be sure, and, under the influence of this new passion for easily replenishing his hive with the coveted sweets, he rushes out with a vehemence never known under any other circumstances. Back he goes and repeats the operation, with several of his comrades at his heels. Does he tell them where to go? I wish to digress enough here to say, that I do not believe in a so-called language among bees, or animals in general, further than certain simple sounds which they utter, and which we may learn to interpret almost if not quite as well as they do. When a bee comes into the hive in such unusual haste, podded out with his load in a way also rather unusual where it is obtained from ordinary stores, his comrades at once notice it, and, either from memory or instinct, they are suddenly seized with the same kind of passion and excitement. Those who have had experience at the gambling-table, or in wild speculations of other kinds, can understand the fierce and reckless spirit that stirs these little fellows. Patent hives illustrate the matter very well. A man who afterward became editor of a bee-journal once held up before my untutored eyes a right to make a patent hive, saying:

"Mr. Root, I get $5.00 for these rights, and they do not cost me more than the paper they are printed on—less than half a cent apiece."

The idea that $5.00 bills could be picked up in that way, compared with the slow way I was in the habit of earning them, so impressed itself on my mind that I could hardly sleep nights; but after I had taken that amount from several of my friends and neighbors for the "right," I concluded that money without a clear conscience is not just the thing after all. Can we blame the poor bees for being so much human? Well, the bees, when they see a comrade return in the way mentioned, seem to know, without any verbal explanation, that the plunder is stolen. Anxious to have "a finger in the pie," they tumble out of the hive, and look about, and perhaps listen, too, to find where the spoil is to be had. If they have, at any former time, been robbing any particular hive, they will repair at once to that; but if it is found well guarded, those used to the business will proceed to examine every hive in the apiary. As an illustration of the way in which they communicate, or, rather, observe the movements of each other, see account of bees getting into the honey-house, given in Pollen.

Of course, they have particular notes,[370] as of joy, sorrow, anger, despair, etc., which are produced by the wings, usually when on the wing, but I am quite sure they are unable to communicate to each other more than a single idea. In other words, they have no faculty of telling their fellows that a lot of honey is to be had in a feeder at the entrance, and that it would better be brought in quickly, or other bees may find it. A bee goes out in the spring, and by smelling around the buds, discovers honey and pollen; when he comes into the hive, the others see it and start out, and hunt it up in a similar way. For further information on this subject, see Swarming.

If you will turn back and read ANGER OF BEES, you will get a very good idea of the causes that start bees to robbing. Read, also, BEE-HUNTING, FEEDING, etc. As a general thing, bees will never rob so long as plenty of honey is to be had in the fields. During a bountiful flow I have tried in vain to get bees to take any notice of honey left around the apiary. At such times we can use the extractor right in the open air, close to the sides of the hives, if need be. On one occasion I remember leaving a comb of unsealed honey on the top of a hive, from morning until noon, and not a bee had touched it. It seems they preferred to go to the clover-fields, in the regular way, rather than to take several pounds from the top of a neighboring hive. I can readily suppose that they did not have to visit anything like a hundred blossoms at this time, and perhaps they secured a load in going to not more than a half-dozen. Such a state of affairs is not very usual in our locality. We have very few days during the season, when it would be safe to use the extractor for a whole day in the open air; the bees will generally learn to follow the freshly uncapped combs about, and that it is easier than going to the fields. The first indication of robbing which you will have, will probably be the cool and wicked way of stinging, that I have described in ANGER OF BEES.

After the season begins to fail, you may expect that every colony in your apiary will be tried. As a rule, any fair colony will have sentinels posted to guard the entrance, as soon as there is a need of any such precautions. The bee that presumes to think he may enter for plunder will be led off by "the ear," if I may so express it, and this will be repeated until he learns that there is no chance for speculation at that house. At the close of the honey harvest we should be sure that there are no feeble hives that may be overpowered, for one such may start the fashion of robbing, and make it a much harder matter to control this propensity. An apiary, like a community, may get so demoralized that thieving becomes a universal mania. "A stitch in time will save" a great many more than nine, in this case. Be sure that each colony has the entrance contracted, and, in fact, the space occupied by the bees also, in proportion to their numbers. Give them only so many combs as they can cover, if you wish them to defend them properly from either moths or robbers. A colony without either queen or brood is not apt to fight for their stores very vigorously, so it will be well to see that they have either one or both, should there be an attack made on them. It is hardly necessary to repeat what has been said about Italians being better to defend their stores than the common bees. A few Italians will often defend a hive better than a whole swarm of black bees.

COLONIES THAT WILL MAKE NO DEFENSE.

Although this is contrary to the rule when the queen and number of bees are all right, yet such cases do sometimes come up. I have found that colonies which have been wintered indoors are most liable to get into that peculiar state where they will allow bees from other colonies to come in and help themselves without molestation, yet it is not always the case. When they can not be stirred up so as to show a particle of spunk or resentment, the temptation is sometimes very strong to say, "It is good enough for them; they ought to starve." This might be gratifying to one's feelings for the time, but, on the whole, it would not pay. I have cured them of it in various ways; sometimes by giving them some good fighting bees from another hive, and sometimes they got over it themselves after being shut up a while. I have tried scenting the robbers with some strong odor, like camphor or peppermint. Do this just at night, and, by the next morning, the bees from each colony have an odor so distinct that the sentinels have no trouble in telling their own bees from the others. This has seemed to answer; but as they might have been all right anyway, I am not quite certain that changing the scent was the cause of the cure. Contracting the entrance and closing all cracks and crevices are always very important in stopping robbers.

HOW TO KNOW ROBBER-BEES.

It sometimes puzzles beginners exceedingly, to know whether the bees that come out are robbers, or the ordinary inmates of the hive.

A robber-bee, when he approaches a hive, has a sly, guilty look, and flies with his legs spread in a rather unusual way, as if he wanted to be ready to use his heels as well as wings, if required. He will move cautiously up to the entrance, and quickly dodge back, as soon as he sees a bee coming toward him. If he is promptly grabbed for as soon as he attempts to go in, you need have but little fear. If a bee goes in and you can not well tell whether he was a robber or not, you must keep a close watch on the bees that come out. This is a very sure way of telling when robbers have got a start, even at its first commencement. A bee, in going to the fields, comes out leisurely, and takes wing with but little trouble, because he has no load. His body is also slim, for he has no honey with him. A bee that has stolen a load is generally very plump and full, and, as he comes out, he has a hurried and guilty look; besides, he is almost always wiping his mouth, like a man who has just come out of a beer-shop. Most of all, he finds it a little difficult to take wing, as bees ordinarily do, because of the weight. In BEE-HUNTING I told you how a bee, laden with thick undiluted honey, would stagger several times under his load before he could take wing for his final trip home. Well, the bee, when he comes out of the hive with the honey he has very likely just uncapped, feels instinctively that he will be quite apt to tumble unless he can take wing from some elevated position, and therefore he crawls up the side of the hive before he launches out. When he first takes wing he falls a little by the weight of his load, before he has his wings fully under control, and therefore, instead of starting out as a bee ordinarily does, he takes a downward curve, coming quite near the ground before he rises safely and surely. With a little practice you can tell a robber at a glance, by his way of coming out of the hive, particularly by that fashion of running up the side of the hive before taking wing, in the way I have mentioned.

HOW TO TELL WHERE THE ROBBERS BELONG.

If you are a bee-hunter you will probably line them to their hive without any trouble; but if you are not, you can easily find from which hive they come, by sprinkling them with flour as they come out of the hive being robbed. Now watch the other hives, and see where you find the floured bees going in. I can generally tell in a very few minutes, by the excited actions of the robbers, already mentioned.

HOW TO STOP ROBBERS.

It depends a great deal on what particular stage of proceedings they have reached. If they are fighting briskly, and stinging one occasionally, they will usually take care of themselves, if there are plenty of bees inside, and their entrance is contracted. I have known the robbers to get up so early on a cool morning that the regular inmates were not stirring; and before they were roused, and could put a stop to it, the robbers had quite a lively "trade" started. This is a bad fashion for an apiary to learn, but it will usually cure itself, if the colonies are all strong. If the bees are going in and out very rapidly, and running over the sentinels in a way indicating that they are overpowered, you must shut up the hive at once. Now be sure you shut it up so it will stay.[182]

Be sure you remember the caution I am going to give you in regard to this. Should the hive be standing in the sun, during a very hot day, and be full of bees, they would be very likely to smother, without a good deal of air.* We have used with success an ordinary Reese bee-escape (see COMB HONEY). The same is so attached to the entrance that bees may come out but can not get back. If this is left on for a time, and then removed, and the entrance contracted, all will be quiet again.

If there are not many of them, there will be no danger of suffocation. It is the bees gorged with honey that are most apt to suffocate, for they are much like an individual who has eaten too large a dinner, and they can not stand close confinement. When near suffocation they will disgorge the honey, and the quantity is often sufficient to wet the whole mass almost as thoroughly as if they had been dipped in honey. The heat given off by the damp crowd is often so great as to melt down the combs into a sticky mass, and, when touched by the hand, it often feels almost scalding hot. The bees soon die in this condition, for their breathing-pores are closed; and unless they can be speedily licked off by other bees, or washed, they will be "no good." If they are found in this condition, with life enough to move, they may be saved by giving them to clean bees to lick off; but they should be confined so that they can not readily crawl out of the hive in the dirt; they will always do this if they can, for they seem to consider themselves of no use, and, like any ailing bee, try to get off out of the way of those that are healthy and well. I have often saved almost every one by dipping a teacupful, or even a pint, with a spoon, and placing them right over the frames of a strong colony. If you do not give each hive too many at once, they will soon clean them off as bright as themselves. Letting the outside robbers get at the mass will do, but it may result in more trouble, unless you are master of your business. One of our lady friends reported, at one time, saving such a colony by washing the bees in warm water, and then

* If you are so fortunate as to have one, cover the hive with a bee-tent; see elsewhere.

drying them in the sun, in a box covered with wire cloth.

There are several ways of preventing bees from smothering, when the hive is closed, and a very common one is to give them air, by means of an opening closed with wire cloth. Unless this is quite large they will often pack so densely over it as to exclude every particle of air, and thus defeat its purpose. If an upper story can be put on, and this covered with wire cloth, it will do very well; but even then the robbers inside make such a fuss as to call the robbers outside to them, and keep up a disturbance in the apiary all day. But a still worse objection is, that the robbers will sometimes make an arrangement with those inside, by which they will pass the honey out, and thus clean out the hive, in time, as effectually as if they were allowed admittance. Our neighbor Shaw used a double wire cloth, with a half-inch space between the sheets, for his small nucleus hives, just to prevent this kind of sharp practicing. I have several times seen bees pass honey through the wire cloth in this way, but have always stopped the fun, before the insiders had passed it all out. A correspondent in GLEANINGS for Jan., 1879, gives an instance where the whole of the honey was handed out to the robbers, leaving the insiders so destitute that they actually starved to death, the whole of them. These fellows, it seems, were a little too sharp, and in their greed for ill gotten-gains rather overstepped themselves.

Well, if we can not give them ventilation through wire cloth, what shall we do? I would let the robbers out, without letting any of the outsiders in; I generally do this by brushing away, with a little bunch of asparagus-tops, all the bees which are around the entrance, and then keeping them away until all get out that wish to. You can then close the hive with very little danger. If the colony is a large one (it is very seldom a large colony is caught being robbed), you would better shade the hive, to be on the safe side. It will also be a good idea to set on an upper story, and let them go up into that. If you have got the robbers all out, it will often do to give them their liberty the next morning; but if they will not defend themselves then, I would shut them up and let them remain 3 days.[183] By this time all the bees that remained in the hive, or a large part of them, even if they are robbers, will adhere to the stand as if it had always been their own. I hardly know why this is, for a bee remembers things that happened several weeks before. Perhaps they get interested in the ways of their new home, and conclude to cast their lots there. I know that bees remember more than 3 days, because I once carried a stock away to a swamp and kept them there about a month. When I brought them back I placed them on a new stand, and jostled them a little in opening the entrance. At this they sallied out in quite a body; but when they tried to return to their hive, they all went directly to their old stand. Bees have been known to do the same, after being in a bee-house over winter.

After a colony has been confined a day or two, because they would not repel robbers, I would let them out just about sundown, and watch them closely. To be on the safe side, you would better get up next morning before they begin to fly, and see if they are all right.

It has been often recommended, that the combs be broken and the honey set running in the robbers' hive, that they may be induced to stay at home; this will sometimes check them; but as these colonies are almost always extra spry and active, they will have things fixed up in a trice, and be out at their old trade again. In trying to people our house-apiary in the fall, when it was first built, I had a great deal of trouble with one certain colony. In fact, if any robbing was going on anywhere, it was sure to be these hybrids who were at the bottom of the mischief. After I had tried every plan I had heard recommended, and still these fellows would persist in pushing into every new colony I started, the idea occurred to me that, on the principle that it takes a rogue to catch a rogue, it would be well to try to see how they would repel robbers. I simply took the greater part of the combs from the robbers, bees and all, and carried them into the house-apiary, and put them in place of the colony which they had been robbing. The effect was instantaneous. Every laden robber-bee that came home with his load, on finding the queen and brood gone, at once showed the utmost consternation, and the passion for robbing was instantly changed to grief and moaning for the lost home. The weak colony which they had been robbing, and which had only a queen-cell, was placed with them, and they soon took up with it, and went to work. The robbers newly domiciled in the house-apiary repelled all invaders with such energy and determination that the rest seemed to abandon the idea which they, doubtless, had previously formed; viz., that the house-apiary was a monster hive but ill garrisoned, and I had but little trouble afterward. Before I swapped them, as I have mentioned, I had serious thoughts of destroying the queen, simply because they were such pests; but the year afterward, this colony gave me in the house-apiary over 100 lbs: of comb honey.

The practice of changing colonies is not always a very safe one, on several accounts, although an experienced or a careful hand will often make it serve an excellent purpose. Sometimes the queen of the weaker colony may be attacked and destroyed; and, again, bees from other hives may strike in, and both being demoralized by the unexpected transition, and unfitted to repel intruders, robbing may be started on a much larger scale than before. Instead of exchanging hives and all, I think by far the better way is to leave the hives on their old stand, and simply exchange the greater part of the combs, with the bees adhering. With the fingers between each two combs, with both hands we can raise four combs with all the adhering bees, and carry them all together. If done in this way, enough of the original inmates will be left in the strong hive to protect it, and enough will also be carried to the weaker hive to make it perfectly safe. The queen of the stronger hive will be in no danger, but the queen of the weaker one may have to be caged, although I have seldom found this necessary.

WHAT HAPPENS IF ROBBING IS NOT STOPPED.

Well, when the work is under real headway, the honey of a strong colony will disappear in from 2 to 12 hours; the bees will then starve in the hive, or go home with the pillagers, or scatter about and die. This is not all: when the passion is fully aroused, they will not hesitate to attack the strongest stocks, and you will find your bees stung to death in heaps, before the entrances. This may, after a spell, put a stop to it, but I have seen them push ahead until every hive in the apiary was in an uproar, and it seemed as if every bee had gone crazy, sure. At such times the robbers will attack passers-by in the streets, and even venture an attack on cats, dogs, aye, and hens and turkeys too. Like the American Indians when infuriated at the sight of blood, every bee seems to have a demoniacal delight in selling his life by inflicting all the torments he possibly can, and feels sad because he cannot do any more mischief.[185]

The account below, taken from page 224 of GLEANINGS for 1877, illustrates very vividly what I have tried to describe.

I send you a paper, the *Valley Herald*, published at our county seat, which has a little article on "Bees on a Rampage." I should be glad to hear your views on the subject. What caused those bees to act so, etc.? JOHN W. HOODENPYLE.

Looney's Creek, Tenn., July 10, 1877.

BEES ON A RAMPAGE.

Mr. Elisha Tate, who lives some fifteen miles from this place on the head of Battle Creek, met with quite a singular misfortune on the 19th inst. He has, or did have at that time, about twenty hives of bees, and on that day, while all were away from the house except a daughter and the baby, the bees became mad from some cause or other, left the hives in large swarms and commenced to sting every living thing on the place. They attacked the daughter, who fled from the house, leaving the babe on the bed. A fine jack was stung to death in the stable; all the chickens were killed, and a sheep, that was around the house, was stung so badly on the nose that that organ swelled to huge dimensions, causing death by suffocation. The cries of the daughter brought Mr. Tate to the house, and he proceeded to rescue his babe, which he found literally covered with bees; and we understand that it was with great difficulty that its life was saved. Mr. T. attempted to destroy the bees at night by piling fodder on the hives and setting fire to it, but it only served to again arouse them, and they attacked the family and compelled them to abandon their house and go to a neighbor's.

No one can account for the strange occurrence. Some think that a snake must have visited the hives, as it is known that bees have the greatest antipathy toward snakes.

In all probability the account is considerably exaggerated, as such things usually are before they get into the papers, but it affords an excellent lesson, nevertheless, on the results of letting bees get into a habit of robbing each other, or of finding honey scattered about the premises. I tried, in ANGER OF BEES, to illustrate it, but the above does it still better. The worst season seems to be after basswood is over, and the bees seem to get especially crazy, if they even get a smell of this aromatic honey left carelessly about the hives. One who has never seen such a state of affairs can have but little idea of the furious way in which they sting every thing and everybody. The remedy is to get a kettle of coals and put in enough chips or sawdust to make a "big smoke;" carry this out among the hives and proceed to close every hive that shows any symptoms of being robbed. Shut up every bit of honey where not a bee can get at it and do your work well; for at such times they will wedge into and get through cracks that would make one think *inch boards* were hardly protection enough. Just before dark, let all the robbers go home, and be up betimes next morning to see that all entrances are close and small. and that all the hives are bee-tight. An experienced hand will restore peace and quietness in a very short time, in such a demoralized apiary. Black bees are much worse than Italians, for the latter will usually hold their stores against any number of assailants; good, strong, well-made hives, filled with Italians, with plenty of brood in each, will be in little danger of any such "raids," although we have seen the wounded and slain piled up in heaps, before robbers would desist and give up trying to force an entrance.

The love of honey, my friends, is by far more potent than "snakes" in demoralizing an apiary. I do not think bees have any particular enmity to them.[186]

There is one more point: If in uncapping drone-brood, or in cutting out brood to rear queens, you leave the cappings or bits of comb scattered about, the bees will get a taste of the milky fluid and juices of the brood, and it seems to craze them worse than honey even, if that is possible. Below is a letter illustrating it.

CROSS BEES.

I had some of the crossest bees this summer that were ever heard of. They would fight the top of a stovepipe that runs up through a shed roof: there would be 50 or 100 bees at once, just whacking against that pipe, and very many fell into it, and burned to death. They would dive into my smoke-pan, and burn up in that, and sting folks along the road. What the cause was I could not imagine, but at last I happened to think. I had been destroying drone-brood, and when it was in a milky state I could not shake it out of the combs; the bees would eat it and it just made them crazy and ugly. Well, I always want to be sure about any thing, so I left it off for awhile and they became peaceable again. On again giving them access to the milky brood, the same result followed. I suppose you will laugh, but I am well satisfied that this, and this only, was the cause of the fierceness of the bees. D. GARDNER.

Carson City, Mich., Nov. 9, 1877.

PREVENTION OF ROBBING.

Beginners are very apt to say that the bees must rob some — that there is no such thing as preventing it absolutely. They say honey will get daubed about on the door-knobs, on the posts, and on the ground, and that it can not be helped; that the bees will rob after the honey-yield has ceased, for they will crowd into the hives when they are opened to cut out queen-cells, etc. Is this so, my friends? To be sure, it is not. You can have your honey-house as clean as your kitchen, and you can have every particle of honey cleaned up. You can have a wash-basin and cloth, and, just the moment a drop falls, you can, if you have a mind to, get right down on your knees and clean it up. You can not afford to take so much time? I verily believe it will take less time to have every thing neat, and always in place, than it will to have such scenes of disorder. I could sit down and cry, many times, if I thought it would do any good, when I see young people defeat themselves, and make themselves unhappy too, by their heedless, careless way of doing things. Is it because they have not been trained differently? Perhaps so, and perhaps experience is the best teacher. Experience is a very slow teacher, and I should like to stir you all up, and have you get along faster in habits of neatness, for I know you all admire a neat apiary nearly if not quite as much as I do.

WORKING WITH BEES BY LAMPLIGHT WHEN ROBBERS ARE TROUBLESOME DURING THE DAY.

I believe I have before mentioned my troubles in trying to people the house-apiary, in the fall. Queens were already hatched in the lamp nursery, and, unless the colonies were divided at once, so as to make use of them, all would be lost. The surplus combs for making these late swarms were in the upper stories, and the robbers knew it; for no sooner was a cap raised than they were on hand; and before I could get the brood-combs to go with them (I found that the bees would not adhere even to their own combs, unless some of them contained unsealed brood), a smart traffic would be under way. It came night, and my hives and queens were in all sorts of bad shapes. I was glad to have it come night, I assure you, for I longed for the time when the robbers would be compelled, by the gathering darkness, to go home. I presume many of you have had cause to repent trying to work with bees when it began to grow dark, but I got the idea into my head that, with some good lamps with nice shades on them, I could do my work in the evening. I went at once and got a lamp, and walked around the apiary viewing the inmates of the different hives that were clustered out at the entrances, humming merrily, I presume in remembrance of the rich loads they had but an hour before snatched from me. Scarcely a bee took wing, and I then ventured to open a hive. With the lamp on one of the posts of the trellis, I found I could handle the bees almost as well as in daylight, and, to my intense relief, not a bee would leave his hive, no matter how many combs were held temptingly under their very noses. I went to work, divided my hives, caught the queens, and even handled vicious hybrids, with less stings than I could possibly have got along with in the daytime. As I passed again and again the hives of the robbers who were clustered out viewing proceedings, I could hardly resist the temptation to place my thumb at the side of my nose, to let them know how much I enjoyed having completely outwitted them. The last hive in the house-apiary was filled, unsealed brood and a queen-cell given to all, and all were fixed so that they could repel robbers by morning, without trouble. Of course, I had a good smoker, and this did much toward preventing them from taking wing. If the lamps were placed very near the bees, occasionally a bee would buzz against the light; but when placed off at a distance of 6 or 8 feet, they rarely approached it. I have extracted honey late in the fall by moonlight, when it would have been impossible to do it in the daytime, on account of the robbers. You will probably find the pure Italians much more easy to handle by lamplight than blacks or hybrids.* [187]

HOW TO CIRCUMVENT ROBBERS.

During the summer of 1879 the basswood season failed us suddenly about the 20th of July, and left us with something like 250 queen-rearing colonies. Now, bees were coming in daily, and bees were going out daily. Queens and pounds of bees were ordered by every mail, and must go by first express, especially if we hoped to hold our customers, and so, even if robbers did incline to dip into every hive, business could not be stopped. I instructed the boys to make a wire-cloth house, to set over a hive when they wanted to open it. This answered excellently; but as it was so heavy, requiring two men to handle it, our boys devised the following very ingenious contrivance. It is capable of being folded up into a bundle, or spread out as seen in the cut on next page.

FOLDING BEE-TENT.

It is made by taking four basswood sticks, about 8½ feet long, and fastening them together like letter X's, with a good strong screw where they cross. A piece of good strong tarred twine, or small rope, makes the ridge-pole, as seen in the engraving, and this same twine unites the sticks at their tops. The mosquito-bar is sewed into a sort of bag, having the same strong twine all round its lower edges, and down each of the four corners. At these corners are also sewed metal rings, and these rings, when pulled down strongly, will loop over screw-heads, near the lower ends of the four sticks. When thus looped over, the sticks are bent, or bowed, so as to give room in the top of the tent. The whole structure weighs less than five pounds, and yet it gives room inside for a hive, and to do all necessary work. The basswood sticks are 1 x ¾ at the lower end, and tapered to 1 x ⅜ at their upper end, with the corners taken off, to make them as light as possible. Where the bend comes, they are scraped a little thinner.

In the small cut below at A is shown the way the ring is looped over the screw-heads, and just below is seen the end of a 2½-inch wire nail, bent so it can be (when turned with the point downward) used as an anchor to keep the tent from blowing over. If the sticks are spread a little when the anchors are pushed into the ground, the tent stands very securely.

When it may be desirable to store it away, it may be quickly folded into a bundle, as represented below.

The tent, as thus folded, we shove into a couple of loops four feet apart, made by U-shaped cords, attached to screw-eyes in the ceiling of the work-shop adjoining the apiary. The tents, as they hang suspended in our work-shop, are just above our heads, and yet within easy reach of the hands, for immediate use as occasion may require.

The uses to which this tent may be applied to advantage are numerous. We will first consider

ITS USE IN STOPPING ROBBING.

To do this I can not do better than to mention the following incident:

One Sunday morning it was somewhat wet and rainy; but for all the wet, the bees seemed starting off with quite a roar, which I at first thought must be the remnants of basswood-bloom. Pretty soon, however, I decided the roar was on too high a key; and by the time I saw a few bees hanging about the ventilators of the chaff hives, I concluded it was robbing somewhere. I passed one apiary after another, glancing up the avenues of grapevines (which are now quite bushy, and are about six feet high or more). "Oh, yes! here they are." It was one of the last artificial colonies made, and all about it was a perfect hubbub of activity, while the other four hundred colonies were comparatively still. The apiarist, Mr. K., soon got a bee-tent, by my instruction, and

---

* Since the above was written we have found that a good lantern is preferable to a lamp. The latter is apt to be affected by light breezes, and is often blown out. The former, while not open to this objection, will receive rougher handling. During the season of 1886 we used the lantern in the apiary with entire success.

placed over the hive. He remarked that it had a hole in the top, but I told him I thought it would do no harm. The robbers collected in large numbers in the top of the tent. As soon as they found the hole they buzzed out and started homeward, rejoicing over their heavy load of ill-gotten gains. The question was, Did they take their point to come back and get in at this hole? I told Mr. K. what had been reported in the journal, that a tent was better with such a hole in it, and we found that it worked all right. Of course, the great body of bees came back and besieged every hive in that vicinity, but not a bee had sense enough to go to the top of the tent and crawl in that hole out of which the robbers were coming. After they had satisfied themselves that no more plunder was to be had, either by *hook* or crook, they one after another went quietly back to their homes: and when I came home from meeting, there stood the tent without a robber-bee inside of it, for they all got out at the hole in the top; and neither was there a robber-bee inside of it, or anywhere about the apiary. All you have to do is to put such a tent over the bees being robbed, and go back about your other work. No bees will buzz their wings off inside of the tent, or die of suffocation.

You observe, therefore, that it is a great advantage to have a hole or slit in the peak of the tent. As the old adage runs, prevention is better than cure, I value it chiefly as

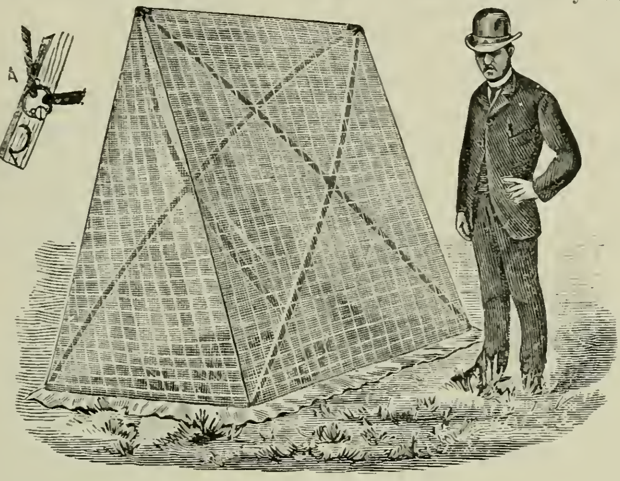
A PREVENTIVE OF ROBBING.

We will suppose that the honey-flow has suddenly stopped, and in going over the hives we discover that robbers are just beginning to show their annoying presence. They follow us about, and just as soon as the hive-cover and enameled cloth are removed they commence their pillaging. If we proceed thus all day, toward the latter part of it we shall find quite a little swarm of robbers making repeated raids into the hives. We are then obliged to contract the entrances of all nuclei; and if we continue in this way, the next day we will unhesitatingly affirm that the bees are "unusually cross."

Now, it would be very desirable to avoid all this; hence we will take our "stitch in time." We proceed to the workshop, draw out the tent from its two loops, which I described, and set it on end outside. We spread apart the basswood strips until each pair forms a letter X. We next grasp one of the rings on one corner of the tent, and draw it over the screw-head situated at the base of the strip, as seen at A, previous page. In like manner we adjust the other three rings. The tent is now set up, and each of the strips will be bent in the form of a bow, as seen in the large cut.

Having lighted our smoker, we grasp it with the right hand—the nearest corner of the bellows between the thumb and fingers. We now lift up one end of the tent and step inside. We grasp the two intersections of the cross-piece, at the same time holding the bellows of the smoker between the thumb and fingers. If you try a few times in different ways you will soon learn the knack of holding one side of the tent and the smoker at once, with ease. We can now cage ourselves and the hive together; take all the time we want to examine the hive, robbers

TENT FOLDED.



FOLDING BEE-TENT, READY FOR USE.*

*Our artist has shown the bottom fringe of the tent as common cloth; it is nothing but a continuation of mosquito bar.

or no robbers. The latter will buzz around the outside; but if we continue to examine the hive thus in rotation all day they will give it up as a bad job. If, on the other hand, the robbers have got started, they will be likely to follow the cage about for two or three days, even though they do not get inside. But if we are careful not to give them a "sip" of stolen sweets, they will finally let us alone.

Where there are no grapevine twigs to stick out and hinder, the tent will cause but little more trouble than the non-use of it; and if we take into consideration the fact that the use of the tent prevents the annoying presence of robbers, the time and trouble saved will vastly more than compensate any possible inconvenience it may occasion.

Right here I will say, before I forget it, if you use the tent awhile until the robbers have ceased buzzing about, then lay it aside for an hour or so, you will get the robbers started again, and then when you resume the use of the tent you are right where you started. If you wait too long before you resort to the tent, the robbers may be out in such strong force as to make even the tent fail of its object; for when the work with the hive is finished, and the tent is lifted off, the swarm of robbers will pounce into the entrance in such force as to make a real case of robbery; and before the inmates of the hive are aware of what is going on they have an "elephant on their hands." It is true, you may contract the entrance, but the bees will boil around every crack of the hive like mad hornets. When there are many queen-rearing nuclei in the apiary it doesn't pay to let things go so. It is and has been a standing rule in our apiary, that as soon as the bees show a disposition to rob, either quit work or use the tent—the latter alternative being the one most frequently adopted.

The tent is invaluable for getting bees out of sections. See article on COMB HONEY relative to this subject.

BORROWING.

Before closing this subject of robbing there are a few more points to be mentioned. There is a kind of pillaging called borrowing, where the bees from one hive will go quietly into another, and carry away its stores as fast as gathered; but this usually happens where the robbed stock is queenless, or has an unfertile queen. As soon as they have eggs and brood, they begin to realize what the end of such work will be. This state of affairs seldom goes on a great while. It either results in downright robbing, or the bees themselves put a stop to it.

Caution to Beginners:—The first year I kept bees I was in constant fear that they would get to robbing, as I had read so much about it in the books. One afternoon in May I saw a large number of bees passing rapidly out and in, at a particular hive, and the more I examined them the more I was persuaded that they were being robbed. I contracted the entrance, but it seemed to make little difference. I finally closed it almost entirely, compelling the bees to squeeze out and in, in a way that must have been quite uncomfortable, at least. After awhile they calmed down, and we had only the ordinary number of bees going out and in. "There," thought I, "if I had not read the books and known how, I might have lost my bees," and I presume I felt very wise if I did not look so. On turning my head, behold, the robbers were at another colony, and they had to be put through the same programme; then another, and another; and I concluded a host of robbers had come from somewhere, and made a raid on my apiary, and that, had I not been on hand, the whole of them would have been ruined. I had got very nervous and fidgety, and, when I found the whole performance repeated the next day, I began to think bee culture a very trying pursuit. Well, in due course of time I figured out that there was no robbing at all, but that it was just the young bees taking their afternoon playspell. Since then I do not know how many of the A B C class have gone through the same or a similar experience, and it is but a few days since I saw our minister and his wife out by a hive, closing it up, to stop the robbers that were making a raid on it. On my suggesting that they were mistaken, they replied, "Why, the air was full of them, and we could see them circling about away up in the air," proving conclusively to me that it was the young bees playing, as I have said before. The directions I have given for distinguishing robbing - bees from the ordinary inmates of the hive, will enable you to tell whether it is playing or robbing;[188] but as the books had not described the afternoon playspell that young bees always take in suitable weather, I was somewhat excusable.

ROCKY - MOUNTAIN BEE - PLANT (*Cleome Integrifolia*). This is a beautiful plant for the flower - garden, to say nothing of the honey it produces. It grows from two to three feet in height, and bears large clusters of bright pink flowers, as shown in the cut.

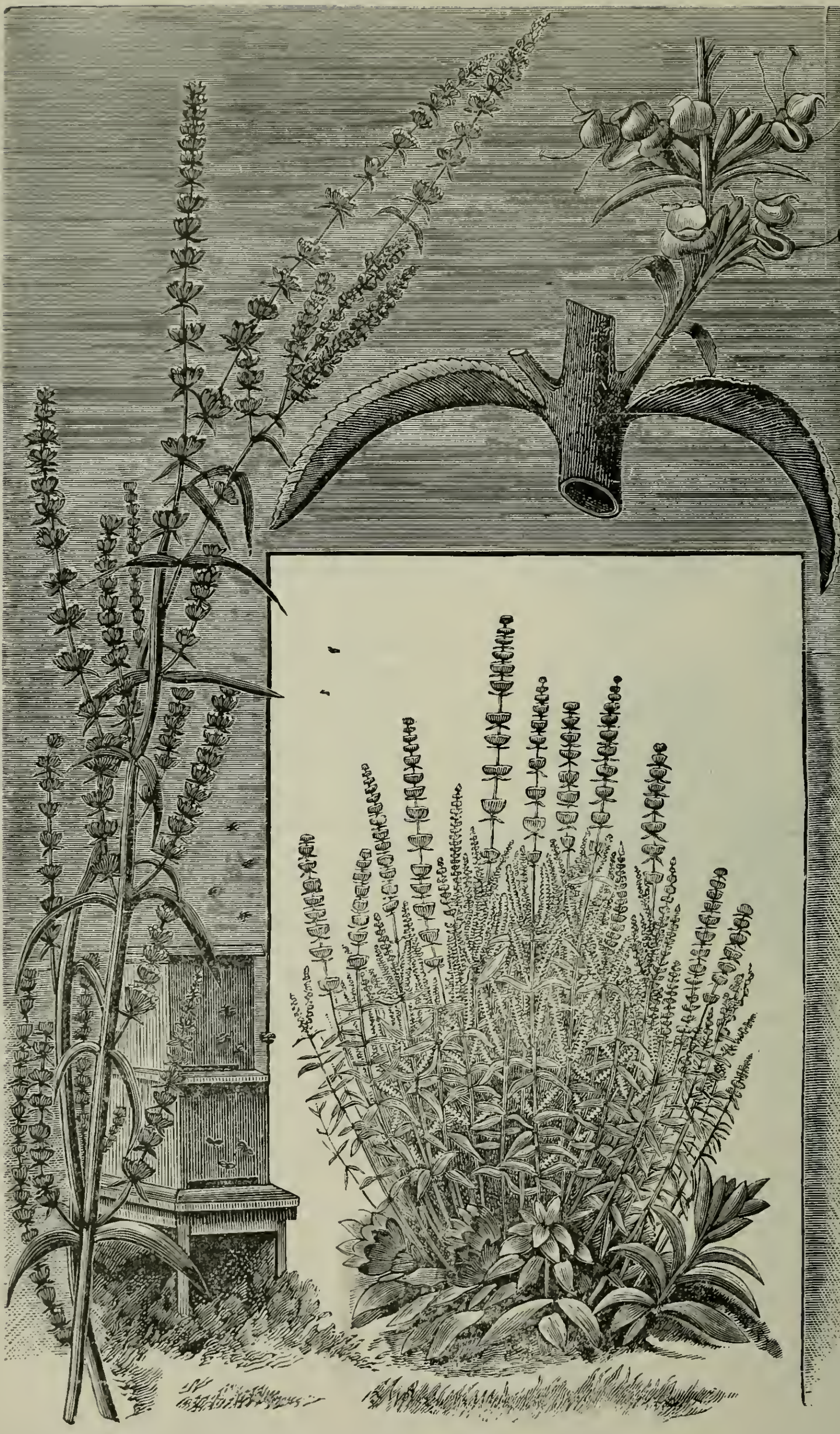
It is a near relative of the SPIDER-PLANT, which see. It grows naturally on the Rocky Mountains, and in Colorado, where it is said to furnish large quantities of honey. Although it succeeds easily under cultivation, in our locality I can not learn that it has ever been a success pecuniarily. With this, as well as with all other plants, it must be borne in mind that, to yield honey enough to give it a fair test, acres are needed, instead of little patches in the garden. The seed has been offered for sale for several years past, as a plant to be cultivated for honey; even if it does not pay for honey, it will pay to have a bed of it on account of its beauty.

ROCKY-MOUNTAIN BEE-PLANT.

The engraving was copied from a larger-sized picture, in Prof. Cook's "Manual of the Apiary." During the past season of 1879 we have had a number of the plants growing in our honey-garden. It is, however, so much inferior in looks, as well as in the amount of honey produced, to the spider-plant, that we have not taken pains to save the seed. The two plants very much resemble each other, but the latter is a much stronger and finer-looking plant, and has a rank luxuriance of growth that the Rocky-Mountain bee-plant has not.

To have them do well in our gardens, that is, give us a good yield of honey, the seeds would better be planted in a box indoors, say in February or March. Set them out when all danger of frost is past, and give them good rich soil, with about the same cultivation you would give your cabbages. They should stand about as far apart as hills of corn. If you have many plants, it will be a good plan to cultivate them as you do field crops.[371] It should be remembered, the better the soil and cultivation, the better will be the yield of honey. These remarks will apply to either Rocky-Mountain bee-plant, spider-flower, or the Simpson honey-plant. The first two blossom the first year; the last, sparingly the first year, but abundantly the second year.

June, 1891.—Since the above was written, the Michigan Agricultural College has experimented with several acres of the plants, with the special point in view of testing its honey-producing qualities. They found it exceedingly difficult, however, to get a good stand of plants. In fact, I do not know how a perfect stand can be obtained without transplanting; and as this makes the expense equivalent to a field of cabbages or strawberries, of course the honey produced did not come anywhere near paying expenses. Some of our seed catalogues have described it in glowing terms, and greatly exaggerated its honey-producing qualities. Flaming colored prints of the flower covered with honey have also been given, and I suppose many people have been deluded into the belief that these plants could thus be grown in small patches so as to produce honey profitably. It has been advertised under various fanciful names, such as "The Great Mexican honey-plant," etc.



THE PLANT THAT PRODUCES THE CELEBRATED SAGE HONEY OF CALIFORNIA.

S.

SAGE (*Salvia*). This plant also belongs to the great family of *Labiatæ*, or the mint family. Labiate means lip-shaped; and if you look closely you will see that plants belonging to this family have blossoms with a sort of lip on one side, something like the nose to a pitcher. Many of this family, such as CATNIP, MOTHERWORT, FIGWORT, GILL-OVER-THE-GROUND, have already been mentioned as honey-plants, and the number might be extended almost indefinitely. The sage we have particularly to do with is the white mountain sage of California; and I do not know that I should be far out of the way in calling this one of the most important honey-plants in the world. The crops of honey secured from it within the past ten years have been so immense that the sage honey is now offered for sale in almost all the principal cities in the world, and a nice sample of well-ripened California honey, whether comb or extracted, is enough to call forth exclamations of surprise and delight from any one who thinks enough of something good to eat, and pleasant to the taste, to commit himself so far. I well remember the first taste I had of the mountain-sage honey. Mr. Langstroth was visiting me at the time, and his exclamations were much like my own, only that he declared it was almost identical in flavor with the famed honey of Hymettus, of which he had received a sample some years ago. Well, this honey of Hymettus, which has been celebrated both in poetry and prose for ages past, was gathered from the mountain thyme, and the botany tells us that thyme and sage not only belong to the same family, but are closely related. Therefore it is nothing strange if Mr. Langstroth was right, in declaring our California honey to be almost if not quite identical in flavor with the honey of Hymettus. This species of sage grows along the sides of the mountain, and blossoms successively as the season advances; that is, the bees first commence work on it in the valleys, and then gradually fly higher up, as the blossoms climb the mountain-side, giving them a much longer season than we have in regions not mountainous.

There are several varieties of mountain sage, and there has been some discussion as to which one furnishes the largest amount and the finest honey. The one figured below was sent us by a friend in California, who assures us it is the veritable mountain sage, and produces the celebrated honey that has made California famous.

CALIFORNIA WHITE MOUNTAIN SAGE.

A peculiarity of this honey is, that it is not inclined to candy, but remains limpid, during the severest winter weather. I have taken a sample so thick that the tumbler containing it might be turned bottom upward without its running at all, and placed it out in the snow, in the dead of winter, and failed to crystallize it. This is a very valuable quality of it, but it is not invariably the case. I presume the honey should be fully ripened in the hive, to have it possess this property, as it is well known that perfectly ripened clover honey will often possess this same property here, while unripened honey, of any kind, is much disposed to candy at the approach of cool weather. I believe some effort has been made to cultivate this plant; perhaps a soil that raises pennyroyal naturally would suit it, as they are nearly allied, and I have been told that pennyroyal yields considerable quantities of honey on the waste lands of Kelley's Island, in Lake Erie.

It has been said, that one soon tires of this beautiful aromatic flavor of the mountain sage, and that, for a steady diet, the white-clover honey of the Western Reserve far outrivals it. This may be so; for, as a general thing, I believe people usually tire of these strong and distinct flavors in honey, like those of basswood and mountain sage. For all that, dear reader, if you have never tasted mountain-sage honey, and are a lover of honey, there is a rich treat in store for you when you do come across some.

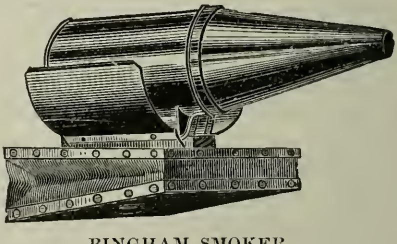
We have tried raising the plant on our honey-farm, but it seems to need a little coaxing in our climate, and I have not been able to discover that the blossoms furnish more honey here than many other plants. The secret of the immense yields from it in California is probably on account of the vast areas that it covers. The large cut on the preceding page shows another variety of the California sage.

SIZE OF FRAMES. See Hive-making, also Nucleus.

SMOKE AND SMOKERS. We can drive cattle and horses, and, to some extent, drive even pigs, with a whip; but one who undertakes to drive bees in any such way will find to his sorrow, that all the rest of the animal kingdom are mild in comparison, especially as far as stubbornness and fearlessness of consequences are concerned. You may kill them by thousands; you may even burn them up with fire, but the death agonies of their comrades seem only to provoke them to new fury, and they push on to the combat with a relentlessness which I can compare to nothing better than to a nest of yellow-jackets that have made up their minds to die, and to make all the mischief they possibly can before dying.[189] It is here that the power of smoke comes in; and to one who is not conversant with its use, it seems simply astonishing to see them turn about and retreat in the most perfect dismay and fright, from the effects of a puff or two of smoke, from a mere fragment of rotten wood. What would we bee-keepers do with bees at times, were no such potent power as smoke known?

There have been various devices for getting smoke on to the bees, such as, for instance, a common tin tube with a mouthpiece at one end, and a removable cap with a vent at the other end, for the issue of smoke. By blowing on the mouth-piece, smoke can be forced out. Others, again, have used a tin pan in which was some burning rotten wood. This is put on the windward side of the hive, so as to blow smoke over the frames. All of these, however, were miserable makeshifts in comparison with the smokers of to-day.

It is to the credit of Moses M. Quinby for first giving us a *bellows* bee-smoker. This was a great step in advance over the old methods of introduc'ng smoke among the bees. In principle his original smoker did not differ essentially from the Bingham or the L. C. Root, that were introduced later. It had, however, one serious defect; and that was, it would go out, the fire-pot not being properly ventilated to insure a good draft. Some years after, Mr. T. F. Bingham, of Abronia, Mich., and Mr. L. C. Root, son-in-law of Quinby, then of Mohawk, N. Y., but now of Stamford, Ct., introduced bee-smokers to the world on the principle of the original Quinby bellows smoker, but with several added improvements. The fire-cups, at the same time, were made rather larger, and were ventilated in such a way that a continuous draft could be maintained, even when the smoker was not in use, thus preventing them from going out like the old original Quinby. I do not hesitate to say that both smokers are excellent, and both have their peculiar merits. The Bingham is used very largely in the West, while the L. C. Root is used more generally in the East.

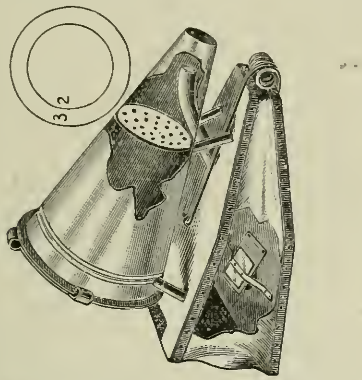


BINGHAM SMOKER.

Both smokers employ what is known as the hot-blast principle—that is, the blast of air from the bellows is blown *through* the fire. This makes a heavy volume of smoke—volume enough with the proper kind of fuel to subdue the worst kind of hybrids, and sometimes overcome the apiarist. The tendency of these hot-blast smokers is to burn out too rapidly, and occasionally to blow sparks among the bees.

COLD-BLAST SMOKERS.

Partly to remedy these defects and partly for one or two other reasons, smokers were constructed upon the "cold-blast" principle; that is, the air is conducted directly from the bellows by means of a tube to a



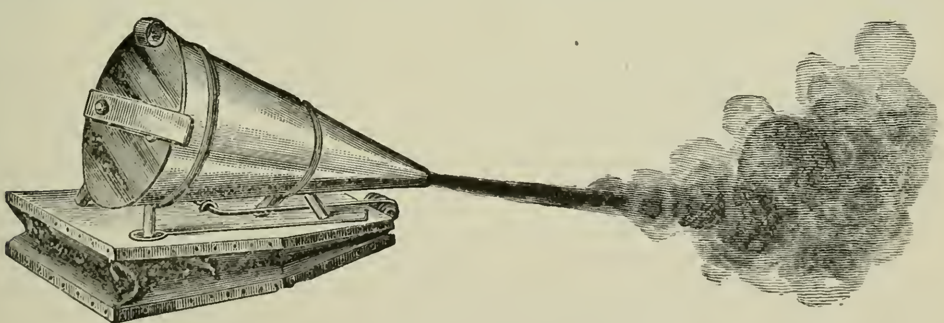
CLARK SMOKER, SHOWING INTERNAL CONSTRUCTION.

point inside the fire-box above the fire (not through it); making it possible to send *cold* air charged with smoke, upon the bees. This principle was invented almost simultaneously in 1879 by J. G. Corey, of Santa Paula, Cal., and Norman Clark, of Sterling, Ill., each without the knowledge of the other.

Of the two smokers the Clark had the better principle, and this, after many improvements suggested by careful apiarists, was finally perfected into the Clark of to-day. So popular is it that fifteen to twenty thousand are sold annually.

The action of the cold-blast principle will be made plain by the cut above. It represents a Clark smoker, with a portion of the bellows and fire-box torn away, to show its internal arrangement. The air passes from the bellows into the curved tube. Thence it is forced through the nozzle of the fire-box itself. The rush of air from the latter produces a partial vacuum, and consequently a suction at the opposite end. As the sliding-door by which the smoker is replenished does not fit air-tight, the air rushes in between the door and the end of the smoker. The smoke, thus forced, passes through the perforations in the circular grate, and thence out of the nozzle. The blast is cold air; and the smoke being brought up is mixed with the discharge of air from the curved tube. With the hot-blast principle already described, the blast must necessarily pass through the fire. Here it is not only unnecessarily heated, but it encounters so much obstruction through the burning fuel that its force is very materially weakened. The cold-blast smoker will therefore send a stream of cold smoke six or eight feet; whereas the hot-blast, with an equal effort of the bellows, will not send it more than two or three feet, and hot at that.

When it is necessary to fill the new Quinby smoker, or even the Bingham smoker, the top has to be removed; there is, consequently, considerable danger of burning the fingers, both in pulling off the top and in adjusting it on again properly. In the Clark smoker, as illustrated below, you observe that it is made so that it can be replenished from the end, or, in other words, it is a "breech-loading" smoker. You notice that the revolving door is riveted at one end, so that, when it is necessary to open the door for replenishing, you simply slide it around, and a light touch of the fingers revolves the door back again to its place. There is, therefore, not a particle of danger of burning the fingers in opening and closing the door.



CLARK'S COLD-BLAST SMOKER.

WHICH SMOKER IS THE BETTER—HOT OR COLD BLAST?

The answer to this question depends somewhat upon circumstances. For real solid subduing smoke, the hot-blast principle is better; but in most cases such quantities of smoke are unnecessary, especially with Italians, and exceedingly unpleasant to the bee-keeper. Many prefer the cold-blast principle because one filling will last longer, and at the same time give all the smoke that is required for ordinary operations, besides sending a stream of smoke to a greater distance. The Clark costs less than half the price of the others. There are a few cases, however, when I prefer the hot-blast principle; for instance, with cross hybrids, or with any bees, after a cold, wet, rainy morning, or when there has been a heavy honey-flow, and it has suddenly stopped; *then* we need to use quite a volume of smoke. But with the proper filling of the Clark, you will be able to make nearly as heavy a volume.

FUEL FOR SMOKERS.

It will be unnecessary to give directions how to use these hot or cold blast smokers, as printed directions accompany all smokers sent out by each manufacturer; but it may be well to allude to the different kinds of fuel that have been used. Rotten wood is good, and accessible to all, but it burns out too rapidly. In the Clark we prefer a kind of stringy sawdust packed solid that comes from the hand-holes made in making hives. Mr. Bingham recommends sound hard wood for his smoker. Dr. Miller and some others prefer turning-lathe hard-wood shavings, or, if these are not available, planer shavings. In certain localities peat can be obtained very cheaply, and it makes an excellent fuel. In some parts of the South, dry pine needles are used. Your locality as well as your own notions will decide what fuel you will use. You want something that will give good smoke, and at the same time be lasting.

HOW TO LIGHT A SMOKER.

To save time in lighting the smoker, our boys use an ordinary spring-top oiler. This is filled with kerosene. After putting the fuel into the smoker we send a few spurts of oil on the fuel, light it, and then we soon have a blazing fire. Dr. Miller uses a prepared rotten wood. This will light readily, and burns under circumstances when other material would go out. His manner of preparing it is as follows:

In a gallon of water he dissolves a pound of saltpeter. Into this he drops some dried rotten wood, and allows it to soak for a little while. It is then taken out, after which it is dried. This leaves the saltpeter in the fiber of the wood, which in consequence is made quite inflammable. The doctor then takes a piece of this prepared rotten wood, lights it, and drops it upon the grate in the smoker-barrel. When it is going well he covers it over with planer shavings, and packs them down quite tightly. Into the nozzle he stuffs a wad of green grass to prevent sparks. As the rotten wood will burn under unfavorable circumstances, there is little danger of the smoker going out by packing the shavings down tightly. The shavings are not as dense as the sawdust, hence the smoker will need replenishing about every hour.

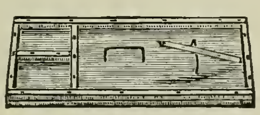
SOLDERING. About the year 1858—is it possible that it is really so long?—there appeared in the *Scientific American*, and several other papers, an advertisement, headed "Mend Your Own Tinware," and to the effect that the implements, with full printed instructions, would be sent by mail for 30 c.

The signature to the advertisement was Amos I. Root & Co., Medina, O. The Amos I. Root was myself; but the "Co." existed only in my fertile, but (I fear) unscrupulous brain. Many 30 "centses" were sent, and I drove quite a thriving business, for a boy of only 18. I believe the implements generally gave good satisfaction.

It was just about this time that the *American Agriculturist* began to do a thriving business exposing humbugs and swindles, and, the first I knew, they had my soldering-implements held up to view. My little soldering iron, or brass, rather, they laughed at, and, without even reading the printed directions, they pronounced the little metal case of chloride of zinc, with the few strips of solder, entirely worthless for mending tinware; and so I dropped that speculation, not, however, without something of a protest that I was right, and they wrong. Very soon after, they got up some soldering-implements of their own, which they sold for $1.00. They gave a full-sized soldering-copper, a box of rosin, and quite a bar of solder. As bee-keepers find a great many uses for tin and tinwork about the apiary, it has occurred to me that I might get up a little "kit of tools" that would help you a great deal, or, rather, might tell you how to get up your own. Well, here we are, ready to talk about soldering.

A 1-lb. soldering-copper will cost you about 35c., and a handle for the same, perhaps 10c. It may not be in order when received, and to put it in working trim will be your first job. File each of the four sides bright and smooth, and, either with file or hammer, make a nice sharp point to the tool. Soldering-irons, like lead-pencils and a great many other things, should be kept sharp, to do good work. Get a piece of brick, some solder, and some rosin. Heat your iron hot, but not red hot, and rub it in the rosin and brick-dust. This should be placed in a small cavity, in a piece of wood. If you rub the point of the iron hard against the wood, the brick will scour it bright, and the rosin will coat it so that no air can oxidize the copper. If you now melt a little from your bar of solder, in the cavity in the wood, it will readily unite with the copper and cover the surface as if it were dipped in quicksilver. When it is tinned all over, it is in working trim. Every time you forget and let the iron get red-hot, it will burn the solder off, and it must be tinned over again, in the same way.

If you wish to solder on bright tin, you have only to fasten the pieces securely where you want them, and then just solder it. If you look at a tinsmith you will think it is just as easy as can be, to make the bright melted tin run down the joint so smoothly that it looks like one continuous piece; but when your own inexperienced hands undertake the task—oh dear! oh dear! You are awkward, without doubt; but perhaps the greatest trouble is, that you have not all the necessary appliances at hand. To do a nice job, and do it conveniently, you will want a soldering-board, something like this:



SOLDERING-BOARD.

It should be about 12x18 inches, and the sides about an inch high. The two staples are for resting your iron, to prevent its burning the wood when not in use, and for holding the bars of solder, when the iron is touched to them. On the right hand, a bar of solder is shown, ready for use. You can never do any thing with your solder laid flat on a board. On the left are two little boxes; one is to hold a wet rag, on which the iron is to be wiped every time you take it from the fire, that we may have a bright clean surface. The other is to hold the powdered rosin; and if you wish to work with satisfaction, I would advise you not to get the rosin on your fingers or clothes. For a brush for applying the rosin, draw some candle-wicking into a tin tube. You can do a cleaner job by having the rosin mixed with oil, for all that is left after soldering may be wiped off with a soft cloth. Our girls use the rosin and oil for making the inside work to extractors. The ability to do smooth nice work, and do it rapidly, comes by practice.

Below I give you a cut of the soldering-iron, the bar of solder, the box of rosin, and the printed directions, such as are sent by mail for $1.00. Common solder is worth about 20c. per lb.; but for fine nice work, we use a larger proportion of tin. About equal parts of lead and tin is the general rule.

SOLDERING-IRON AND IMPLEMENTS.

You will probably get along very well with bright new tin; but when you come to try repairing, or mending old breaks where the metals are old and rusty, much more skill will be required to make a strong job. You will also find that something more than rosin is needed for iron, brass, and copper, and for rusty tinware. This was where my soldering implements came in, years ago. I got hold of the idea in this way: One dull day in the winter, a stranger called, asking if we had any tinware we would like repaired, *free of charge.* You may be sure that he and I were friends at once, and we gathered up the tin pans, and set him at work. He took a pretty little camphene-lamp out of his pocket, then a bottle of some liquid, next an old file, and some little lumps of solder. A pan had a hole in the bottom; he scraped around the hole with his file, then punched the hole a little larger, so as to raise a slight burr, held the place over the lamp, wet the metal with the liquid, and dropped on a bit of solder, which melted and filled up the hole in a twinkling; then another, and another, until all were done.

"How much for your work?"

"Nothing."

"Nothing? But what *do* you want us to do?"

"Buy that little bottle of soldering-fluid."

"For how much?"

"Twenty-five cents."

I put down the money very quickly, and he prepared to go. But I was full of questions about the contents of that bottle. I was chemist enough, and Yankee enough, to make him own up, before he got out of the gate, that it was nothing but sal-ammoniac and chloride of zinc, in solution. In return, he made me promise not to sell any of it inside of our county, under one year. The next week found me in a neighboring county mending tinware, *gratis*; and before Saturday night, I was back with between $10 and $12 clear profit, which was quite a speculation in those days. To make this wonderful soldering - fluid which will cause the solder to flow on copper, zinc, iron, or brass, you are to get ½ of a lb. of muriatic acid, of a druggist, set it in a glass jar or tumbler, out of doors, and slowly drop in pieces of zinc, until it will "eat" no more. Dissolve 2 oz. of sal - ammoniac in a glass of water, and add this to the acid and zinc. Strain the liquid into a glass bottle, and keep it out of the way of the children. When you mend the tinware for "nothing," a half-oz. bottle of it is sold for 25c. Keep it off your clothes, and especially off your tools, for it rusts every thing badly. When you solder any thing with it, carefully wash the article in clean water, or rub it off well with a wet cloth. If iron or steel, finish off with some oil on a cloth. If you are careless with such things, you would better let it alone entirely. Always use rosin when you can make it work, as the fluid destroys the tinning on the soldering-iron very rapidly.

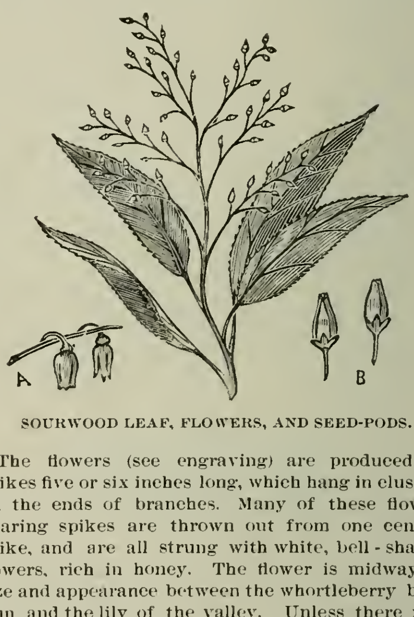
SOURWOOD (*Oxydendrum Arboreum.*)

This is considered a great honey - bearing tree in some localities, especially in the South; but as I have had no personal experience with it, I submit a description from one of our friends who has furnished us with the specimen of the leaves and flowers, from which our engraving was made.

The sourwood, sometimes called the sorrel, is a fine tree from 40 to 60 feet in height, and about a foot in diameter; although it sometimes reaches 70 feet in height and a foot and a half through. The popular name, sourwood, is derived from the odor and the peculiar sour taste of the leaves and small twigs.

It is entirely distinct from the black-gum and sour-gum, or pepperidge, with which it has been unwittingly classed by some writers on honey - plants, much to the injury of Sourwood. The former are honey - producers to a small extent, but are not worthy to be compared with sourwood, which, we are convinced after living where basswood, poplar, clover, buckwheat, goldenrod, persimmon, and aster abound, has not its superior among the honey-producing plants of America, either in the amount of yield, or in its beautiful appearance. Basswood is more important, only because of its widely extended growth. We write this article, to call attention more directly to this tree as a honey-producer. Bee-masters are familiar with other flora which abound where those who have written our books on bee culture reside, yet few are aware of the merits of sourwood, outside of the regions where it is found.

We are not familiar with the extent of its growth, but know this much: It abounds in the native forests from Southern Pennsylvania into Georgia and Mississippi. It seems to be more abundant along the whole mountainous tract of country on both sides of the Alleghanies and the Blue Ridge, reaching, in places, even as far as the tide-water on one side, and to Central Tennessee on the other. In many sections where poplar abounds and much buckwheat is raised, sourwood is considered *the honey-plant*, and yields the largest amount of surplus honey. It seems to flourish best on high, dry soil, and often abounds on poor woodland ridges, which can be purchased at a nominal price; though the forests along the rivers, in rich cultivated soil, are often beautifully checkered with the white blossoms in July. Being a tree, the growth is tall and generally spare of branches along the trunk, except when it grows in the edges of fields, where it yields the greatest amount of honey. The trunk preserves its uniformity of size for some distance up from the ground. The wood is white, with straight grain, which splits nicely. It is brittle and quite fine grained, and is used for posts by cabinet-makers.



SOURWOOD LEAF, FLOWERS, AND SEED-PODS.

The flowers (see engraving) are produced on spikes five or six inches long, which hang in clusters on the ends of branches. Many of these flower-bearing spikes are thrown out from one central spike, and are all strung with white, bell - shaped flowers, rich in honey. The flower is midway in size and appearance between the whortleberry blossom and the lily of the valley. Unless there is a failure of the blossom, the honey-yield is sure to be abundant; for, being in the woods with good roots, the flow is not checked by ordinary droughts, nor do the rains wash out the honey from the pendant, cup-shaped flowers. Often have we regaled ourselves, while riding along the road, by breaking a bunch of the blossoms, shaking out the honey in the hand, and licking up the delicious nectar. It bears no fruit; but each flower, as it dries up, produces a brown seed-pod about the size of a large grain of wheat, which separates, when ripe, into five parts, and permits the very fine seed to fall to the earth.

We omitted to state that the tree commences to bloom the latter part of June, and the harvest from this source lasts until the middle of July.

We are inclined to think that the tree would thrive in our more northern latitudes; perhaps anywhere in our land. It is found abundantly in many parts of the Alleghany Mountains, where it is very cold, the thermometer often indicating several degrees below zero. JAMES W. SHEARER.

Liberty Corner, N. J., July 4, 1878.

The following is from Feb. No. of GLEANINGS for 1880:

SOURWOOD HONEY, ETC.

I send you to-day a sample of sourwood honey. Examine it and let us know what you think of its quality. I get more of it than of any other kind. I took about 800 lbs. last year from the poplar, and something more than 1200 from the sourwood, all extracted.

Now, Mr. Novice, nearly all of you bee-men up North say that all pure honey will candy in cold weather; and I want you to keep the sample I send you through the winter, and report if cold weather candies it. I know you have colder weather than we have down here, but I don't believe it will get cold enough to candy sourwood honey.

J. F. MONTGOMERY.

Lincoln, Tenn., Jan. 5, 1880.

Thanks. You will see under EXTRACTED HONEY and SAGE that I do not claim that *all* pure honey will candy. If sourwood honey never candies, it will be a great point in its favor, and I would pay a good price for a barrel of it now, just on account of this one peculiarity. The sample is at hand, and, although it is not as light as our clover and basswood, the color is fair, and the flavor is beautiful. Its aroma is delightful, and has a suggestion of timber and forest-trees.

SPACING FRAMES. In nature we find combs spaced all the way from 1⅜, 1½, 1⅝, and sometimes up to two inches apart, from center to center. Dzierzon, the first one to conceive the idea of a movable comb, gave 1½ as the right distance until Wyprecht made accurate measurements on straw hives having straight combs built in them. Out of 49 measurements, the average distance was scant 1⅜ inches Baron von Berlepsch, in 49 other measurements, verified this result. In the United States, prominent apiarists have found the distance of natural-built combs averaged 1⅜ inches from center to center It has been observed, that, in the center of the brood-nest, the combs are spaced more closely than those on the outside, the latter ranging anywhere from 1⅝ to 2 inches apart.

It has been urged that we follow nature in the spacing of our brood-frames. But it seems to me that nature is a very poor guide, inasmuch as we find such a diversity of measurements. The bee-keeper should adopt that spacing which will give him the best results—the most brood and the most honey in the surplus arrangements Quite a number of bee-keepers are using 1½ spacing for their frames The reason for this is, principally, because they happened to *start* with this spacing. But those who have given special attention to the matter, trying *both* spacings, agree almost uniformly that the right distance is 1⅜, or, if any thing, a trifle scant. Many, indeed, who had fixed-distance frames adapted for 1½ inches, have gone to the enormous expense of changing over to 1⅜. The advantages of this latter spacing are so evident that very few deny that better results may be obtained with it. Brood comb is found to be, on an average, ⅞ inch thick; capped brood, one inch thick. On 1⅜ spacing, this will allow ½ inch between uncapped comb and ⅜ between the capped comb.

The following paragraph I take from an article published in *Gleanings in Bee Culture*, page 673, Vol. XVIII., written by Mr. Julius Hoffman. It applies right here exactly:

If we, for instance, space the combs from center to center so as to measure 1½ instead of 1⅜ inches, then we have an empty space of ⅝ inch between two combs of brood instead of ½, as it ought to be; and it will certainly require more bees to fill and keep warm a ⅝ than a ½ space. In a ½-inch space, the breeding bees from two combs facing each other will join with their backs, and so close up the space between the two brood-combs; if this space is widened, however, to ⅝, the bees can not do this, and more bees will be required to keep up the needed brooding temperature. What a drawback this would be in cool spring weather, when our colonies are weak in numbers yet, and breeding most desirable, can readily be understood.

Where wider spacing is adopted, there is apt to be more honey stored in the combs, and less of worker brood, but more drone brood Close spacing, on the contrary (1⅜), tends to encourage the rearing of more worker brood, the exclusion of drone brood, and the storage of less honey below. This is exactly as we would have it. I said, there is ½ inch between the uncapped brood. The bees need a little more room in backing in and out of the cells for the purpose of feeding the larvæ than they do after these cells are capped over into sealed brood. Sealed brood, requiring less attention from the bees, and less heat from the cluster, is spaced ⅜ apart, and this is ample For further hints on this subject, see FIXED FRAMES, also HIVE-MAKING.

SPANISH NEEDLE. This plant yields immense quantities of honey along the low bottom grounds of the Mississippi and Illinois Rivers. The following from GLEANINGS, p. 162, Vol. XVI, is from the Hon. J. M. Hambaugh, and tells all about the plant, and the immense quantities of honey that are often produced by it.

Something over a year ago I wrote a letter for

GLEANINGS, claiming that the honey gathered from this plant is superior to that produced from other fall flowers, and that it should rank among the very best grades, and command the same price in the markets as clover and linden honey. My peculiar location has, fortunately, placed me in a position to pretty thoroughly understand the nature of this plant, and the quality of the honey it produces. Located at the foot of the bluffs of the Illinois River, there is a broad expanse of low marshy lands to the east and south, from three to five miles in width. These lands are subject to overflows from the river once a year, which usually take place in early spring. This renders a large portion of the soil unfit for tilling purposes; and the consequence is, the Spanish needle has secured a permanent foothold, almost to the exclusion of all other plants; and early in September they begin to open their beautiful petals, and in a short time whole districts are aglow, and their dazzling brilliancy reminds one of burnished sheets of gold. It is now, should the weather prove favorable, that the bees revel in their glory, and the honey comes *piling in;* and the beauty about this kind of honey is, it needs but little "boiling down," and the bees no sooner fill their cells than they are cured and ready to seal. This is one great advantage, and saves the bees lots of labor, and makes the storage of honey more rapid. I had one colony of bees that stored 63½ lbs. of honey in six days; another one, 86 lbs. in nine days, and 43 producing colonies netted me 2021 lbs. in ten days—an average of 47 lbs. to the colony. This honey, though not quite as clear as clover or linden, is of a golden hue, exquisite flavor, and very fine body, weighing fully 12 lbs. to the gallon, and, as previously stated, I can not see why it should not rank in grade and price on the market with clover and linden honey.

So far as my market is concerned, there is no honey so universally liked by the consumers as my "golden coreopsis;" in fact, not one word of complaint has ever come back to me from this honey. save one. A neighbor ceased buying it; and when questioned as to why, he stated, "My children eat it up too fast." I am now running a peddling-wagon, and my salesman states he can sell more honey going over territory he has previously canvassed than to hunt up new routes. This certainly speaks well for this kind of honey. I have sold over 4000 lbs. in my home market this season, and the demand seems to be on the increase; and I believe if apiarists will locate their bees so as to get the benefit of these large areas of coreopsis they will not only be conferring a boon on their fellow-man, but will reap a financial reward for themselves. Another word in favor of the coreopsis honey: It is less inclined to granulate; and at this date there is but little sign of granulation, while my two barrels of linden honey is as hard as New Orleans sugar.

J. M. HAMBAUGH.

Spring, Brown Co., Ill., Jan. 21, 1889.

In 1891 Mr. Hambaugh wrote another article on the subject, from which we make the following extract:

The "golden coreopsis," or Spanish needle, stands at the head of all the honey-producing plants with which I have had any experience. It is not only the richest in nectar, but the quality is *par excellence*, and sells in my home market equal to, if not better, than clover honey. Its weight is fully 12 lbs. to the gallon, and it seems to need little if any curing by the bees when gathered. I have never yet seen any crude or unripe Spanish-needle honey, notwithstanding I have extracted it from the same supers three times in two weeks, and on one occasion twice in five and six days. One colony netted 73 lbs. in 5 days, and the apiary of 43 producing colonies, in 8 days, produced 2033 lbs., being upward of 47 lbs. per colony; and this is not true of that particular year only, but it has proven the surest honey-producing plant we have in this locality. Nothing short of cold rainy weather will spoil the harvest from this plant.

SPIDER-FLOWER (*Cleome Pungens*). This has but recently been brought into notice as a honey-plant. It belongs to the same family as the ROCKY-MOUNTAIN BEE-PLANT, which it much resembles.

Early in 1878, Mollie O. Large, of Pine-Hill Apiary, Millersville, Ill., sent me some seeds, which I had started in a flower-pot, in the house, but transplanted them to the garden some time in May. Aug. 16th they were in full bloom, and the bees were at work upon them; but, strange to say, the blossoms opened only at about sunset; accordingly, after the time when the bees have usually stopped flying, they were seen eagerly hovering over this strange but beautiful plant.

The petals, which are of a lovely deep pink, are all on one side of the blossom; and on the other side we see what resembles the long, sprawling legs of the spider. The foliage is also quite ornamental, and we have decided to have a bed of it on our honey-farm.

In September of the same year. Mrs. Large wrote as follows:

Our experience with the spider-plant, this season, is this: It commenced to bloom about the 25th of June, and the bees have worked on it every fit day since. They commence about 5 o'clock P. M., and work until dark. I used to think bees went home with the sun, but I have heard them on this plant when too dark to see them at any distance, and found them again in the morning as soon as it was light, and for a while after sunrise. If you tie a piece of mosquito-bar over a bunch of the flowers, in the afternoon, and examine it about sundown, you can see the honey for yourself. We have about $\frac{1}{16}$ of an acre this year, but expect, next season, to plant several acres, as we consider it ahead of any thing that we have tried for honey.

MOLLIE O. LARGE.

Pine-Hill Apiary, Millersville, Ill., Sept. 11, 1878.

Acting upon her suggestion, we tied a piece of lace over one of the blossoms on our plants, to keep the bees from it, and the drop of honey that collected was so large that I had a fair taste of it. It was very white and limpid, but had a slightly raw, unripened taste, which I presume the bees would know how to remedy.

LATER.

To-day is the 11th of October, 1879. This morning I got up before 6 o'clock. I had been reading, the night before, in Muller's book, "The Life of Trust," and I was particularly impressed with what he says about early rising, and the blessings God sends to those who make it a point to rise early and give their best and freshest thoughts to him. I put the book away, and went right to bed, that I might get up early. The gray of ap-

SPIDER - PLANT.*

proaching daylight heralding in this warm autumn day met my gaze as I sallied forth toward the factory. I opened my mouth and took in the fresh pure air, and, as I opened my eyes to the beauty of the world we dwell in, I opened my heart in thankfulness to Him who gave it all. As I came near the garden, I was surprised to hear a loud humming so early. It was not robbing, but it was a hum of rejoicing. How strange it is, that bees will make this happy hum over the honey from the flowers, but never over syrup from any kind of a feeder. The sound led me to the spider-plant. It had been bearing honey a couple of months, at night and early in the morning, but I had no idea that they ever made so much noise over it as now. I approached leisurely, but was startled to find that each floweret contained a large drop of some liquid, so large, in fact, I thought it must be dew, and not honey. I touched my tongue, and, behold, it was fair honey, of a beautiful limpidity and taste, and then I understood the humming. As a bee alighted, and made his way down between the stamens, I watched until he spread out that delicate, pencil-like tongue, and began to draw in the nectar. Surely no bee can take in so large a drop; and so it proved. He lapped as long as he could and then rested awhile; again he sipped the "sparkling ambrosia," and again he stopped. I could imagine him soliloquizing as he dipped into it a third time.

"Did anybody ever before hear of a single floweret containing more than a bee could carry?"

He finally spread his wings, and essayed to fly; but his greed had been too great; and when he bumped against a Simpson-plant, which is now out of bloom, down he went on his back in the dirt. Others did the same way, but soon they tried again, and I presume created a commotion in the hive, by coming in, podded out with such loads.

This plant is strikingly like the Rocky-Mountain bee-plant, of which I have given you a picture already, but it is so much larger, and bears so much more honey, that I can hardly think it worth while to raise the latter for honey. Our engraver has given you a picture of the blossom and leaf.

The picture scarcely needs explanation. On one side is the beautiful leaf of the plant; on the other, one of the flower-stalks, of which there are from 12 to 20 to each plant. As the flowerets, shown in the center, keep blossoming each evening, the stem grows out in the center, until it becomes, finally, two feet long or more, and lined with seed-pods its whole length. These seed-pods, when ripe, break open, and the seed must be gathered daily, or it is lost. Each floweret opens twice, but the honey is yielded only from the first blooming. In the center of the picture, a single floweret is shown, with its load of honey sparkling in the rays of the rising sun. The sight of a whole plant bending beneath a sparkling load of nectar like this is enough to set any bee-keeper crazy, let alone your enthusiastic old friend Novice. Our plants are on ground made by piling up the sods taken from where the factory stands; this may, in part, account for the great yield of honey.

*The picture above was reproduced from W. Atlee Burpee's catalogue.

MORE ABOUT THAT WONDERFUL SPIDER-PLANT.

Oct. 14th.—Yesterday morning Mr. Gray came down before sunrise, to verify my observation and see that there was no mistake about that large drop of honey, the product of a single night. There is no mistake. Not only does a single floweret produce a large drop, but some of them produce a great many drops. Last evening we made observations by lamplight; and, before nine o'clock, the globules of honey were of the size of large shot. The crowning experiment of all took place this morning. I was up a little after 5 o'clock, and, with the aid of a teaspoon, I dipped honey enough from 3 or 4 plants to fill a 2-dram vial, such as we

ENLARGED VIEW OF SPIDER PLANT.

used in the queen-cages, a little more than half full. The honey in some of the flowerets had collected in a quantity so large that it spilled out and actually streamed on the ground. I have called this honey, but it is, in reality, the raw nectar, such as is found in clover and other flowers. The taste is a pure sweet, slightly dashed with a most beautiful, delicate flavor, resembling somewhat that of the best new maple molasses. The honey will be as white as the whitest linden, so far as I can judge. With the aid of a lamp I evaporated the nectar down to thick honey. You can see something of what the bees have to do, when I tell you that I had in bulk only about a fifth as much as when I commenced. You can also see that we now have some accurate figures with which to estimate the amount of honey which may be obtained from an acre of honey-plants.

HOW MUCH HONEY WILL AN ACRE OF PLANTS YIELD?

I think I visited with my spoon, four plants. Perhaps half of the nectar was wasted, either by overflowing before I got there, or in my attempts to spoon it out. This will give a half-dram of nectar to each plant, each morning. We shall set the plants 3 feet apart each way. At this rate, we have nearly 5000 plants to the acre, and they would yield every morning, perhaps 5 gallons of nectar, or one gallon of ripe honey. The plant has been in bloom in our garden for the astonishing length of time of about 3 months; this would give, counting out bad weather, perhaps 60 gallons of honey, worth—say $60.00. I have known a single colony of bees to gather a gallon of raw honey in a day, from the clover; but as the bees seldom work on the spider-plant after 9 or 10 o'clock in the morning, an acre might require 5 or 10 colonies, to go all over it every morning. How many acres of our best honey-plants will be required, to keep 100 colonies out of mischief? As the Simpson honey-plant yields honey all day long, the two would go very well together; and I am inclined to think 5 acres of each (*good* soil, *well* cultivated) would keep 100 colonies of bees busy, and out of mischief at least, during the whole of the fall months when bees have nothing to do.

After a more extended and thorough trial I will further state that the spider-plant does not yield honey profusely unless it has a deep rich soil. On our creek bottom the stalks made a tremendous growth, and the blossoms were full of nectar; but another plantation, on higher ground, yielded, comparatively, but little honey; and during a dry spell, scarcely any nectar would be found in the blossoms. The Simpson honey-plant has turned out in much the same way.

STINGS. It is true, that bees can not bite and kick like horses, nor can they hook like cattle; but most people, after having had an experience with bee-stings for the first time, are inclined to think they would rather be bitten, kicked, and hooked, all together, than risk a repetition of that keen and exquisite anguish which one feels as he receives the full contents of the poison-bag, from a vigorous hybrid, during the height of the honey-season. Stings are not all alike, by any means; and while I can stand the greater part of them without even wincing, or stopping my work, I *occasionally* get one that seems as if it could not possibly be borne. As I always find myself obliged to bear it, however, I try to do so as best I can.

I have often noticed that the pain is much harder to bear, if I stop and allow my mind to dwell on it; or after being stung, if I just think of former times when I have received painful stings, at the mere thought a sudden pang darts along the wounded part. I do not know why this is, unless it is the effect of the imagination; if so, then it is clear to my mind that even imaginary pains are very hard to bear. I have sometimes purposely, by way of experiment, allowed my mind to dwell on the pain of the sting the moment it was inflicted, and the increase would be such that it would almost make me scream with pain. If you doubt this, the next time your feet get very cold, just think of wading barefooted in the frozen snow, at a zero temperature. Perhaps my imagination is unusually active, for it sometimes makes the pain, when riding in the cold, almost unbearable, while I get along very well if thinking of something else. Well, if others have had a similar experience, and I presume you all have, you can see why I have so often given as a remedy for stings, simply keeping on with your work, and paying no attention to the stings whatever.

Of course, where stings swell on one so badly as to shut an eye, or the like of that, I presume you might be obliged to stop work awhile; but even then, I would advise paying as little attention to the matter as it is possible to do, and by all means to avoid rubbing or irritating the affected part. I have known stings to be made very painful by rubbing and fussing with them, which I have good reason to think would have given little if any trouble otherwise. You all know that when you get warmed up with hard work, a bruise, a bump, or a slight flesh wound, gives little if any pain; but to sit down calmly and cut into one's flesh gives the most excruciating pain. When a lad, I have repeatedly cut great gashes in my fingers with my jack-knife, and felt but little pain at the time; but when it became necessary to lance the flesh to get a sliver out of the foot, or to cut open a stone-bruise, the pain was the most intense I can imagine. To pare away with the razor until you get through the skin, and see the blood start—why, it makes my flesh creep to think of it now; but the clips that came unawares with the dull jack-knife were scarcely heeded at all, more than to tie up the wound to keep the blood from soiling my work.

Well, the point is, we are to take stings just as we used to take the cuts with those jack-knives, in our boyhood days. Of course, we are not to rush needlessly into danger; but when it comes, take it philosophically. I would pull the sting out as quickly as possible, and I would take it out in such a way as to avoid, as much as possible, squeezing the contents of the poison-bag into the wound. If you pick the sting out with the thumb and finger in the way that comes natural, you will probably get a fresh dose of poison in the act, and this will sometimes prove the most painful of the whole operation, and cause the sting to swell when it otherwise would not have done so.

I have sometimes thought it might be nearly as well to leave the sting in the wound. I have frequently found them when washing, and the presence of the sting was the first indication I had that I had been stung; but I presume I knew at the time that a sting had been inflicted.

THE PROPER WAY TO REMOVE A BEE-STING.

The blade of a knife, if one is handy, may be slid under the poison-bag, and the sting lifted out, without pressing a particle more of the poison into the wound. When a knife-blade is not handy, I would push the sting out with the thumb or finger nail in much the same way. It is quite desirable that the sting should be taken out as quickly as possible, for if the barbs (to be described further along) once get a hold in the flesh, the muscular contractions will rapidly work the sting deeper and deeper. Sometimes the sting separates, and a part of it (one of the splinters, so to speak) is left in the wound; it has been suggested that we should be very careful to remove every one of these tiny points; but after trying many times to see what the effect would be, I have concluded that they do but little harm, and that the main thing is, to remove the part containing the poison-bag, before it has emptied itself completely into the wound. When I am very busy, or have something in my other hand making it inconvenient to remove the sting with my knife or finger-nail, I have been in the habit of rubbing the sting out against my clothing, in such a way as to push the poison-bag off sidewise; and although this plan often breaks off the sting so as to leave splinters in the wound, I have found little if any more trouble from them than usual.[91]

REMEDIES FOR BEE-STINGS.

For years past I have taken the ground that remedies of all kinds are of so little avail, if of any avail at all, that the best way is to pay no attention to any of them. This has awakened a great deal of arguing, I know, and the remedies that have been sent me, which the writers knew were good, because they had tried them, have been enough to fill pages of this book. I have tried a great many of them, and, for a time, have imagined they "did good;" but after giving them a more extended trial, I have been forced to conclude that they were of no avail. Nay, further: they not only did no good, but if the directions with the remedy were to rub it in the wound, they did a positive harm; for the friction diffused the poison more rapidly into circulation, and made a painful swelling of what would have been very trifling, if let alone. Please bear in mind that the poison is introduced into the flesh through a puncture so minute that the finest cambric needle could by no manner of means enter where the sting did, and that the flesh closes over so completely after it, that it is practically impossible for the remedy to penetrate this opening; now, even if you have a remedy that will neutralize the poison, in something the same way that an alkali neutralizes any other acid, how are you to get it in contact with the poison? I know of no way of doing it, unless we resort to a surgical operation; and if you will try that kind of "tinkering" with one bee-sting, you will probably never want to try another. I tell you, there is no remedy in the world like letting it alone, and going on with your work without even thinking about it. But, suppose we get a sting under the eye, that closes up that very important organ; shall we go on with our work still? Well, I believe I would go on with my work still, and do the best I could do with one eye. If both were closed at once, I do not know but I would wait awhile until they should get open again. I would not resort to medicine and "tinkering," even then, but would let the eyes alone, until they came open of themselves.

If the wound is feverish, or if a person has received a great number of stings at one time, an application of cold water, or cloths wet in cold water, may prove a relief; but even in using this simple means, I would lay the cloth on very quietly, and carefully avoid rubbing or irritation. I have often dipped my hand in cold water after having a painful sting; but as my hand ached just as bad under the water (it really ached worse, because I had nothing else to do but to stand there and think about it), I soon dropped that remedy also. A year or two ago, kerosene oil was suggested as a remedy, and two of our friends regarded it of such importance that they almost got into a controversy about which was entitled to the honor of the discovery. Well, I had a very bad sting on my hand, and I went for the oil-can, and dropped oil on the spot for some time; as kerosene will remove a rusty bolt or screw when nothing else will avail, and as it seems to have a wonderful power of penetrating all cracks and crevices, I began to have faith that it might follow the sting of the bee, and in some way neutralize the poison I had the satisfaction of having one of the most painful and lasting stings I ever got; and, together with the offensive smell of the oil, it quite sickened me of that, as a remedy. I presume the oil made it no worse, but it really seemed to me that it must have done so.

In discussing this matter of bee-sting remedies, we should remember that the pain of a sting very often ceases suddenly, with no application whatever; those who have been stung a great deal will all tell you that this is the case. Well, the beginner who carries his saleratus-water or hartshorn, and always makes an application of some kind, will tell you, and truthfully too, that the pain stopped the very moment the remedy was applied. Again, some stings swell very badly, while others do not swell at all. Well, if an application is made, and no swelling results, he will remember how former stings had swelled, and at once ascribe the difference to the remedy applied. You will see from this, that it is only by repeated trials, extending through a considerable period of time, that we can arrive at the truth. There is one rule that will apply to this, and to a great many other similar matters. If a thing is really good, it will come into general use, and stay there, not only for a few weeks and months, or for a single season, but will be in demand year after year. If I am correct, not one of the bee-sting remedies has stood this test. Sooner or later they have all been dropped, and old bee-keepers get along in the way I have advised—picking the sting out, if they are not in too much of a hurry, and thinking no more about it.

WHAT TO DO WHEN STUNG A GREAT NUMBER OF TIMES, ALL AT ONCE.

There is very seldom any need of such a catastrophe; but as such an event may come about, it may be well to consider the matter. In hiving hybrids, under certain conditions, I have known them to attack the operator in a mass, and sting him most unmercifully. A neighbor of ours was stung in this way until he fainted, and had to be carried into the house. In such cases, I would resort to the usual means to restore the person from the fainting-fit, and then extract the stings as speedily as possible, and treat with wet cloths. It is true, that death may result from the stings of bees, and, if report is correct, a single sting has been known to result in death, in very rare instances. Shall we stop keeping bees on this account? People are killed by horses almost every day, and such cases are comparatively frequent: but did any one ever advocate giving up the use of horses on that account? Cases that have resulted fatally, or in laying a person up for a time, or have produced fainting, are usually where the person is stung for the first time; after the system gets inured to the poison, its effects are comparatively harmless.

GETTING HARDENED TO THE EFFECTS OF STINGS.

When I first commenced bee-keeping, stings swelled so badly, and were so painful, that I had either my hands or eyes swelled up most of the time, and I seriously contemplated giving up the business, just on this account alone. After I had had a little more practice, I discovered that there was very little need of being stung at all, if one was careful not to provoke the ire of the little insects. Still further, I found the swelling to be gradually less and less; and before my first summer was over, I very seldom felt the effects of any sting, the day afterward. When first commencing, if my eye was swelled so as to be closed by a sting, it often took until the third day, to have it go down entirely. The A B C class, almost without exception, corroborate this experience.

HOW TO AVOID BEING STUNG.

Some may imagine, from the foregoing, that it is necessary for one who keeps bees to submit to the pain of being stung several times, every day. A short time ago a lady said that she could never stand it to have her husband keep 100 swarms, for she got stung four or five times a day with only a dozen, and 30 or 40 stings a day would be more than she could possibly bear. Now, my friends, I think I can take any one of you into an apiary of 100 colonies, and have you assist me all day long, without your getting a single sting. Nay, further: if you are very timid, and cannot bear a single sting, by taking some pains you may be able to work day after day, without being stung. The apiary must be properly cared for, and no robbing allowed, and you must do exactly as I tell you. See ANGER OF BEES. It may be a hard matter to tell you in a book how to behave without being stung, but I will try. In the first place, avoid standing right in front of any hive. I am often very much tried with visitors (some of them bee-keepers, too, who ought to know better), because they will stand right before the entrance until they have a small swarm scolding around them because they cannot get out and in, and then wonder why so many bees are buzzing about in that particular spot.[193] If you should go into a factory, and stand in the way of the workmen until a dozen of them were blocked up with their arms full of boards and finished work, you would be pretty apt to be told to get out of the way. Now, you are to exercise the same common sense in an apiary. By watching them you can tell at once their path through the air, and you are to keep out of their way. Right back of any hive is a pretty safe place to stand.

One of the first things to learn is to know whether a bee is angry or not, by the noise he makes. It seems to me you should all know by the hum of a bee, when it is gathering honey from the heads of clover in the fields, that it has no malice toward any living thing; it is the happy hum of honest industry and contentment. People sometimes jump when a bee hums thus harmlessly along, and it seems to me they should know better, but I presume it is because bees are not in their line of business, and they don't know "bee talk."

Well, when you go in front of a hive, or even approach hives that are not accustomed to being worked with, one of the sentinels will frequently take wing, and, by an angry and loud buzz, bid you begone.[194] This note is quite unlike that of a bee upon the flowers, or of the ordinary laborer upon the wing; it is in a high key, and the tone, to me, sounds much like that of a scolding woman, and one who will be pretty sure to make her threats good, if you do not heed the warning. When one of these bees approaches, you are first to lower your head, or, better still, tip down your hat-brim; for these fellows almost always instinctively aim for the eyes. He will often be satisfied, and go back into his hive if you move away a little; but you do not want to give him to understand that you admit yourself a thief, and that he has frightened you. If he gets very threatening, and you are timid, you would better go into some building. I am in the habit of opening the door of the honey-house, and asking visitors to go in there, when an angry bee persists in following them. Very many times I can hardly get them to go in as I direct, because they can not see why the bee will not follow them, and thus have them cornered up and a sure prey. I do not know why it is, but a bee very seldom ventures to follow one indoors. A single bee never does, if I am correct; but a very vicious colony of hybrids, when fully aroused, may do so.[195]

WHAT TO DO WHEN A SINGLE BEE FOLLOWS YOU ABOUT BY THE HOUR.

It not unfrequently happens, especially in an apiary where there are hybrids, that a good-for-nothing rascally bee (of this race) will follow you about the apiary for hours, poising himself just before your eyes, making believe to sting. It does not pay to be humane with such fellows. While your offender is holding himself aloft before your face in a menacing manner, smash him between your hands, or, with a stick, give him a smart rap; but take care that you don't miss him, or he will stop his dallying and deliver his sting.[196]

HOW TO SAVE YOURSELF FROM A STING.

Sometimes a bee will be in the act of inserting his sting in your hand. If the other hand is not holding a frame, or is not otherwise engaged, bring it to the rescue by smashing the bee before he succeeds. If, as is sometimes the case, the other hand is holding a frame, slap the hand which is being attacked, against your person. If you do it right you can both smash the bee and also rub out the sting, if its owner has succeeded in plunging it into the flesh. Never slap the hand directly against yourself, but give it a sort of sliding motion. You will thus accomplish the double purpose. If a bee strikes you in the back of the neck (and you have no veil on), lodging in your hair, smash him by that half-slap and half-rubbing motion. I recommend killing bees as above, when they have actually begun to insert their sting, because they are then, so far as I am able to observe, determined to accomplish their purpose or die. If it is in my power, I usually prefer to have them do the latter; for if a bee is foiled after he has got so far, he will carry out the principle most persistently of the little adage, "If at first you don't succeed," etc. See ANGER OF BEES.

Where there has been no robbing going on, one has usually warning enough, and in ample time, to take precautions. Where the bees are quietly at work, that is, during the working season, there is but little danger from bees in the air. When you are working with a hive, bending right over the uncovered frames, you are comparatively secure from the bees of other hives; for when there is no robbing, bees seem to have no disposition to meddle or hang around their neighbors' homes. This is one reason why bystanders, or those who are off at a little distance, are so much more apt to be stung than the apiarist who is right among them.

JERKING THE HANDS BACK.

A good many times, especially if the bees are inclined to be a little cross, three or four, as you proceed to lift the frame, will strike against the hands as if about to sting. The natural tendency, of course, is to jerk the hand back. This is the worst thing that you can do. You will be almost sure to be stung then, while, if you hold your hands motionless, and let the bees see that the new objects are not afraid of them, they will rarely if ever go beyond a pretense of using their weapon. I am sure that a large number of stings received by beginners on the hands are attributable to this jerking-back of the hands. The same is true with reference to the face, if not protected by a veil. Nine-tenths of the bees which make such demonstration will not sting, if you can control your nerves, letting your tormentors know that you are not to be frightened.

HOW TO OPEN A HIVE, WITHOUT BEING STUNG.

Have your smoker lighted, and in good trim, and then set it down near the hive you are going to work with. Now, I would never use smoke with any hive of bees, unless they need it to subdue them; for why should we disturb and annoy the little fellows while quietly going about their household duties, unless we are obliged to? I frequently open hive after hive, with no kind of use for smoke at all, and yet I often see bee-keepers drive the poor little chaps down to the bottoms of their hives with great volumes of smoke, when they have not shown the least symptom of any disposition but the most friendly one. It is true, where the colony is very large, the bees sometimes pile up in the way, on the rabbets and ends of the frames, so that it becomes desirable to drive them away for their own safety. For this purpose, very little smoke is needed; and if you are in no great hurry, they will clear out of the way, if you just pat them on the backs gently with a weed or bit of grass.[197] If the bees are disposed to be cross, and to show fight, you will readily discover it the minute you turn up the first corner of the cloth covering; and if it takes smoke to make them beg pardon, give them smoke, but only in small quantities until you are sure more is needed. See FRAMES, HOW TO MANIPULATE

WHAT KIND OF BEES STING WORST.

The general decision is, that the pure Italians are, as a rule, the most easily handled.* Not only do they sting less, but as they keep their places on the combs without getting excited, when hives are properly opened, they are far less liable to get under one's clothing than the common bees. A great many stings are received from bees that are in no way badly disposed at all, simply by their getting pinched accidentally, while on the person of the bee-keeper. Pure Italians may be handled all day, with no such mishap; but after working among blacks or hybrids, I often find a dozen or more under my coat, up my sleeves, if they can get up, and, worst of all, up my trousers, if I have not taken the precaution to tuck them into my boots, or stockings when I wear low shoes. See BEE-DRESS. Well, I believe this one thing alone would decide me in favor of the Italians, if they were simply equal to the blacks in other respects. The hybrids, as I have before stated, are much worse to sting than either of the races when pure.

It may be well to add, that we find many exceptions to these rules; a hive of blacks will sometimes be much easier to handle than a hive of Italians in the same yard, and the progeny of a queen that we may have every other reason to call pure, may be as cross as the worst hybrids. Still further: A very cross swarm of bees may be so educated, by careful treatment, as to become very gentle, and *vice versa*. The colony in front of the door of the honey-house is always a gentle one, season after season; the explanation of it is, that they become accustomed to the continual passing and repassing of the bee-keeper in front of their hive, and learn to be dodging past some one almost all the time. On the contrary, those bees that are in the remote corners of the apiary are very apt to sting you, if you just come round to take a view of their entrance. The Egyptian bees are said to be very much worse than any of the other races; and as they do not yield to smoke, as do others, they have been discarded, principally on account of this unpleasant feature.†

The Cyprians and Syrians are more vindictive than Italians, and more nervous than a cross between the blacks and Italians. Still, these Eastern races can be handled if rightly managed.

†Carniolans have the reputation of being very gentle, but I think are no more so than Italians.

*Queenless bees are almost always much worse; it may be because they seldom work with energy, and have therefore no fresh accumulation of stores, that tend so much to put bees on their good behavior.

THE BEE-STING POISON.

When bees are very angry, and elevate that portion of their bodies containing the sting, you will often see a tiny drop of some transparent liquid on the point of the sting. This liquid is the poison of the bee-sting. It has a sharp, pungent taste; and when thrown in the eyes, as often happens, it has a stinging, acrid feeling, as if it might be a compound of cayenne pepper, onion-juice, and horseradish combined; and one who tastes it or gets it in his eyes concludes it is not so very strange that such a substance, introduced into the circulation, produces such exquisite pain. The poison of the bee-sting has been shown to be similar in composition to that of the viper and scorpion; but at the present writing I can not learn that any chemist has ever given us an analysis that would tell us just what the poison is. The acid obtained from ants is called formic acid, and I have wondered whether that from bee-stings is not similar, if not the same. It is probably a vegetable acid, secreted from the honey and pollen that constitutes their food, and it is well known that the poison is much more pungent when the bees are working in the fields, and accumulating stores largely, than it is when they are at rest in the winter months. It is generally during basswood-bloom that we get those severe stings which draw the blood and show a large white spot around the wound.

HOW IT IS DONE.

It is quite an interesting experiment to let a bee sting you on the hand, and then coolly observe the whole performance, without disturbing him. When a boy wishes to jump across a brook, he usually goes back a few feet, and takes a little run; well, a bee, when he introduces the point of his sting, prefers to make a short run or dash, or he may fail in lodging the barbs of the sting securely in the flesh. I do not believe a bee can very well get up the necessary energy to sting, unless he is under the influence of some excitement. I have sometimes, in trying to see how far I could go with an angry colony of bees without the use of smoke, had a lot of them strike my face with a sudden dash; but as I kept perfectly still, they would alight without stinging. Now, the slightest movement, even an incautious breath, would result in some pretty severe stinging; but if I kept cool and quiet, and carefully walked away, I might escape without any stings at all. Very often, a single bee will work himself up to a sufficient passion to try to sting; but to commence while standing still, I have always found to be rather difficult work for them; and although they sometimes prick slightly, and give one a touch of the poison, they seldom sting very severely, without taking wing again. To go back: After the bee has penetrated the flesh on your hand, and worked the sting so deeply into the flesh as to be satisfied, he begins to find that he is a prisoner, and to consider means of escape. He usually gets smashed at about this stage of proceedings, unless he succeeds in tearing the sting — poison-bag and all —from the body; however, if allowed to do the work quietly, he seldom does this, knowing that such a proceeding seriously maims him for life, if it does not kill him. After pulling at the sting to see that it will not come out, he seems to consider the matter a little, and then commences to walk around it, in a circle, just as if it were a screw he was going to turn out of a board. If you will be patient and let him alone, he will get it out by this very process, and fly off unharmed. I need not tell you that it takes some heroism to submit patiently to all this manœuvring. The temptation is almost ungovernable, while experiencing the intense pain, to say, while you give him a clip, "There, you little beggar, take that, and learn better manners in future."

Well, how does every bee know that he can extricate his sting by walking around it? Some would say it is instinct. Well, I guess it is; but it seems to me, after all, that he "sort o' remembers" how his ancestors have behaved in similar predicaments for ages and ages past.

ODOR OF THE] BEE-STING POISON.

After one bee has stung you, if you use the hand that has been stung among the bees in the hive, the smell of the poison, or something else, will be pretty sure to get more stings for you, unless you are very careful. Also after one sting has been inflicted, there seems a much greater chance, when about in the apiary, of getting more stings. Mr. Quinby has suggested that this is owing to the smell of the poison, and that the use of smoke will neutralize this scent. This probably is so, but I am not fully satisfied of it.

THE POISON OF THE BEE-STING AS A REMEDIAL AGENT.

For some years past there have been running through our journals many reports in regard to the agency of bee-stings in the cure of certain forms of diseases, especially rheumatism. From the facts put forth, I think any candid reasoner will have to admit, that being stung frequently does certainly have the effect of relieving certain forms of rheumatism, paralysis, and perhaps dropsy. It is true, the open-air exercise may have something to do with it; but I believe the poison of the sting itself often gives almost immediate relief in the diseases above mentioned. I may add here, that it is well known that homeopathists use bee-sting poison as a remedial agent, under the name of *Apis mellifica.* In their hands it is one of the most useful of all remedies in the treatment of œdematous and dropsical conditions of the cellular tissue, skin, serous and mucous membranes, and the glandular system. C. F. Muth, of Cincinnati, has sold a good many colonies of live Italians to doctors, for the sole purpose of extracting the poison. If I am correct, they extract the poison by means of alcohol. We have also sold bees by the pound for the same purpose. During the summer of 1889 we furnished 10,000 stings to a prominent pharmaceutical establishment, and have since furnished stings in smaller lots for other parties.

DOES THE BEE DIE AFTER LOSING HIS STING?

This is a question that remained long in uncertainty. While I am unable to give any positive information in regard to it now, I can give something more definite. It has been ascertained by experiment, by repeated trials, that a few bees caged (a dozen or so) deprived of their stings willingly or unwillingly, will die in from 24 to 72 hours, but rarely ever live longer.* It is stated, that a whole colony of bees which have lost their stings will live and prosper, the same as if the absent members were present. One of our correspondents relates the following incident. Through a piece of carelessness he allowed a certain one of his colonies to become so infuriated as to sting everybody and every thing within their reach. He declared, upon a subsequent examination, that there was scarcely a bee in that whole colony which did not show unmistakable evidence of having lost its sting in the uproar just mentioned. Now, the singular fact was that these bees actually lived, gathered honey, and prospered. Were it not for some partially substantiating testimony to the same effect, we could hardly credit it. It may be, however, that those bees were not made stingless after all, and that our good friend was deceived. I shall be glad to hear from others in the same line.

*A dozen bees uninjured, so caged, will live 10 days.

SMOKE NOT ALWAYS A PREVENTIVE OF BEE-STINGS.

Although smoke is our great reliance as a security against stings while working among bees, there are sometimes colonies, or seasons of the year, I scarcely know which, when one can get along better without it. I remember trying to open a colony of hybrids in the fall of the year, to show them to my wife. As a safeguard, I first gave them a good smoking; but, to my surprise, they got into a perfect panic, and poured out of the hive and showed fight, in great numbers. It is true, I could drive them down; but the minute I ceased smoking them, to lift out a comb, they became perfectly infuriated; and although driven down to the bottom-board repeatedly, they were up and ready for an attack, almost as soon as the smoker was turned away from the hive. I let them go, without half making the examination I wished. The next day, in passing the hive I thought I would look in and see if they were of the same opinion still. I had no smoker, and so raised the corner of the cloth over the frames cautiously. They kept on with their work, and seemed to care nothing about the intrusion. I took the cloth clear off, lifted frame after frame, but not a bee showed the least sign of hostility. In surprise, I carried a frame with the queen on it into the house and showed it to my wife, and told her it was the same swarm that acted so wickedly, just the day before. The only trouble seemed to be that they very decidedly objected to having their hive deluged with the offensive smoke, and I am sure it must be very painful to them in its effects. I took the lesson, and have since often found that I could get along even better without smoke. Have your smoker in readiness; and if you are obliged to use smoke, use a very little, as circumstances seem to decide best. Sometimes the only way seems to be to use it in considerable quantities, but I would never smoke the poor little fellows needlessly.[201]

MECHANICAL CONSTRUCTION AND OPERATION OF THE STING.

After a bee has stung you, and torn himself away from the sting, you will notice, if you look closely, a bundle of muscles, near by and partly enveloping the poison-bag. Well, the curious part of it is, that, for some considerable time after the sting has been detached from the body of the bee, these muscles will work with a kind of pump-like motion, working the sting further into the wound, as if they had a conscious existence, and burned with a desire to wreak vengeance on the party attacked. Nay, further, after the sting has been pulled from the flesh, and thrown away, if it should stick to your clothing in such a way that your flesh will come in contact with it, it will commence working again, pulling itself into the flesh, and emptying the poison into the wound, precisely as if the living bee were himself working it. I have been stung a great many times from a sting without any bee about it at all. Without any precise figures, I should say a sting would hold life enough to give a very painful wound, as long as full five minutes, and it may be, in some cases, even ten minutes.*[304] This phenomenon is wonderful, and I have often, while watching the sting sink into the rim of my felt hat, pondered on that wonderful thing, animal life. Why should that isolated sting behave in this manner, when the bee to which it belonged was perhaps far away, buzzing through the air? Why should this bundle of fibers and muscles behave as if it had a life to throw away? I do not know. This, however, I do know; when you pull a sting from the wound, you should throw it far enough away so that it will not get back on your face or hands, or into your hair, to sting you again.

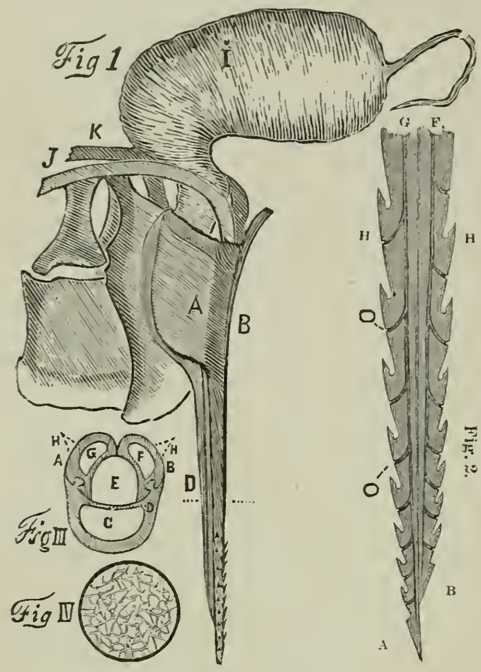
In giving the following description of a bee-sting, I am much indebted to the drawings and description given by J. R. Bledsoe, of Natchez, Mississippi, in the *American Bee Journal* for August, 1870. I am also indebted to Prof. Cook's excellent Manual.

Under the microscope the sting is found to be a beautifully fashioned and polished instrument, whose delicate taper and finish make a most surprising contrast with any instrument man has been able to produce. In shape it appears to be round; but it is, in reality, egg-shaped, and is of a dark red color, but transparent enough so that we may see the hollow that runs through the center of each of its parts. These hollows are probably to secure lightness as well as strength.

I have given you three views of the different parts of the sting, like letters representing like parts in all. Bear in mind that the sting proper is composed of three parts—the outer shell, or husk, D, and two barbed spears that slide partly inside of it. In Fig. 2 I have shown you the spears. The barbs are much like the barbs on a fish-hook; and when the point of one spear, A, penetrates far enough to get one barb under the skin,

*Muscular contraction of the sting has taken place under the field of the microscope 20 minutes after being detached from the bee.

the bee has made a hold, and has no difficulty in sinking his sting its whole length into the wound; for the pumping motion at once commences, and the other spear, B, slides down a little beyond A, then A beyond B,



BEE-STING MAGNIFIED.

and so on. The manner in which these spears are worked is, as near as I can make out, by a pair of something like pump-handles, operated by small but powerful muscles. I have shown you the arrangement of these handles at J and K, Fig. 1, as nearly as I could conjecture what it must be, from watching its workings under the microscope. These muscles will work, at intervals, for some time after the sting has been torn from the bee, as I have explained. They work with sufficient power to send the sting through a felt hat, or into a tough buckskin glove. I have often watched the bee while attempting to get his sting started into the hard cuticle on the inside of my hand. The spears will often run along the surface diagonally, so that you can see how it works down by successive pumps. The hollow in these spears is indicated at G and F, in Figs. 2 and 3; O, O, ducts leading from G and F.

I am not certain as to what the real office of these ducts, O, O, is. I have sometimes thought that they were for the purpose of conducting the poison to the wound from the canals G and F, the latter communicating directly with the poison-bag itself. Indeed, Frank Cheshire says, they afford the only means of exit for the poison, and he is probably right.

Fig. 3 is a transverse section, sliced across the three parts, at about the dotted line D. A and B are the barbed spears; F and G, the hollows to give them lightness and strength; H, H, the barbs. It will be observed that the husk, D, incloses but little more than ½ of them. Now, the purpose of this husk is to hold the barbs in place, and to allow them to slide easily up and down, also to direct them while doing this work. To hold all together, there is a groove like a chopping-knife in both spears, and a corresponding projection in the husk, which fit each other, as shown. This allows the barbs to project to do their work, and yet holds all together tolerably firm. I say tolerably firm, for these spears are very easily torn out of the husk; and after a sting is extracted, they are often left in the wound, like the tiny splinters I have before spoken of. When torn out and laid on a slip of glass, they are scarcely visible to the naked eye; but under the microscope, they show as seen in Fig. 2.

Stings do not all have the same number of barbs. I have seen as few as 7 and as many as 9. The two spears are held against each other, as shown in Fig. 3, and you will observe that the shape and the arrangement of the 3 parts leave the hollow, E, in their center. The hollows are the channels for this wonderful vegetable poison. The working of the spears also pumps down poison, and quite a good-sized drop collected on the points of the spears while I saw them working under the microscope. Friend Bledsoe found a valve that let the poison out of the poison-bag into this wonderful little pump, but prevented it from returning. I have not been able to see this, but have no doubt that it is there. The drop of poison, after it has lain on the glass a few minutes, dries down, and seems to leave a gummy substance, that crystallizes, as it were, into strange and beautiful forms. I have tried to show it to you in Fig. 4.

I can not close the subject of stings, without speaking of the wonderful similarity between the mechanism of the sting of the bee, and the apparatus furnished many insects for sawing and boring into wood and other substances, for the purpose of depositing their eggs. Almost precisely the same apparatus is used, but the barbs on the extremities are saws instead of the sharp hooks. If you will look at the cut you will see that but very little change need be made in these barbs to convert them into saw-teeth, and then we should have an engine for cutting and boring holes, that might easily be patented, if old dame Nature were so disposed. Now listen. If the insect had but one saw, even though he had strength to draw it back and forth, his light body would not give him purchase enough to do much execution with it. It is true, he might "dig in his toe-nails," and hold himself down so that he could work it to some extent; but then he could not change his position, according to his work, etc. When the saw was worked, instead of its cutting into the hard timber, his light body would be simply slid to and fro; but with two saws, like the barbed spears of the bee-sting, working in a sheath to hold them together, he can stand his ground and use his enormous muscular strength to do rapid cutting, even if his body does weigh only half a grain, or less. While one saw goes forward, the other goes backward; and the rapidity with which these insects work them enables them to make astonishing progress, even in substances so hard that one would not suppose they could make any impression at all. Now here comes in again the wonderful law I have spoken of so many times, on these pages. The insect that has the most effective and perfect set of tools will lay most eggs and have them most secure from the depredation of enemies, and his species will stand a better chance of survival than the individual or class with poorer tools. By giving a constant preference to the best workers, and taking into account how nature sports and varies, would it be strange, if, after the lapse of ages, the result should be the beautifully finished work we see through the microscope? I do not know that bee-stings could develop into saws, or saws into bee-stings; but if an insect should be found using its ovipositor as a weapon of defense, as well as for the purpose of egg-laying, it might look as though the thing were possible. I am not an entomologist, and I do not know that any such insect has ever been discovered. Who will enlighten us?

SUMAC (*Rhus*). This is a sort of shrub, or small tree, readily known by its bunches of bright red fruit, having an intensely sour taste. The acid property, however, seems to be only on the surface of the fruit, in the red dust that may be brushed off. I have had no experience with the honey, which the bees sometimes get in large quantities from the small greenish flowers, but give the following from page 96, GLEANINGS for 1874:

June 22, 1874.—Contrary to expectations, we are now in the height of a wonderful flow of honey from sumac, which of late years has not yielded much. Every thing in the hives is filled full, and I am kept busy hiving swarms, as it has become too much of a job to keep them from swarming by removing frames of brood. G. F. MERRIAM, Topeka, Kan.

SUNFLOWER (*Helianthus*). This plant embraces a very large family; but the principal ones for honey are the common sunflower and the Jerusalem artichoke. During some seasons and in some localities, the bees seem to be very busy indeed on these plants, all the day long. The mammoth Russian sunflower bears flowers of enormous dimensions; and from the way the bees crowd each other about the nectaries, one would suppose they yielded much honey.[375] The seed, which is yielded in large quantities, would seem almost to pay the expense of cultivation. The following is taken from page 36, Vol. III. of GLEANINGS:

My boy had a small box of sunflower seeds, which he kept as one of his playthings. Last spring he accidentally spilt them in the garden by the fence, and, old as they were, they came up profusely. They looked so thrifty, I took it into my head to transplant them. I set them all around in the fence, out of the way, where nothing else would grow to advantage, and, if you will believe me, I had an enormous crop. When they blossomed the bees went at them in earnest; and after the bees got through with them there were several quarts of seed. I sold a dollar's worth to my druggist, and the remainder I fed out to my hens, and, as a writer of old has said, I found nothing so good and nourishing for laying hens as sunflower seeds. Then I cut off the empty heads, place them near the bee-hives, fill them with sugar and water, and that suits the bees to a T. So you see I was at no expense, and they paid well. I write this that others may be benefited as well as myself.
DR. R. HITCHCOCK.
South Norwalk, Conn., Feb. 2, 1875.

SWARMING. All animated nature seems to have some means of reproducing its like, that the species may not become extinct; and, especially among the insect tribes, we find a great diversity of ways and means for accomplishing this object. In the microscopic world we find simple forms of animal life contracting themselves in the middle until they break in two, and then each separate part, after a time, breaks in two, and so on. With bees we have a somewhat similar phenomenon. When a colony gets excessively strong, the inmates of the hive, by a sort of preconcerted, mutual agreement, divide themselves off into two parties, one party remaining in the old hive, and the other starting out to seek their fortunes elsewhere.[292]

I have carefully watched this proceeding, with a view of determining how the matter comes about, that is, whether it is because a part of the bees become dissatisfied with their old home, and seek to better their condition, or because the queen leaves, for some reason of her own (because she has not room to lay her eggs, for instance), and the bees simply follow from a sort of natural instinct, since she is the mother of the colony, and an absolute necessity to their prosperity. After seeing a number of swarms issue, and finding that the queen was among the last to leave the hive, I concluded that the bees take the lead, and that the queen simply followed as a matter of course, in the general melee.[176] Suppose, however, that the queen should not take a notion to join the new adventure; well, swarms do often start out with no queen accompanying them,[377] and they usually go back to the hive after a time, to try it again next day. If she does not go then, nor at the next attempt, they often wait until they can rear a new queen, and then go off with her. After I was pretty well satisfied that this is the correct idea of their plan, a little circumstance seemed to upset it all. A neighbor, wanting to make an observatory hive, drummed perhaps a quart of bees from one of his old hives. As he had no queen, I gave him a black queen taken from a hive purchased several miles away. I mention this to show that the queen had never been out of the hive, in the location which it then occupied. After a day or two, this neighbor informed me that I had played a fine trick on him, for my queen had gone home, and taken his quart of bees with her. I told him it was impossible, for she had never been out of the hive, only when I carried her over in the cage.

We went and looked in the hive she came from, and there she was, true enough, with the bees she had brought with her stung to death, in front and on the bottom-board. It is possible that the bees swarmed out first; but even if they did, they certainly followed the queen in going back to her old home. We also know that bees sometimes follow a young queen when she goes out to take her wedding-flight.

It is my opinion that it is neither the queen nor the workers alone that make the first start, but that all hands join together and act in concert.

WHY BEES SWARM.

If you can contract the size of the hive when honey is coming in bountifully, the bees will be very apt to take measures toward swarming, about as soon as the combs are full of brood, eggs, pollen, and honey. They will often wait several days after the hive is seemingly full, and this course may not cause them to swarm at all, but it is very likely to. As soon as it has been decided that the hive is too small, and that there is no feasible place for storing an extra supply of honey where it can be procured in the winter, when needed, they generally commence queen-cells. Before doing this I have known them to go so far as to store their honey outside on the portico, or even underneath the hive, thus indicating most clearly their wants in the shape of extra space for their stores, where they could protect them.[204]

I believe want of room is the most general cause of swarming, although it is not the only cause; for bees often swarm incessantly, when they have a hive only partly filled with comb. First swarms usually come about from the cause I have mentioned; but AFTER-SWARMING (which see) often gets to be a sort of mania with the bees, and they swarm, apparently, *without* a reason.

AT WHAT SEASON BEES USUALLY SWARM.

The old adage runs,—

"A swarm of bees in May
Is worth a load of hay;
A swarm of bees in June
Is worth a silver spoon;
A swarm of bees in July
Is not worth a fly."

There is much truth in this, especially if managed on the old plan; but with modern improvements, a swarm in July may be worth a silver spoon, or even a load of hay; possibly, both together. See AFTER-SWARMING. A colony that was very populous in the fall, and has wintered finely, may cast the first swarm in May, in this latitude; but such events were very unusual before the advent of Italians. The latter often swarm during fruit-bloom, and in some cases even earlier. In our locality, swarms do not usually issue until the middle or last of June. If the season is a little late, sometimes the greater part of them will come in July, and we almost always have more or less swarming going on during our national holiday. At this time, basswood is generally at its height, and we frequently have quite a yield from clover, after basswood is gone. On this account, swarms that come out during the first week in July usually get enough to winter, and are therefore worth the price of a swarm of bees any way. I presume the old adage referred, principally, to the amount of honey they would store; if the July swarms did not secure enough to winter over, and were allowed to starve, they would not be worth the trouble of hiving them, and so they might be rated as of less value than a start in May would have the whole season before them; and if they did not get set back before white clover came out, would very likely make a surplus worth $5.00, the mar-

A SMALL STARVED-OUT SWARM.

fly.[295] Swarms that come out in June would fill their hives, and perhaps make a surplus that, on an average, would bring at least a dollar, the old price of a silver spoon; while those that were so thrifty as to be able to ket price of a load of hay. In some localities, bees seem to swarm in the latter part of July and Aug., and reports seem to indicate that they do it when little or no honey is to be had, and when the bees are disposed to rob; but such is certainly not the case here. for our bees give up all preparations for swarming, some little time before the honey-crop has ceased. I do not remember ever to have seen a natural swarm issue here later than July; but in some localities, buckwheat swarms are a very common thing. Where the apiarist has plenty of extra combs filled with stores, it is an easy matter to care for and make valuable stocks of swarms that issue at any time.

SYMPTOMS OF SWARMING.

Although we can sometimes tell when bees are going to swarm, I do not think it will be safe, by any means, to assume that we can always do so. It has been said, that the bees which have been clustering outside will, all the morning of the day they are intending to swarm, go inside the hive; but this can not always be so, for I have seen a swarm issue while the loafers were hanging on the outside as usual; and at the sound of the swarming-note, they took wing and joined in. Where a colony is intending to swarm, they will not be working like the rest, as a general thing; and quite likely, on the day they are intending to swarm, very few bees, comparatively, will be seen going out and in at the hive.[206] With movable combs we can generally give a very good guess of the disposition to swarm, by opening the hive. Bees do not, as a rule, swarm until they have got their hive pretty well filled up, and have multitudes of young bees hatching out daily. The presence of queen-cells is generally considered an indication of the swarming fever, and it used to be supposed that there was no danger of swarming unless these were present in the hive;[207] but since so many stocks of Italians have swarmed when nothing in the shape of a queen-cell was to be found in the hive, the idea of removing queen-cells, to arrest or prevent swarming, has been to a great extent abandoned.

Many think that the clustering of the bees on the outside of the hives is an indication that they are going to swarm. To a certain extent this may be the case, but it is by no means an indication that they are going to swarm very soon. I knew a colony, belonging to a neighbor, that hung out in great masses nearly a month, before the bees came out. His new hive was in readiness, and he stayed at home and watched day after day, until clover and basswood both were almost gone, and finally they cast a truly large, fine swarm.

NEVER ALLOW BEES TO HANG OUTSIDE THE HIVE.

This swarm had hung outside the hive during the great honey-harvest of the season; and as it is no unusual thing for a colony to store 10 lbs. a day, during the height of the season, they had lost at least 100 lbs. of honey, for the swarm was an unusually strong and fine one. I think they could easily have secured this amount if they had worked, but it is by no means certain that they could have been made to go to work as they did after they swarmed and were put into a new hive. Within two or three weeks after they swarmed, if I remember, they filled their hive, and gave about 25 lbs. of surplus. How shall we deal with such bees? Well, it will be an excellent problem for our A B C class to work out by actual practice. One way is to put section boxes on the top, and then drive the bees inside with your smoker, and thus make them go to work—that is, *if you can*. If they will not do so, get from some other hive some sections partly filled, and this will generally accomplish the object. If the bees are in a box hive, and you can not at the time transfer them (it is rather unsafe to transfer during a great honey-yield, with the hive full of honey, you know), fix a new hive all right, move away your old box hive, brushing all the bees off on the ground, and then give them a queen or a frame of brood in the new hive, as in ARTIFICIAL SWARMING, and make them go to work at something. You can do it every time, although it may be a few days before they get over their stubbornness, and get to work fully. Sometimes a very large new swarm will hang out, and refuse to work. If bees hang out during the hot weather of August, after honey has ceased coming, you can still set them to work by feeding; but unless you want more colonies, more combs built out, or can rear queens for sale, it may not pay to try to keep them at work. Toward night, after very sultry days, bees will sometimes hang out so as to cover their hives, and there may be no harm in allowing them to do this, although I should prefer to have them better occupied by doing something indoors. A really energetic colony will often be at work rearing brood at such a time, if they are gathering honey enough. Bees should always have room enough during the working season, to prevent their being crowded out; but we should not go to the opposite extreme, and give them so much that they feel cold drafts in their hive, and can not keep up sufficient heat for comb-building and brood-rearing.

PREPARATIONS FOR SWARMING, TO BE MADE BY THE BEE-KEEPER.

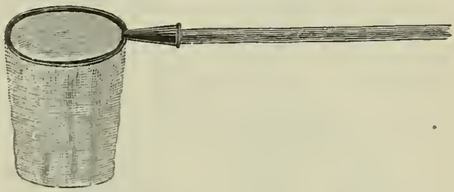
Every apiarist, even if he have but a couple of hives, should make preparations for swarming, at least to some extent; for, even though artificial swarming is practiced, and the utmost care used to prevent any other, there will always be a chance that swarms may come out unexpectedly. Hives should be in readiness, and at least one should be fixed on the stand where you wish your next colony placed. Bank it round with cinders and sand, and fix as nice and level as if it contained bees. Have some extra combs if possible, and have them placed in the honey-house where you can put your hand on them at any minute. I would also have some hives where I could get a comb of unsealed larvæ, without very much trouble; that is, make up your mind what hive you are to go to, in case you should want such a comb in a hurry. Bees will often swarm on Sunday; and as we would not wish to work with our bees on the Sabbath more than is absolutely necessary, it behooves us to be at all times prepared to take care of a swarm, should it come, with very little trouble. I can remember having swarms on Sunday, when it became necessary to hunt up a hive, decide on its location, hunt up some empty combs, and then look over my hives to see where there was one with no surplus boxes on, that I might get at a brood-comb with as little trouble as possible, to put in the new hive, to prevent them from decamping. All these things take time, and more than one swarm have departed while a hive was being made ready to receive them. If you keep the wings of your queens clipped as I have advised, you will need some queen-cages where you can lay your hands on them at a minute's notice, for there are times when you need to step about as lively as you would if a house were on fire, and you do not want to be bothered by hunting for things.

MILLER QUEEN-CATCHER.

The best queen-catcher, or, rather, a cage for confining the queen, during the swarming season, is the Miller introducing-cage, a cut of which will be found under INTRODUCING. We will suppose that a swarm has just issued, and that your clipped queen is hopping around the entrance of your hive. Your wife or attendant, feeling some hesitancy about picking up so delicate an object by her silken wings, can take a cage of this kind and place the mouth directly over her. In a moment, finding herself confined, she will ascend into the cage. The little wooden plug is now inserted, and your captive queen can be placed among the flying bees, and the swarm hived as described elsewhere. The cage is also used for introducing. See INTRODUCING.

SWARMING-DEVICES, VARIOUSLY CONSTRUCTED.

Almost every apiarist has his own peculiar notion as to how a swarming-device should be constructed. Some of these implements are very ingenious, and valuable assistants during the swarming season. Their particular use is to remove a swarm after it has clustered, and place it in the hive where it is desired that the new swarm shall take up its new abode. The first one to which I call your attention, not because it is the best, but because it is the simplest, is a sort of butterfly-catcher.



The hoop is made of stout wire, and is about 20 inches in diameter. The ends are soldered into a tin socket that will receive a rake-handle, or, for tall trees, something still longer. The bag is to be put up under the swarm, and the hoop is then made to gently cut off the cluster so that the bees will fall into the bag. It is then turned edgewise, so as to confine them while it is taken down and carried to the hive. As the bag is made of cheese-cloth, they have plenty of air. To get the bees out, turn it inside out. The bag has the same diameter as the hoop, and is about four feet long.

This implement is very light and handy where the swarm is conveniently situated; but if it is necessary to reach the swarm by holding the pole perpendicularly, the hoop is not properly set. Mr. W. F. Clarke, former editor of the *American Bee Journal*, now of Guelph, Ontario, Canada, has suggested and put into practice the following modifications, as shown opposite.

You will observe that the hoop is attached so as to be at right angles to the pole; this, consequently, permits the sack to hang perpendicularly, with wide-open mouth ready for the reception of the swarm, even when the pole itself is held perpendicularly, as shown in the accompanying cut. Mr. Clarke has the pole also made in joints, to accommodate the varying distances of a swarm from the ground. For the purpose of securing lightness it is made of bamboo. Such a pole can be very easily made in joints. The pith can be bored out at the two ends (which are to be joined) to a distance of a couple of inches. In the end of one of the joints can be driven a short piece of iron, of suitable length and size. The other end can now slip over and make a good strong serviceable union. To obviate the possibility of splitting near the ends. I would suggest driving on an ordinary brass ferule, which can be obtained at any of the hardware stores.

W. F. CLARKE'S SWARMING-DEVICE.

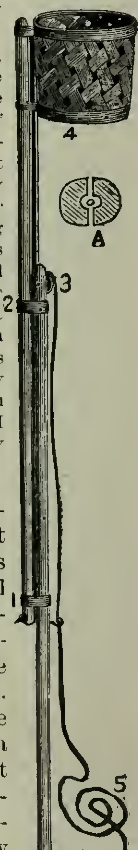
So much for the construction. We will suppose that the old gentleman who seems to be taking things pretty easy has pushed his bag up gently around the bees. A gentle thump of the rod or pole against the body of the limb will jar the bees into the sack. Of course, he wishes to retain every bee, and so he revolves the pole in such a way as to close the mouth of the sack.

It does not matter particularly if he does not have the hive ready, for the bees can not get out or smother. As soon as the new domicile is provided, the mouth of the apparatus is placed before the entrance, and the bees are allowed to enter their new home.

There is one defect in this apparatus — in fact, with all such implements which make use of a bag. A great many times swarms are not so accommodating as to locate in a convenient position, as shown in the engraving, and it is therefore necessary to shove the swarming-device up and between the limbs and twigs. It is almost impossible to secure a swarm thus situated, with a device having a sack attached to it, for the reason that the sack will catch and tangle in the limbs.

MORRISON'S SWARMING-DEVICE.

The accompanying cut represents this device, and Mr. Morrison's description of it is as follows:



It is made of two pieces of pine, 16 ft. long, 2x2½ inches. One side of each is made flat, and a groove for a rope is made in the center of each, from top to bottom. The other side of each pole is rounded. At 3 is a pulley; set in at 1 is a narrow band of iron encircling the other pole; at 2 is another; at 4 is a ring staple on which a peach-basket is tied. The rope is fastened at 1, and runs over pulley at 3 You see the rest. A swarm 35 feet above the ground can be reached by it, and a little jar under the cluster secures the bees in the basket. It is very easily made, inexpensive, and I am sure there can be none better. I have used it two seasons very many times. S. W. MORRISON, M. D.

Oxford, Pa.

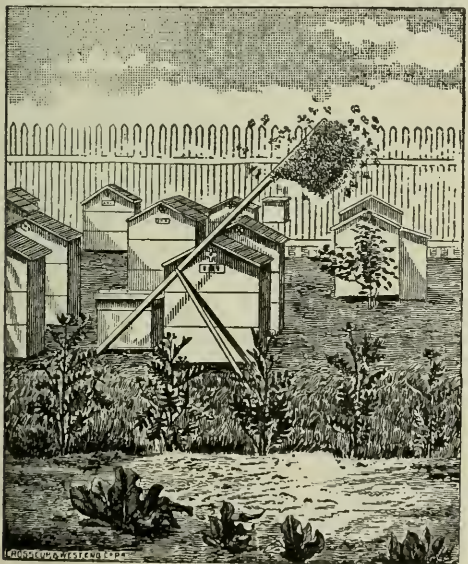
There is considerable machinery about this device; but in some localities, in the hands of certain bee-keepers, it will no doubt prove quite an assistant. Observe that Mr. Morrison says that a swarm can be reached 35 ft. from the ground. No other device with which we are acquainted will secure a swarm that distance, without climbing. With this the apiarist is supposed to stand directly beneath the swarm. By drawing on the rope, at 3, the peach-basket can be elevated to the desired height. Where the swarm is so situated as to permit jarring it right in the mouth of the basket, perhaps the position of the basket is about right. Sometimes a swarm will refuse to enter the open mouth of a basket; but if the same be inverted, the bees will crawl through the splints. During times of swarming, bees seem to be partial to cavities perforated by holes. This is the peculiar feature of the Shepard box already described; but the basket device, while possessing these features, is lighter.

Such an implement as the one above represented would hardly be of very great advantage in those apiaries where there is only low-growing shrubbery, or, at most, small fruit-trees in the vicinity. In such apiaries we want something a little lighter and a little easier to handle.

A. E. MANUM'S SWARMING-DEVICE.

The engraving given below shows a tripod, one leg of which projects beyond the rest, so as to hold the swarm of bees, as shown. Mr. Manum, of Bristol, Vt., clips all of his queens. His description is as follows:

It is simply a wire-cloth cage fastened to a pole with two legs, so attached to the pole that they can be set out or in, something like a tripod. The lower end of the pole may be sharpened, to stick in the ground, in order to steady the catcher, and to prevent it from being tipped forward by the weight of the bees.



A TRIPOD SWARMING-APPARATUS.

The head, or cage, is 10 × 10 inches square by 1¾ thick, and is covered on each side with wire cloth. It is made in two parts, and hinged together so as to open and close. When closed it is held together by a small hook. One of the parts of the head is fastened to the pole, forming a catcher, as may be imagined by referring to the cut.

The head is made of ⅜×⅜ stuff, hence is very light. I usually furnish eight or ten of these catchers to each of my apiaries.

Now, as we have our catchers all made and ready for use, by having them distributed through the apiary in order to have them handy, we will proceed to catch that swarm that is just coming out. We will take this catcher here, and open it; hold it to the entrance, and catch what bees we can. Close it and lay it on the ground near by, and watch for the queen. As she comes out, catch and put her in the catcher with the bees. Now set up the machine in some shady place, if convenient. The buzzing of the bees and the scent of the queen will soon attract the swarm, when all will alight on the catcher, where they may remain until we are ready to hive them; and if we fear another swarm may issue before these are hived, they may be covered with a sheet.

See! there comes another swarm! run with another catcher, and proceed as before, and set this catcher some distance from the first, if we wish to hive the swarms separately.

This is one of the most practical implements in the whole list. It is very simple, cheap, easily constructed, and easily operated. Like the wire-cloth-cage swarmer, it will catch and cage a larger part of the bees and the queen. Above all, it stands alone, and accomplishes the rest of the swarming automatically.

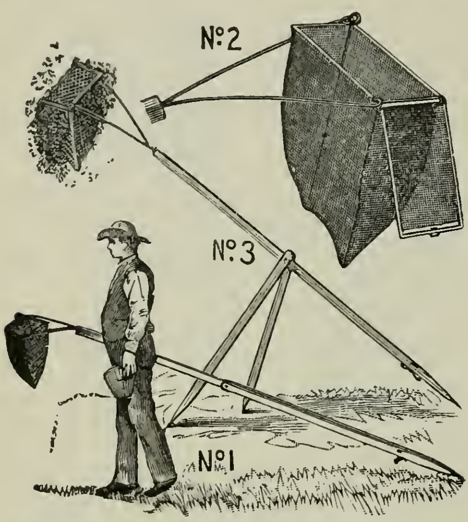
THE DEVICE WE PREFER.

Mr. Manum clips all his queens' wings. As we sell bees by the pound, and send off a good many queens by mail, we do not practice clipping. As the Manum device seems to possess so many decided avantages, we decided to modify it somewhat, so as to be adapted to an apiary where queens' wings are not clipped. The device, as modified by us, differs from the one just described, in that we use a large wire-cloth cage. Mr. Manum's will hold perhaps a quart of bees, while ours will hold several. The engraving opposite will serve to give you an idea of its construction.

Fig. 2 represents the wire-cloth cage or basket; Fig. 3, the device in position, receiving the bees as they cluster on the outside of the cage. Fig. 1 shows the bees after they have clustered, and the apiarist in the act of walking off to the hive.

METHOD OF CAPTURING SWARMS.

Instead of looking for the clipped queen as soon as the swarm issues, we wait until it begins to cluster. As soon as a cluster is half or wholly completed, we run the basket up to and around the cone of bees. An assistant, if present, gives the limb a jar, so as to disengage the bees into the basket. In case no one is ready to assist, a sliding movement will precipitate the cluster into the wire-cloth cage, when it is quickly lowered. This operation, in passing down through the limbs, will usually catch the wire-cloth lid, and close it with a slam. In case it is not closed, the apiarist steps forward and does it himself. Half or two-thirds of the bees are generally confined. In all probability the queen is there also. As the bees can not get out, those still flying in the air will very readily cluster on the wire cloth, surrounding the majority of their companions inside. To make this more expeditious, the tripod is adjusted, and the cage is suspended in the air, as shown in Fig. 3, right where the bees are flying thickest. In two or three minutes the remainder of the bees will be clus



MANUM'S MODIFIED SWARMING-DEVICE.

tered on the outside. At this stage of the proceeding the apiarist comes forward, folds the two short legs against the pole, grasps it at its center of gravity (see Fig. 1), and walks off to the hive, which he has previously prepared. The wire fork is made of steel, and is light and springy. The walking of the apiarist has no tendency then to jar the bees off from the basket.

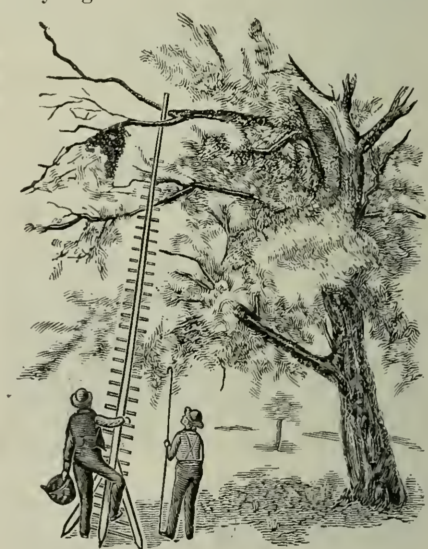
One of the special features of the Manum arrangement is, that the basket can be adjusted to almost any position, all the way from 2 to 10 feet from the ground. All that is necessary is to spread the tripod legs, catch them into the ground, and leave them standing. In the mean time, if the hive is not prepared, the apiarist has ample time to get it ready. After this he can return to the swarm just now clustered. Most of the devices require to be held until the cluster has settled. It is a tedious job to hold a pole at arms' length, with face upturned. If the swarm clusters very high, some other arrangement, perhaps, would be better than the Manum; but for low shrubbery it is just the thing. The other special feature of the device is, that, after you have gotten about half or two-thirds of the bees into the basket, they can not escape and seek their original point of attachment.

THE SWARMING-HOOK.

With most of the swarming-devices I have illustrated, what might be called a swarming-hook can be used to considerable advantage at times. It is simply an iron hook, large enough to compass an ordinary limb on which swarms cluster, mounted on the end of a long pole, therefore resembling, somewhat, a shepherd's crook. One of the swarming-devices is passed beneath the swarm. This hook can reach over, grasp the limb on which the swarm is clustered, and one or two smart jerks will jar the bees into the basket, bag, or box, as the case may be.

SWARMING-LADDER.

Swarms usually alight low, so that the ordinary swarming-implements previously described will reach them from the ground. But there are times when they will settle on pretty high limbs. It is then that a ladder


STRIMPL'S SWARMING-LADDER.

is called into requisition. If it will not reach the swarm it will at least land the climber among the upper limbs, so that he can step from one limb to the other, and finally reach the bees. But it is difficult to stand an ordinary ladder against a limb of a tree so that it will be secure for climbing, on account of the unevenness of the limbs. A Bohemian by the name of R. Strimpl, of Schetschan, Bohemia, sent us a drawing of a ladder that can be lodged—that is, the upper part of it—securely on some limb above. The engraving illustrates its principle of application.

The two side arms, or forks, prevent the ladder from revolving; and it will be observed that the ladder terminates in a single pole, which can be very easily lodged in the fork of a limb, where a two-pronged ladder would not. The three prongs below the ladder are sharpened at the ends, and securely pushed into the ground; and the perfect lodgment of the other end in the crotch of the limb makes it a safe means of ascent. Aside from this, the ladder will be lighter. But it is desirable to prevent swarms from going beyond our reach—at least clustering on elevated limbs. The following is one of the indispensables, especially if the queen's wings are not clipped.

THE FOUNTAIN PUMP, FOR CONTROLLING SWARMS WHILE IN THE AIR.

One of the most useful implements for the apiary, during the swarming-time, is a good hand force-pump. The Whitman Fountain pump, sold by supply-dealers for $6.00, is the best implement for the purpose. A swarm of bees in the air, that might otherwise circle about for fifteen or twenty minutes, may usually be made to cluster in from two to five minutes by its use. Whether the fine particles of water dampen the wings, and so impede their flight, or cause the bees to think it is raining, and that therefore they had better cluster at once, or both, I will not say; but certain it is, the spray has a very decided effect. One who has become moderately expert will be able, n t only to make the bees settle, but to *compel* them to cluster on some point easily accessible to any of the ordinary swarming-devices just described. Occasionally a swarm will make for the top of a tall tree. With the pump you can head them off, and cause them to settle on a lower branch. Even when a swarm is clustered twenty or thirty feet from the ground, by adjusting the stream nozzle, and letting it play directly on the swarm itself, you can, many times, dislodge them, cause them to take wing, and finally to settle again upon a lower point of attachment. Again, several swarms will come out simultaneously, two or more of which will be likely to cluster. By the timely use of the spray, each swarm can be kept separate by keeping the wings of the stragglers of the two swarms about to come together dampened. A good many times, a swarm that is about to abscond can be headed off and made to cluster; in fact, our boys, during the summer of 1889, could drive a swarm about like a flock of sheep. It is very annoying and inconvenient to have a swarm pass from our premises over to those of a neighbor. During the summer of 1889 we had something like eight or ten swarms come out every day, for about one week, and yet in only one or two cases did they leave the immediate vicinity of the apiary; and had it not been for the pump, we should, in all probability, have had to chase all over the neighborhood, to say nothing about climbing tall trees.

After a swarm begins to cluster on a desirable point, stop spraying in this direction. Retreat, and drive the stragglers toward it, but be careful not to spray the place where they are clustering. As a general rule, there will be two or three small clusters forming at once. Spray the undesirable ones, and keep them sprayed until these points of attachment are abandoned.

During the swarming-season it is a good idea to keep several barrels of water in and in the immediate vicinity of the apiary, so as to have the water right handy. If you run to the pump every time you use a pail of water, a swarm may get away from you, or cluster in the top of a tall tree.[209]

HOW TO HIVE SWARMS WITHOUT SPECIAL SWARMING-DEVICES.

If your apiary be located in a locality where there are no tall trees, with only low-growing shrubbery, or, at most, low-growing fruit-trees, the special tools I have already described will not be found absolutely necessary, and perhaps not even a convenience, if we except Manum's arrangement. Our own apiary, illustrated at the frontispiece, you will notice has no large trees. Outskirting it are rows of low-growing bushy evergreens. There is absolutely no place for the bees to cluster in the immediate vicinity of the apiary, except on one of these evergreens, or else on one of the grapevines in the apiary itself. Rarely do we have swarms cluster elsewhere. If one alights on one of the two places just mentioned we select a frame of unsealed larvæ, the use of which has been previously anticipated. As the swarm is rarely ever above four or five feet from the ground, this frame is gently thrust among the bees. A large majority of them will very soon lodge upon the frame. This together with the adhering bees is placed in a hive on the shady side of the evergreen or grapevine, in company with three or four more frames. Those bees which have already clustered on the frames will begin to call their companions.

As soon as a few bees have discovered the entrance, a few will indicate their discovery by the usual humming of the wings. An enamel sheet can be placed over the cluster. A bunch of grass will now brush the bees out of the way so the cover can be shut down without smashing any bees. The hive is left until the bees have all entered it. Before they have had time to fix a location, they are removed to their permanent location in the apiary.

You will scarcely appreciate the absence of large trees and the presence of small undergrowth, until you have had an apiary so circumstanced. Swarming does not have half the terrors to the bee-keeper that it does when the clusters are just as likely as not to attach themselves to elevated positions.

The method I have just described applies when the queen's wings are not clipped, either because we do not wish to mutilate her fair proportions or because she happens to be a young queen. But a great many times apiarists prefer to clip their queens' wings. Perhaps I might say a majority do so. The following is the modus operandi usually employed :

HOW TO HIVE A SWARM WITH A CLIPPED QUEEN.

By turning to QUEENS, you will see what I say about clipping the wings of every queen as soon as she becomes fertile; if we do this, our queen can not take wing, as she usually does as soon as she gets out of the hive (she is generally nearly the last to come out), but hops helplessly on the ground. If you are on hand, pick her up as soon as she makes her appearance, and cage her. As soon as the bees are all out, move the hive to a new stand, put a new hive in its place, and lay the caged queen down close by the entrance. The bees, as soon as they discover that the queen is not with them, will come back to their old stand, and enter the new hive. When they are going in nicely, release the queen and let her go in with them. All this is very simple, and we have practiced the plan quite extensively. To let the new swarm go to work at once, and prevent any probability of absconding, we give them a single comb containing eggs and larvæ, and fill out the rest of the hive with frames of fdn. The bees usually commence coming back in about 5 or 10 minutes ; but they may cluster and remain away 15 minutes, or, in extreme cases, as much as a half-hour.

They will always come back sooner or later, so far as I have been able to learn, unless they have an extra queen, or get another queen by uniting with another colony, or something of that sort.[379] See ABSCONDING SWARMS. If you do not find the queen as she comes out of the hive, and she has a clipped wing, you may be pretty certain that she will come back. AFTER-SWARMS (which see) have unfertile queens, and consequently their wings can not be clipped. If you see them when they come out, and succeed in catching them, you can often hive the swarms in the same way; but the young queen will sometimes put right out again, and you must expect her to show all sorts of eccentric manœuvres.

If you do not wish to move the old stock away, you can tie the caged queen to the end of a pole, with some leafy twigs near her, and usually succeed, without much trouble, in getting the bees to cluster around her.[209] We have usually kept on hand for this purpose, a common rake, with a bush tied to the end of it. If they commence clustering on a limb, hold it near them while you shake the limb and keep it in motion, and you will soon have them on your rake, to be carried where you please. If your hive is already fixed, lay the rake on the ground in front of the hive, and the bees, finding the cavity, will at once commence to travel in. If they do not discover the entrance at once, guide them to it with a twig ; after they are going in nicely, release the queen, and watch to see that she goes in with them, and not under the bottom-board.

Very often the readiest way of getting a swarm, especially if you are away from home and without tools, is to cut off the limb on which they are clustered, and carry them where you like. If the limb is small, you can cut it with a stout knife ; but if large, a saw will be needed. The teeth should be fine, that there be not too much jarring, and it would be well to make a slight cut first on the under side, that the bark may not hang when you get it nearly off.

TWO OR MORE SWARMS COMING OUT AND UNITING.

When the swarming-note is heard in the apiary, it seems to carry with it an infection ; this may be a mistake, but in no other way can I account for swarms issuing one after another, while the first is in the air, unless they hear the sound, and haste to go and do likewise.[210] Of course, they will all unite in one, and as many as a dozen have been known to come out in this way, and go-off to the woods in a great army of bees, before any thing could be done to stop them. If your queens are clipped, and you "hustle around," and get them all in cages deposited in front of the hives, they usually separate and each bee go where he belongs.[380, 211] Unless you have plenty of help, you will be unable to get the hives all moved away, and a new hive fixed for each one before they come back. In this case they will go back into their old hive, and, if the queen is released, will sometimes go to work; but oftener they will swarm out again within a few hours, or the next day; and if you keep putting them back they will soon attack and kill their queen, and loaf about until they can rear a new one, and then swarm.[212] This is very poor policy, and we can by no means afford to have such work. If they swarmed for want of room, they may go to work all right, after having room given them.[381] If they come out the second time, I should give them a new location, divide them, or do something to satisfy their natural craving for starting a new colony, otherwise they may loaf, even if they do not try to swarm again.

To go back: Suppose they get a queen or queens having wings, and cluster in one large body. In this case you are to scoop off bees from the cluster, with the swarming-bag, a tin pan, or a dipper, as may be most convenient, and apportion parts, made about as nearly of the size of a swarm as may be, about in different hives. Give each hive a comb containing eggs and larvæ as before, and then get a queen for each one if you can. In dividing them up, should you get two or more queens in a hive, they will be balled as I have before described, and you can thus easily find them. If more than one queen is in a hive, you will find a ball of bees, perhaps the size of a walnut or hen's egg, about them, and this can be carried to the colony having none. If you can not tell at once which are queenless, you will be able to do so in a few hours by the queen-cells they have started. If you are more anxious for honey than bees, you may allow two swarms to work together; and if you give them sufficient room, you will probably get a large crop of honey from them; but this plan does not pay, as a general thing, because the extra bees will soon die off by old age, and your colony will be no larger than if the queen had had only her ordinary number of bees.

PREVENTION OF SWARMING.

If we can entirely prevent swarming, and keep all the bees at home storing honey all the season, we shall get enormous crops from a single hive. Whether we shall get more in that way than from the old stock and all the increase, where swarming and after-swarming is allowed, is a matter as yet hardly decided. If a swarm should come out in May, and the young queens get to laying in their hives by the first of June, their workers would be ready for the basswood-bloom in July, and it is very likely that the workers from 3 queens or more would gather more honey than those from the old queen alone. But, another point is to be considered. The two or three new colonies must have stores for winter; and as it takes nearly 25 lbs. to carry a colony through until honey comes again, this amount would be saved by the prevention of swarming. Where one has plenty of bees, and desires honey rather than increase, a non-swarming apiary would be quite desirable.

This subject is a mooted one, and some of our best and most experienced bee-keepers —Dr. Miller among the number—confess they have been baffled in their efforts to confine swarming within reasonable limits. Usually it is not desirable to prevent first swarms. Second swarms or after-swarms are the ones we should *like* to control. Some prominent bee-keepers practice cutting out all queen-cells but one, eight days after the issue of the first swarm; that is, they allow all the unsealed larvæ to become capped over, leaving no opportunity for further building of cells. If only one cell is left in the hive, of course only one queen can be hatched and reared. If she is successfully fertilized the colony will generally settle down to business. Excessive swarming is often brought about because a number of young queens are allowed to mature about the same time. These unfertile queens will be pretty apt to keep up swarming in the hive so long as there is a surplus of queens. See AFTER-SWARMS.

PREVENTION OF SWARMING BY CAGING OR REMOVAL OF QUEEN.

Hetherington, Elwood, and some others, have practiced caging or removing the queen during the honey harvest. Of course, no swarm will issue regularly without a queen in the hive; and if no cells are allowed to hatch, the prevention is accomplished. When the harvest has commenced, before giving the bees a chance to swarm, the queen is caged in the hive, or, perhaps, preferably given to a nucleus. If queen-cells are not already started they will certainly be started on removal of the queen; and if the queen is caged they will just as certainly be started in a short time. In any case they must be cut out before any possible danger of hatching out. If all cells are destroyed at the time of removing the queen, then a second time, eight days later, and a third time eight days later still, there will be no possibility of any swarming. The advocates of this plan claim that the bees that would be raised from eggs laid at the time during which the queen is caged or removed would be too late to be of any service in gathering the harvest, hence only consumers.

On the other hand, there are those who question whether the bees work just as industriously without a laying queen in the hive. One difficulty about the plan is, that it is about impossible to be sure that no queen-cell has been missed; and a missed queen cell gives rise to very undesirable complications.

Some do not desire even first swarms. When running for comb honey it is nearly impossible, under the present methods of contraction, to prevent it altogether—see CONTRACTION. Many times bees swarm because the apartment for brood-rearing is limited. Contraction and the queen-excluding honey-board give the queen only a limited amount of room, and swarming is the consequence. For this reason it is desirable not to reduce the brood-chamber too much. But whether contraction is practiced or not, the fever may be greatly allayed, and perhaps prevented altogether, by giving an abundance of surplus room on the plan of tiering up. Do not let the colony at any time feel crowded for space. Judicious tiering up, as described under COMB HONEY, will not only secure more honey, but it will largely discourage natural increase when not desired. When running for extracted honey, the problem is much easier. Mr. E. France, of Platteville, Wis., who produces enormous crops of honey, says he is very little troubled by excessive swarming. He does not practice contraction, but allows the queen and bees plenty of room. If the queen desires to go above, she is allowed that privilege. Charles Dadant & Son keep about 500 colonies in large Quinby hives. These hives are so large that the bees are but little inclined to swarm. In fact, Mr. Dadant says, in the *American Bee Journal*, page 311, Vol. XXV., "For more than fifteen years we have dispensed with watching the bees of our home apiary, numbering from 80 to 100 colonies. As the yearly number of natural swarms does not exceed two or three, the expense of such watching would be far above the profit" While large hives filled with combs or foundation tend to prevent if not discourage swarming altogether, for other reasons other bee-keepers seem to prefer smaller sizes, such as the Langstroth. See HIVE-MAKING.

PREVENTION OF SWARMING BY THE USE OF THE EXTRACTOR.

Without doubt, the greatest reason for swarming is, that the bees have got their hive full of honey, and there is no more room for them to labor to advantage; accordingly queen-cells are started, and other preparations made, and they get, as we say, the swarming fever. Now, if their honey is taken away, and more room given them before they have begun to feel cramped for room, they will seldom get this swarming fever.[216] This room may be given by taking out combs filled with sealed honey, and substituting empty combs or frames of fdn., or it may be done by extracting the honey. This latter plan, I believe, is most effectual, for almost every drop of the honey can be taken away by extracting. We extract from the brood-combs as well as from the rest, and this can be done without any injury to the brood, if we are careful not to turn so fast as to throw out that which is unsealed. I would do this, however, only in extreme cases, where the bees will not work, and are determined to swarm. The honey around the brood is generally needed there, and would better not be removed. It should be remembered that this remedy to prevent swarming is not infallible, and I do not know that any one is, at all times. I have known a swarm to issue the day after extracting all the honey I could get from the hive, but they had probably got the swarming fever before any extracting was done. At another time, the bees swarmed while I was extracting their honey.

PERFORATED ZINC TO RESTRAIN QUEENS.

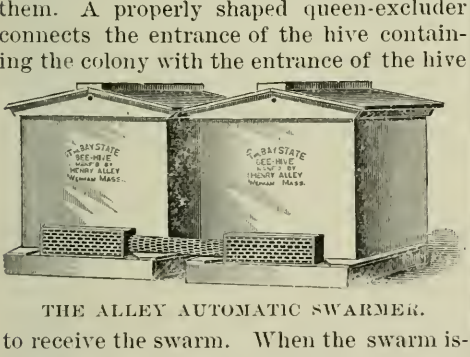
Under DRONES, an incident is given in regard to the matter of entrapping the queen when she issues with the swarm. The employment of perforated zinc will not prevent swarming, but it prevents the bees from accomplishing their purpose; that is, swarming out and taking their queen with them. In other words, the perforated zinc simply takes the place of clipping the queen's wings. In some cases it may be desirable to use the zinc instead of clipping. Usually, from what experience I have had, I should say it is preferable to clip the queen's wings rather than to cause the bees the inconvenience of crawling, during the continuance of the honey-flow, through narrow perforations of zinc, simply for the purpose of preventing the issue of the queen should the swarm come forth.

NON-SWARMING HIVES

A few years ago it was quite common to talk of non-swarming hives, and there were many inventors who claimed to have accomplished the end desired. The most of these hives were covered by a patent, and they have gone the way of most, if not all, patented bee-hives. Giving the bees abundant room, both over the cluster and at its sides, will do very much toward making a non-swarming hive; but they will swarm occasionally, in spite of us. Keeping the hive well shaded, or having the walls entirely protected from the sun, will do much to discourage swarming, and the chaff hive has for this reason proved about as good a non-swarmer as any brought out.

AUTOMATIC SWARM-HIVING.

Henry Alley has invented an arrangement that is intended to hive a swarm of bees in an empty hive, and set them to work all right, even if no one is within a mile of them. A properly shaped queen-excluder connects the entrance of the hive containing the colony with the entrance of the hive



THE ALLEY AUTOMATIC SWARMER.

to receive the swarm. When the swarm issues, the queen can not get through the perforated zinc, but can easily get into the empty hive, where she will be found by the returning swarm. As yet it has not been sufficiently tried to establish it as a reliable plan.

THE ALLEY TRAP IN HIVING SWARMS.

When a swarm issues (see cut under DRONES), the bees will pass the guard; but the queen, on finding herself shut in, will pass "up stairs" in the same way as the drones. Sometimes, however, instead of going above she will return into the hive. In five or ten minutes, the bees, on discovering the absence of their queen, will go back to the hive. The bees should not be allowed to make more than one attempt to swarm in this way, for failing in the attempt to swarm again with the queen they will be likely to kill her. The bees may, however, cluster without the queen.

If the queen enters the upper apartment, the entire trap can be detached, fastened to a rake or some other object, and placed among the flying bees. Of course, they will readily cluster about the cage, when they can be hived; but keeping an Alley trap attached to all hives that are likely to send out a swarm during the ensuing ten or twenty days would be rather expensive, both because of the cost of the trap itself, and because of the inconvenience to the laden workers coming home. The same or very nearly the same result can be attained by clipping the queen's wing, at no expense whatever; and at the same time the bees have, up to the time of swarming, a free and unobstructed entrance.

KEEPING BEES IN UPPER ROOMS AND GARRETS.

This plan for keeping a single colony, to furnish honey for the table simply, has been in vogue for perhaps centuries back. If the room is small, and made perfectly dark, the hive being placed back a few feet from the entrance in the wall, the bees will seldom swarm. One or more sides of the hive are generally removed, and the bees build their combs on the outside of the hive, or against the walls of the room, where the owner can go with knife, plate, and smoker, and cut out a piece for the table, without opening any hive, or disturbing anybody. In fact, he can consider this his "honey-room," and leave the honey stored there year after year, if he chooses. When a friend calls he can say, "Will you have a slice of new honey? or will you have one a year old? or two years old?" He might even have it ten or a dozen years old, for aught I know, if he has a taste for antiquated honey. Would not such a honey-room be nice? While writing about it, it has occurred to me that a room of this kind, fitted up with all modern appliances, might be a very pretty and a very useful thing. With the experience I have had in the house-apiary, however, I am inclined to think that, where there is so much room, there would be a great disposition in the bees to loaf and cluster on the sides of the room, in the shade, instead of going to work. Now for the objections.

If the hive and honey are close by the entrance, the bees will swarm as much as in the house-apiary. If it is a yard or more back from the wall, the bees, not being able to take wing in the dark, will crawl all this distance on foot, which would prove a great loss of time and strength, and, consequently, of honey. Providing the plan succeeds, you get a good crop of honey year after year, it is true; but you have all the time the efforts of only a single queen. While your honey increases, your gathering force is no more, after the lapse of ten years, than it was before. If one colony is all you want, this may be all right. The queen can not live more than three or four years, and at her demise a new one must be reared and fertilized. For some reason, I know not what, she is very often lost in these garrets, and the colony dies of queenlessness. Worst of all, they will often swarm, and keep swarming, until nothing is left of them; but I believe swarming is rather the exception, and not the rule.

DO BEES CHOOSE A LOCATION BEFORE SWARMING?

We have ample proof that they sometimes do; but whether such is always the case or not, we have no means of determining positively, so far as I can see. It is my opinion, that, although they usually do so, there are many exceptions. When a swarm of bees catches the fever by hearing the swarming-note of a neighboring colony, it seems difficult to understand that they could have selected their tree, and made the same provision for housekeeping that the first one may have done. The proof of this has been given many times through our journals. A neighbor of ours once saw bees going in and out of a tree, and supposing that it of course contained a colony, went with his boys the next day, and cut it down. It contained no sign of a bee. While they were standing still and wondering at this strange state of affairs, the boys, doubtless joking their father about his seeing bees where there were none, lo and behold! a swarm appeared in the air. They came to the very spot where the now prostrate tree had stood, and seemed as much astounded as a colony whose hive has been moved away. After some circling around they clustered in a neighboring tree, and were hived. They had selected this as their home, it seems, and an advance party had gone ahead the day before, to clean out and fix the hollow ready for the swarm, and it was these house-cleaners that my friend saw at work. I gave the above in GLEANINGS a few years ago, and a large number of corroborating instances were furnished by our readers. The number of bees that go out to look up a location is not usually great, but they may often be seen about swarming-time prowling about old hives, and hollows in trees, as if they were looking for something. After awhile, swarms come and take possession of these places, if they seem suitable, and of late a hope has been expressed, through the journals, that we might take advantage of this disposition, and fix hives so attractive that the bees will come out, select the "house and lot" that suits their taste best, and then, when they get ready, "move in." When this is accomplished we shall have automatic hiving.

DECOY HIVES.

Many of the friends have followed out the idea given above, by locating hives in the forests, in the trees, and such hives have in many cases been quickly accepted and appropriated. I believe we are indebted to Mr. J. H. Martin, Hartford, N. Y., for first suggesting the idea. Hives left standing on the ground in the apiary have many times been selected by swarms, and, if I am correct, the bees, in such cases, often come out of the parent hive, and go directly to these hives without clustering at all.

One of our bee-keepers in California, by trading and otherwise, had something over a dozen empty hives. Having no immediate use for them he packed them up in a couple of tiers, about six high each. Each hive contained four or five combs, spaced so as to prevent the ravages of the moth miller. One day, by accident he discovered some bees going into one of these empty hives. On examination he found that a swarm of bees had taken possession. His curiosity being now aroused, he examined some of the other empty hives. He kept on until he found six good swarms, each nicely housed, without any effort or expense on his part. In a few days more, the remaining hives were filled with absconding swarms. When the swarming season closed he had 17 colonies secured. The point is this: By accident he had stacked up his empty hives in tiers, so that they resembled trees in the forest. Having combs in them, and entrances open, they were an inviting place for a passing swarm. My brother, Mr. M. S. Root, of California, had a similar experience, and I believe that others elsewhere have become possessors of swarms in the same way. In view of this I would suggest having a few hives scattered, say, through an apple-orchard, in the shade of trees, each of these hives to be equipped with dry combs and a wide-open entrance ready for the reception of a possible swarm. Perhaps it might be advisable to have one or two hives perched in the limbs or the crotch of one of the large trees. If the combs are spaced two inches apart there will be no trouble from moth millers. in case the hives should not be lucky enough to secure a swarm.

RINGING BELLS AND BEATING PANS TO BRING DOWN A SWARM OF BEES.

The books, of late years, have seemed to teach that this practice is but a relic of superstition, and that no real good was accomplished by the "tanging," as it is often called. Perhaps it usually has no effect in causing them to alight; but from watching the habits of swarms, I am inclined to think otherwise. Those in the habit of seeing queens on the wing are generally aware that the note they give when flying is quite different from that of a worker or drone; and many times, when a queen has escaped while being introduced, I have detected her whereabouts by the sound of her wings, before I had any glimpse of her at all. With a little practice we can distinguish this note amidst the buzzing of a thousand bees flying about, so as to turn our eyes upon her when she is quite a distance away. Is it not likely that the bees composing a swarm know this sound[384] as well as we do, or much better? Again, a swarm of bees usually has scouts to conduct them to the tree, or other place of their chosen abode, and it is quite likely they follow these scouts, and know of their presence as they do their queen, by the sound they emit from their wings. A noise, if loud enough, would be likely to drown these sounds, and thus produce disorganization. Throwing dirt or gravel among them will bring them down generally quite speedily, and I suppose it is because it produces disorganization much in the same way.

In concluding the subject of swarming I would ask the reader's attention to an excellent article on the subject, written by G. B. Peters, of Council Bend, Ark., given below.

NATURAL SWARMING, AND ITS ATTENDANT CLUSTERING.

When bees swarm naturally, why do they collect together on some object, and not fly directly to the woods after leaving the parent hive? This was a question which excited my juvenile attention when I was ten years of age.

The ancient and honored custom of ringing bells, beating on tin pans and other sounding things, I had often noticed, and to my childish mind it appeared to be all-important in stopping the swarm when on the wing. It happened that the family were absent at church, on one occasion, and I at home lolling on the greensward, or playing among fruit-trees and roses, when the bees swarmed and clustered as readily as they could have done if all the Callithumpian troupe had been there on duty; and I had the pleasure afterward of boasting to papa that I had hived the bees without noise or assistance. He said some persons borrowed excitement from the agitation and roaring of the swarm, and rang bells more from an ecstatic impulse than from a sense of its necessity; and he had no objection to such persons thus enjoying themselves, but that it had about as much to do in settling bees as the jargon of trumpets, gongs, and horns, used by the ancient heathen, had in frightening away the evil genius that eclipsed the sun, as they supposed. It was manifest to my young mind, that there was a cause for bees fixing on bushes or other objects, and, after observation, I established the fact, long before Langstroth threw out the suggestion of a reconnoitering party.

The bee is impelled in all its operations by instinct alone, which in some cases is so remarkable that some authors have attributed to it the power of rational conception.

When a swarm issues from a parent hive, either with an old or a young queen, they appear confused until they cluster, when they become docile and quiet. Why did they cluster there? Because they were homeless little wanderers, and instinct directs them to sojourn awhile until a set of explorers shall have discovered some cavity in cliff or tree, suitable for a future habitation. A number of scouts, varying from 30 to 50, leave the swarm before it is fairly settled, to explore the country in search of a cavity suitable for the propagation of their species, which is the end and aim of all insect creation. If these scouts are not successful, the swarm may be hived and permitted to remain in the same place and do well; but if they are successful, and on returning find the swarm where they left it, or near the place, they will immediately lead it away. Queen, workers, drones, all take wing, rise high in the air, and abandon old home, kin, and every thing, for ever, and no effort of the bee-keeper can arrest them. This result of a successful scout is as sure to transpire as night to follow the day. Perhaps one in a hundred will go straight to the forest without fixing on any thing; but in such cases they have been delayed from some unknown cause in swarming, been lying outside the parent hive, and have selected their home before issuing forth. I have seen that occur three times myself, and they move differently from the absconding bees that have clustered before starting. Now, those runaways went straight out of the hive to a hollow tree, moving slowly and near the ground, scarcely above your head, and I followed all of them to their place of abode, once on foot, twice on horseback, and very easily kept pace with them; they took a "bee-line" from the hives to the hollow trees not exceeding a half-mile off. I suppose all such have found a hollow near by. I noticed a revolving lot of bees in each, about five feet through, leading the van with a hissing sound not unlike the sound of bees when exasperated. That sound is in plain contrast with the roaring of the great body of bees that follow in the rear, and it is that peculiar sound that makes bees frantic with the impulse to follow it, so that they can not be prevented short of actual destruction.

I will remind the reader here that bees have different sounds to accomplish different ends. The only natural sound of bees on the wing is that produced by the returning laborer when she comes, at even, laden with spoils collected from some flowery field. Who has not been charmed by such industrious energy, as those mellow tones died in the entrance of the hive? The shrill note of the pugnacious defender of the hive is familiar to every child. The sharp sound of bees just beginning to lead out a swarm heralds its advent to the apiarist, and is very different from the two former sounds. The coarse bass roaring of the swarm before it begins to cluster is heard only when they are in search of the queen, and is kept up by both workers and drones; then follows the sharp cutting sound as they begin to cluster, to call the colony together, which is well known to the bee-keeper as the signal of congregating. Then the shrill hissing sound of the escort that leads them to the woods blends with the roar of the rear part of the swarm, making a strange compound heard only from absconding bees. Then again, in that "happy hour" when they have found a house, we hear the happy hum made by a peculiar position of body, and indicating peace and contentment. Also a sound of distress, when annoyed by smoke or enemies, rings through the hive, and no wail of misery from any other insect tribe can equal it. Finally we have the ventilating sound at the entrance and all through the hive, which in hot weather may be heard quite a distance. All these different sounds are instinctively associated with certain purposes, and the movements of the queen are generally governed by them. She thus follows certain sounds as do the whole colony. She never *leads* the swarm, but is attracted by the roaring mass; and when she enters a new hive there follows an air of quiet, which security induces. If she is lost, or has stayed, after awhile her faithful children will leave the hive, and in wild confusion look for their mother, giving out a sound of despair differing from all other sounds.

In settling this dense forest country (Mississippi-River bottom) I deadened large tracts of land for future cotton-fields. I found many bee-trees in these deadenings when divested of foliage. In winter time I would cut them down, saw out a segment of the tree, including the hive when it was not smashed by the falling, place them upright as they originally stood, and leave them to swarm next spring. Having 40 or 50 such stands, I made a specialty of seeing them every day between 10 and 2 o'clock, during swarming-time, and saved many new colonies. In riding one day through the deadening, I heard the shrill noise of escort bees, and soon discovered about 50 circling about a tree, ascending to the branches, then going to the nearest tree, and circling, descending to the very roots, and continuing ascending and descending from one tree to another, taking in saplings even, until I was led by them unconsciously to one of my bee-tree colonies, and there hung a swarm in the bough of a small tree, and into that swarm they went. I was sure that was a band of bee-scouts, and, believing they had returned without finding a hollow tree, I hived them, and, to test my theory, let them remain on the spot. They did well. Thus I deduce the following conclusions which I know to be practically useful to the bee-keeper who prefers natural swarming: 1. They cluster to afford opportunity for the explorers to find a new habitation. Many times they fail to find one, and in *that case alone* the new hive may be permitted to remain where they clustered; but if the explorers find a home, they conduct the whole colony directly to it. 2. As the swarm is watching for the return of scouts, it is necessary to hive them without delay; and as soon as they are quiet, remove them a distance from that place so as to thwart the returning scouts. 3. The new colony will never flee to the woods unless the scouts conduct. I have kept a regular account, running up to one hundred and eighty-two colonies thus treated, and never had one to leave the hive. There are apparent exceptions; for instance, a colony clustering in the full rays of the sun on a hot day will be driven off by its scorching rays to seek a more congenial resting-place. Another exception is where bees in a dry, sterile country, if they ever swarm at all, are almost sure to take wing, in order to find a more favored region where their instinct suggests that the pabulum of bee-life may be more abundant. G. B. PETERS.

Council Bend, Ark., Sept. 22, 1876.

SYRIANS. See HOLY-LAND BEES, under ITALIANS.

T.

TEASEL (*Dipsacus*). The Greek name of this plant signifies to thirst; because the heads, after flowering, are of a porous nature, and "drink" large quantities of rain water. On account of this property, the heads are often used to sprinkle clothes, before ironing. They take up the water, and, when shaken, throw it out in a spray.

TEASEL (*Dipsacus Fullonum*).

The variety that produces honey is the one used by fullers in finishing cloth, and hence its name, *D. Fullonum*, or fullers' teasel. This plant, like the buckwheat and clover, is raised for another crop besides the honey, and therefore may be tested by the acre without so much danger of pecuniary loss, should the honey-crop prove a failure. Our friend Doolittle pronounces the honey remarkably white and fine, but some others have given a somewhat different opinion.

From what I can learn, I am inclined to think teasel does not yield honey every year; it grows in considerable quantities by the roadsides and in waste places in our locality, but I very seldom see bees on it. Perhaps acres of it under high cultivation might make a great difference, as it does with any other plant.[218] The following letter from G. M. Doolittle, of Borodino, N. Y., gives a very full account of the method pursued in its cultivation.

The plant is biennial as a rule, although a part of the plants (the smaller ones) may not produce heads till the third year, and in that case they are called "voors." The ground is prepared much the same as for corn, being marked but one way, the rows being from 3 to 3½ feet apart. The seed is then sown, and, as a rule, left for the rains to wash the dirt over it, as it is sown as early in the spring as the ground can be worked. Some, however, slightly brush the seed in. The plants, when they first come up, are very small, and the first hoeing is a tedious operation, being about the same as that required for beets or carrots. The plants are hoed, or *should* be, three times. Farmers usually raise a part of a crop of beans or turnips with them the first year. One heavy drawback on teasel culture is, that they are very liable to winter-kill by having a thaw, and the weather turning cold suddenly, so as to freeze the plant when there is water in the crown, which entirely destroys it. An open winter is very bad for teasels. The second year, during the month of May, they are passed through with a cultivator, and slightly hoed, when they are left to run, as it is termed. The "kings," as they are commonly called, are heads at the top of the stalks, and commence to blossom about July 10th, continuing in bloom about a week or 10 days, opening first in the center of the head, blossoming toward the tip and base, and ending off at the base. As soon as the blossoms fall off they are cut, cured, and shipped to manufacturers for the purpose of taking the nap from cloth. The "middlings," as they are termed, commence to blossom when the kings are about half through, and the "buttons" come last, making from 20 to 25 days of bloom from the commencing of the kings to the ending of the buttons. The middlings and buttons receive the same treatment as the kings, and all are mixed and sold together. They are sold by the thousand, 10 lbs. making a thousand. An acre will yield from 100 to 250 thousand. At present they bring about 75c. per thousand, but years ago the price was from $2 to $5.00. Bees work on them all hours of the day, and, no matter how well basswood may yield honey, you will find them at work on the teasel at all times; and I have never known teasel to fail to secrete honey, except in 1876.

The honey is very thin, and much evaporation is required to bring it to the consistency of basswood honey when first gathered. We have many times thought, if teasel could come just after basswood it would be of great value; but, coming as it does *with* basswood, it is of no great advantage, except that it usually lasts from 6 to 8 days after basswood is past. G. M. DOOLITTLE.

Borodino, N. Y., Dec. 10, 1877.

TOADS. These, without question, are an enemy to the honey-bee. They usually plant themselves before the entrances of the hives about night-fall, and, as the heavily laden bees come in they are snapped up with a movement that astonishes one who has never witnessed it. His toadship sits near the alighting-board, with an innocent, unconcerned look, and, although you see a bee suddenly disappear, it is only after you have repeatedly witnessed the phenomenon that you can really believe the toad had any thing to do with it. By observing very closely, however, you will see a sort of flash, as the bee disappears, accompanied by a lightning-like opening and shutting of his mouth. The bee is taken in by his long tongue, and I should judge that he is capable of striking one with it when as much as two inches distant. I do not know how many bees it takes to make a meal, but I do know that toads will often become surprisingly thick about the hives during the honey-season, if they are not driven away by some means. I have been in the habit of killing them; but I must confess, my feelings revolt at such severe measures, and I much prefer the plan given by a friend, as follows:

During last season I noticed large numbers of toads hopping about my apiary; and having often seen them eat bees, I devised a plan to dispose of them as follows: I made a pair of wooden tongs, and, with a deep tin pail, I went into the apiary just after sundown one evening, and in a short time picked up, with the tongs, 32 toads; and it was not a good day for toad-hunting either. Well, what should I do with them? I did not really like to kill them, so I took them on to the bridge and dumped them into the Tuscarawas River, telling them to swim for life. About a week after that, I disposed of 16 more in the same way. A. A. FRADENBURG.
Port Washington, O., Nov. 3, 1879.

TRANSFERRING. I firmly believe that *all* of our readers can do their own transferring, and do it nicely, if they will only make up their minds that they *will* succeed. If you are awkward and inexperienced it will take you longer, that is all.

It has so often been said, that the best time is during the period of fruit-blossoms, that it seems almost needless to repeat it. Be sure that you have cleared away all rubbish from about your box hive or gum, for a space of at least 6 feet all round. I would decidedly prefer to have the hive stand directly on the ground with all rough and uneven places filled up with sawdust nicely stamped down. Make it so clean and tidy that you can find a needle if you should drop it, and be sure you leave no cracks or crevices in which the queen or bees may hide or crawl. Make all these arrangements several days beforehand if possible, so that the bees may be fully acquainted with the surroundings, and be all at work; remember we wish to choose a time when as many bees as possible are out at work, for they will then be nicely out of the way. About 10 o'clock A. M. will probably be the best time, if it is a warm, still day. Get all your appliances in readiness, every thing you can think of that you may need, and some other things too, perhaps. You will want a fine-toothed saw, a hammer, a chisel to cut nails in the old hive, tacks and thin strips of pine (unless you have the transferring-clasps), a large board to lay the combs upon (the cover to a Simplicity hive does "tiptop"), an old tablecloth or sheet folded up to lay under the combs to prevent bumping the heads of the unhatched brood too severely, a honey-knife or a couple of them (if you have none, get a couple of long thin-bladed bread or butcher knives), and lastly a basin of water and a towel to keep every thing washed up clean. Now, as I have said before, this is really, a great part of it, women's work; and if you can not persuade your wife or sister, or some good friend among the sex to help, you are not fit to be a bee-keeper. In saying this I take it for granted that women, the world over, are ready and willing to assist in any useful work, if they are treated as fellow-beings and equals. The operation of transferring will afford you an excellent opportunity to show your assistant many of the wonders of the bee-hive; and in the *role* of teacher, you may discover that you are stimulating yourself to a degree of skill that you would not be likely to attain otherwise.

A good smoker will be very handy; but if you have not one, make a smoke of some bits of rotten wood in a pan; blow a little smoke in at the entrance of the hive, tip the old hive over backward, and blow in a little more smoke to drive the bees down among the combs; let it stand there, and place the new hive so that the entrance is exactly in the place of the old one; put a large newspaper in front of the new hive and let one edge lie under the entrance. The returning bees, laden with pollen and honey, are now alighting and going into the hive, and rushing out again in dismay at finding it empty; we therefore want to get one comb in for them, to let them know that it is their old home. Move the old hive back a little further, in order to get all round it, and give them a little more smoke whenever they seem disposed to be "obstreperous;" and now comes the trial of skill and ingenuity. The problem is, to get those crooked, irregular combs, out of that old hive, and then to fix them neatly in the movable frames as in the cut on next page.

Your own good sense will have to dictate much in this matter. Saw off the cross-sticks, if such there be, and with your thin knife cut the combs loose from one side; cut off the nails and pry off this side, but don't get the honey running if you can help it, so as to start robbers. When the side is off, you can probably get one comb out. Lay it on the folded table-cloth, take out the comb-guide, lay the frame on the cloth, and let some one else cut it so as to require that the frame be sprung slightly to go over it. With the clasps he can cut and fasten the combs in as fast as you can take them out; if sticks and tacks, strings or rubbers be used, it will take some longer. When the frame is to be lifted into a horizontal position, the board, cloth and all, is to be raised with it. With the wash-basin and towel, keep the honey neatly wiped up. If robbers begin to annoy, cover both hives with a cloth while you are fitting the combs, and keep the brood in your new frames in a compact cluster, as it was in the old hive, or some of it may get chilled. When you get near the central combs, you will probably lift out large clusters of bees with the comb;[222] these are to be shaken and brushed off on the newspaper. If they do not seem disposed to crawl into the hive, take hold of the edge of the paper and shake them up toward the entrance; they will soon go in. A paper is better than a cloth, for they can not stick fast to it. If you carefully fixed things before commencing, so there was no crack or crevice into which a bee could crawl, except into the entrance of the new hive, and if you have been careful—as you always should be—to avoid setting your (clumsy) feet on a bee, you certainly have not killed the queen, and she is in one hive or the other. To be sure she is in the new hive, shake all before the entrance when you are done, and see that *every* bee goes into the hive. Save out the drone comb, and melt it up, unless fit to be used in sections. At any rate we don't want it in the brood-chamber. Utensils and bits of comb that have much honey daubed on them may be put in the upper story for the bees to clean up; but if the weather is cool, keep the quilt down over them closely for a day or two. I would look them over carefully every day or two, and as fast as they get the combs fastened, remove the clasps or other fastenings and bend the combs into place.

Each operation is very simple and easy in itself, if you go about it at the proper time and in the right way. Bear in mind that the bees, from first to last, are to be kept constantly in subjection, by use of the smoke, and that you must never let them get the faintest idea that, by any possibility, *they* can become master. Send them back among the combs as often as they poke their heads out, until they are perfectly subdued, and hang in quiet clusters, like bees at swarming-time.

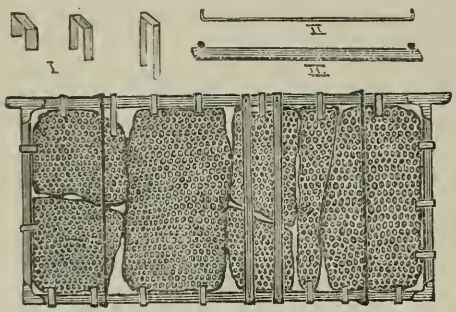
It makes no difference which side up the brood-combs are, in transferring; turn them horizontally from their original position, or completely upside down, as you find most convenient. Store comb, in which the cells are built at an angle, would perhaps better be as it stood originally; but if you do not get it so, it makes very little difference; the bees have a way of fixing all such matters very quickly.

WHEN TO TRANSFER.

Several inquire if I would advise them to transfer bees in the months of June, July, August, etc. I really do not see how I can answer such a question, not knowing the persons. Among our neighbors there are those who would work so carefully that they would be almost sure to succeed; and again, there are others who would be almost sure to fail. I am inclined to think those who make these inquiries would be quite apt to fail, for the careful ones would go to work without asking any questions, and do it at *any* season, if they were sufficiently anxious to have it done. Bees *can* be transferred at any month in the year. If in June or July, you will need an extractor to throw out the honey from the heaviest pieces, before fastening them into frames. The spring has been decided to be the best time, because there are then less bees and less honey, as a general thing, than at other times. The bees will fix up the comb better, when honey enough is being gathered to induce them to build comb to some extent, and the period of fruit-blossoming seems to secure all of the above advantages more fully than any other season.

APPLIANCES FOR FASTENING IN THE COMB.

We generally use transferring-clasps. These are made of pieces of tin of various sizes, from 2½ to 5 in. in length, and from ¼ to ⅜ in. in width. They are bent twice, at right angles, so as to slip over the top-bars. Thin slips of wood, something like comb-guides, are sometimes used by tacking them to the bars of the frame. Others wind fine binding wire clear around the frames. There is still another plan, by the use of bent wires, which I shall call transferring-wires. The wires, and the manner of putting them on, are shown in the cut below.



TRANSFERRING CLASPS, WIRES, AND STICKS, AND THE MANNER OF USING THEM.

These wires have one advantage over the clasps, from the fact that they can be removed without lifting the frames from the hive. Just slip off the top and twist the wire half around, and it can be drawn right up. They also possess another very decided advantage. They support the lightest bottom-bar until the comb is all firmly waxed into the frames, and hanging from the top-bar like a comb built on it naturally.

This cut is not presented as a model of transferring, but only to show how the various wires, clasps, and sticks may be used. Indeed, it does not pay to fuss with such small pieces of comb Combs made from foundation wired into the brood-frames are so far superior that it is poor policy and false economy to use any thing but the largest and best pieces of worker comb. It certainly does not pay to use such small and irregular pieces as are shown in the cut.

We always use and recommend frames wired with two diagonal wires; i. e., a wire passing from, say, the upper right-hand corner to the center of the bottom-bar; thence to the upper left hand corner. After the comb or combs are cut to the right size, crowd the frame over as far as the wire will let it. With the end of the transferring-knife follow the path of the wire, cutting down to the midrib or base of the comb. Imbed the wire in the knife track, and then put in the clasps or other fastenings if necessary. If the combs are well fitted, the diagonal wires will be sufficient. Such transferred combs are good and strong, and, while not as strong as the wired frame shown under FOUNDATION, they do very well.

If you have many weak colonies in your apiary you may transfer a colony, and divide the combs and bees around among those needing it. In this way you can have the combs all fixed and disposed of very quickly.

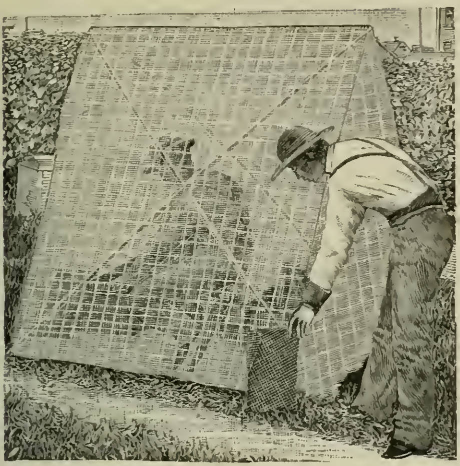
One who is expert in the business should transfer a colony in an hour, on an average; I have taken a heavy one from a box hive, and had it completely finished in 40 minutes. Where the apiarist goes away from home to do such work, the usual price is $1.00 for a single colony, and less for more than one, according to the number.

Some bee-keepers drum out the bees before transferring. The drumming is done by placing a box or hive over the old one, and drumming on the sides of the latter, until the greater part of the bees are up in the box and can be lifted off.[225] After having practiced both ways, I can not but think the drumming a waste of time, and a needless annoyance to the bees. If you work properly the bees should keep bringing in pollen and honey during the whole time; and if you place their brood-combs in the same relative position to each other, they need scarcely know that their outer shell has been exchanged for a different one. Should the bees seem troubled by the different appearance of their new home, the front board to the old hive may be leaned up over the entrance for a few days.

TRANSFERRING WHEN THE BEES ARE DISPOSED TO ROB.

I have recommended the period during fruit-bloom, because at such a time the bees usually get honey enough to prevent robbing. Should it be necessary, however, to do it a little later, say between fruit-bloom and clover, use a mosquito-bar folding tent.

Bring your bee-tent and all the necessary tools for transferring, and stand them near the old box hive. Lay on its side the box hive to be transferred, and with a cold-chisel cut the nails so that one side can be removed.[389-226] After the side is taken off, arrange every thing into as compact a space as possible. This done, step inside the tent and grasp the intersections and "spread" yourself, as it were, over your work. You will then appear like the apiarist in the folding bee-tent shown below.



TRANSFERRING WITH THE TENT.

The operator inside has the old hive from which he is transferring, together with the new hive and all necessary fixtures for holding the combs in the frames. Besides these he has a saw, chisel, uncapping-knife, smoker, bee-brush, a large shallow drip-pan to catch drippings of honey, and clean wired frames. To make his work as easy as possible, he sits on a tool-box. In case he wants a frame or tool which by oversight he does not happen to have, an assistant, who may be engaged elsewhere in the apiary, at a call brings him whatever he desires. In the engraving you observe the assistant is in the act of passing an empty comb under the mosquito-netting.

You may think that transferring in this tent is in pretty close quarters, but I have transferred in this way a number of times easily and successfully, and the tent proved no real hindrance.

TRANSFERRING INDOORS.

If the weather is bad or you have no transferring-tent, you can, if you choose, carry the hive and all into some convenient outbuilding, or into your honey-house, to do the transferring. If you can work before a door with a window in it, all the better; but if no such door is at hand, do the work before a window. When you are through, place the new hive with its combs on the old stand, take out the window, and shake the bees on to the newspaper before the entrance and they will all go in.

A SHORT WAY OF TRANSFERRING FROM BOX HIVES.

A little before swarming-time, pry the top from your box hive and set a single story hive over it, making all the joints bee-tight. Now hang frames filled with fdn. in this new hive, and the bees will soon work up into it. After the queen gets to laying in these combs the bees will soon all move up into it and you can lift it off, and transfer, or do what you please with the old hive and combs. When you are hurried, this plan gets your stock gradually into improved hives, without very much trouble, and no mussing with dripping honey.

HEDDON'S SHORT WAY OF TRANSFERRING.

Where we have a good many colonies, and can afford foundation, Heddon's method will commend itself as being much more expeditious and more easily performed, although at the expense of some otherwise good combs and drone brood. The loss of the latter will be welcomed in most apiaries. In two or three days, instead of patched and uneven combs, we shall have nice, straight well-wired and all-worker combs. There are no transferring-clasps, sticks, etc., to remove. The method as published in *Gleanings in Bee Culture*, Vol. XIII., page 562, is as follows:—

About swarming-time I take one of my Langstroth hives, containing eight Given pressed wired frames of foundation, and, with smoker in hand, I approach the hive to be transferred. First, I drive the old queen and a majority of the bees into my hiving-box. I then remove the old hive a few feet backward, reversing the entrance, placing the new one in its place, and run in the forced swarm. In two days I find eight new straight combs with every cell worker, and containing a good start of brood. Twenty-one days after the transfer I drive the old hive *clean* of all its bees, uniting them with the former drive, and put on the boxes if they are not already on. If there is any nectar in the flowers, this colony will show you box honey. I run them together as I would one colony in two parts. Now to the old beeless hive. Of course, there is no brood left, unless a little drone-brood, and we have before us some combs for wax, for more foundation, and some first-class kindling-wood.

If you have no method by which you can use a full hive of frames, of full sheets of foundation, running a full swarm into them at once, by all means procure it without delay. But if any one has a mania for cutting up combs and fitting them into frames, my method given above does not prohibit them from using all the straight worker-combs the old hive contains, after first extracting the honey from them. Should any one wish to increase his colonies at the same time he transfers, only the following deviations from the above are necessary: Run the second drive into another hive of full frames of foundation, and use the old hive as before. Now that we have foundation perfected, so that the bees will draw the lines or side walls to full breeding depth, in from two to three days, why fuss with the old comb from the old hive? Having once experienced the advantages to be attained by using the above method, I shall certainly never go back to the old one. All of you know what a nuisance a few odd-sized hives are in the apiary; also some who have just started wish they had adopted some other style of hive. The above method of transferring will get all such out of their trouble.

The cost of foundation and new hives is fully made up by the better combs, and you have the change to better style of hive thrown into the bargain. I have thoroughly tested the results of the plan herein described, and am speaking from experience.

We have just practiced the above upon 72 colonies, and without a failure or mishap of any sort. I purchased 16 colonies of bees; that is, I purchased the bees, brood, and honey, with the agreement that I should return the hives and empty combs, which I have done. We made each one cover two sets of combs in two brood-chambers, with two queens, besides the surplus sets used above for extracting, and all are rousing strong. When you plan to double your colonies, you remove the old colony to an entirely new location, when you make the first drive. It is now my opinion, that, even without the use of comb foundation, in the days when we had none this plan of transferring would have been the preferable one. As we are cutting out the old combs for wax, we transfer any that we find, that are *perfect*, now that they are all clear from bees and brood.

JAMES HEDDON.

Dowagiac, Mich., Aug. 6, 1885.

TURNIP. The turnip, mustard, cabbage, rape, etc., are all members of one family, and, if I am correct, all bear honey, when circumstances are favorable. The great enemy of most of these in our locality (*especially* of the rape), is the little black cabbage-flea. The turnip escapes this pest by being sown in the fall: and were it not that it comes in bloom at almost the same time that the fruit-trees do, I should consider it one of the most promising honey-plants.

In the summer of 1877, Mr. A. W. Kaye, of Pewee Valley, Ky., sent me some seed of what is called the "Seven-top turnip," saying that his bees had gathered more pollen from it, in the spring, than from any thing else. I sowed the seed about the 1st of Oct., on ground where early potatoes had been dug. In December they showed a luxuriance of beautiful green foliage, and in May, following, a sea of yellow blossoms, making the prettiest "posy-bed," I believe, that I ever saw in my life, and the music of the bees humming among the branches was just "entrancing," to one who has an ear for such music. I never saw so many bees on any patch of blossoms of its size in my life, as could be seen on them from daylight until dark.

Friend K. recommended the plant particularly for pollen; but, besides this, I am inclined to think it will give a large amount of honey to the acre. We have much trouble here in raising rape and mustard, with the small turnip beetle, or flea; but this turnip-patch has never been touched; whether it is on account of sowing so late in the fall, or because the flea does not fancy it, I am unable to say. The plants seem very hardy, and the foliage is most luxuriant, much more so than either the rape or Chinese mustard, which latter plant it much resembles, only having larger blossoms. As our patch was sown after the first of Oct., and the crop could easily be cleared from our land by the middle of June, a crop of honey could be secured without interfering with the use of the land for other purposes.

Friend K. also recommends the foliage for "greens," and says that he sows it in his garden for spring and winter use. We tried a mess of greens from our patch in December, and found them excellent. Our seed was sown very thickly, in drills about one foot apart. *This* turnip bears only *tops*, and has no enlargement of the root.

If I could get a ten-acre lot covered with such bloom during the month of August, I should not hesitate an instant to hand over the money for the necessary expenses. If we can not get the blossoms in August, we can certainly have an abundant supply between fruit-bloom and clover.

Turnip seed is valuable for the oil made from it, and also as a food for canary birds. If sown on corn-ground at the last cultivating, the plants will gain a good hold before winter, and in the spring blossom profusely. If they are turned under just before going out of bloom they make one of the most valuable of soiling crops. Thus a good turnip pasturage may be obtained with no extra work, except sowing the seed, and the crop would be an actual benefit to the soil if turned under.

U.

UNITING BEES. Uniting colonies is much like introducing queens, inasmuch as no fixed rule can be given for all cases. It is a very simple matter to lift the frames, bees and all, out of one hive and set them into another, where the two are situated side by side. Usually there will be no quarreling, if this is done when the weather is too cold for the bees to fly, but this is not always the case.[227] If one colony is placed close to one side of the hive, and the other to the other side, and they are small enough for a vacant comb or two between them, they will very rarely fight. After two or three days, the bees will be found to have united themselves peaceably, and the brood and stores may then be placed compactly together, and your chaff cushions put in at each side. If there are frames containing some honey, that can not be put in, they should be placed in an upper story, and the bees allowed to carry it down.[228] You should always look to them 20 minutes or half an hour after they are put into one hive, to see if every thing is amicable on "both sides of the house." If you find any bees fighting, or any doubled up on the bottom-board, give them such a smoking that they can not tell "which from t'other," and after 15 or 20 minutes, if they are fighting again, give them another "dose," and repeat until they are good to each other. I have never failed in getting them peaceable after two or three smokings.

If you wish to unite two colonies so large that a single story will not easily contain them, which, by the way, I feel sure is always poor policy, or if their honey is scattered through the whole ten combs in each hive, proceed as before, only set one hive over the other. If this is done on a cool day, and the bees are kept in for two or three days, few, if any, will go back to the old stand. If the hives stood within six feet of each other, they will all get back without any trouble anyway, for they will hear the call of their comrades who have discovered the new order of things. Sometimes you can take two colonies while flying, and put them together without trouble, by making the lost bees call their comrades. Only actual practice, and acquaintance with the habits of bees, will enable you to do this: and if you have not that knowledge, you must get it by experience. Get a couple of colonies that you do not value much, and practice on them. As I have said all along, beware of robbers, or you will speedily make two colonies into none at all, instead of into one.

WHAT TO DO WITH THE QUEENS.

If one of the colonies to be united has been several days queenless, all the better; for a queenless colony will often give up its locality and accept a new one, if simply shaken in front of a hive containing a laying queen. From a hive containing neither queen nor brood, I have induced the whole lot to desert, and go over to a neighboring colony, by simply shaking some of the bees in front of it. They were so overjoyed at finding a laying queen, that they called all their comrades to the new home, and all hands set to work and carried every drop of honey to the hive with the fertile queen. By taking advantage of this disposition we can often make short work of uniting. If you are in a hurry, or do not care for the queens, you can unite without paying any attention to them, and one will be killed; but, as even a hybrid queen is now worth 50 cts., I do not think it pays to kill them. Remove the poorest one and keep her safely caged until you are sure the other is well received by the bees. If she is killed, as is sometimes the case, you have the other to replace her.[229] Where stocks are several rods apart, they are often moved a couple of feet a day while the bees are flying briskly, until they are side by side, and then united as we have directed. This is so much trouble, that I much prefer waiting for cold weather. If your bees are in box hives, I should say your first job on hand is to transfer them. If you have several kinds of hives in your apiary you are about as badly off, and the remedy is to throw away all but one. My friends, those of you who are buying every patent hive that comes along, and putting your bees into them, you little know how much trouble and bother you are making yourselves for the years to come.

In conclusion, I would advise deferring the uniting of your bees until we have several cold rainy days, in Oct., for instance, on which bees will not fly.[230] Then proceed as directed. If you have followed the advice I have given, you will have little uniting to do, except with the queen-rearing nuclei; and with these, you have only to take the hives away and set the frames in the hive below, when you are done with them. If the hive below is a strong one, as it should of course be, just set the frames from the nucleus into the upper story, until all the brood has hatched. If you wish to make a colony of the various nuclei, collect them during a cold day, and put them all into one hive. If you have bees from 3 or 4, they will unite better than if they came from only two hives, and you will seldom see a bee go back to his old home. A beginner should beware of having many weak colonies in the fall, to be united. It is much safer to have them all strong and ready for winter, long before winter comes.

UNITING NEW SWARMS.

This is so easily done that I hardly need give directions; in fact, if two swarms come out at the same time, they are almost sure to unite, and I do not know that I ever heard of two such swarms quarreling. One of the queens will very soon be killed, but you may easily find the extra one by looking for the ball of bees that will be found clinging about her, very soon after the bees have been joined together. A swarm can almost always be given without trouble, to any swarm that has come out the day previous; and if you will take the trouble to watch them a little, you may unite any swarm with any other new swarm, even if it came out a week or more before. Smoke them when inclined to fight, as I told you before, and make them be good to the new comers.[231]

UNITING BEES IN THE SPRING.

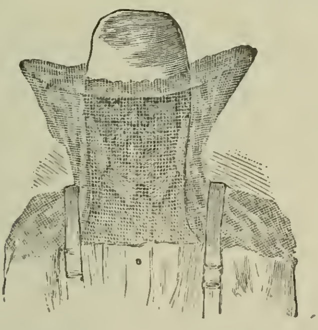
During our spring-dwindling troubles, some years ago we used to unite a stock that has become queenless to one having a queen, or to unite two or more weak stocks, to enable them to go through the spring months. The process is much like uniting in the fall. Lift out the frames and put them together, watching to see that they are friendly to the new comers. Bees are often united in the spring for the purpose of securing great results in honey; and by uniting the bees and brood, great amounts may be obtained from what might be called a single swarm.

V.

VEILS. The necessity of using face protections will depend very largely upon the race of bees to be handled. If you are to deal with hybrids, Cyprians, or Holy-Lands, I would recommend you to wear a veil. With pure Italians it is not so necessary, still I always prefer to have one handy. Its use will, in any case, give the apiarist a sense of security that will enable him to work to much better advantage than he would if continually in fear of every cross bee that chanced to buzz near his eyes.

There are two great objections to the use of veils; one is that they necessarily obstruct the vision more or less, and the other is that they obstruct the free circulation of air, which is so desirable in hot weather, and thus tend to make the wearer sweaty, uncomfortable, and perhaps nervous.

The very *nicest* veil is one made entirely of silk tulle,[232] although it is somewhat more expensive. The material is so fine that a whole veil of it may be folded so as to go in a small vest pocket. I carry one of these constantly during the working season of the bees, and it is always ready for an emergency. It neither obstructs the vision nor prevents the free circulation of air on hot days. A cheaper one, though not so light or cool, is made of grenadine with a facing of silk tulle net sewed in. It is a stronger veil, but not as cool as the one made entirely of silk tulle. The grenadine is strong, and the brussels-net facing obstructs the vision but little if any. The top of the veil is gathered with a rubber cord, so that it may be made to fit closely around the crown of the hat.



BEE VEIL AND HAT PREFERRED BY THE BOYS AT THE HOME OF THE HONEY-BEES.

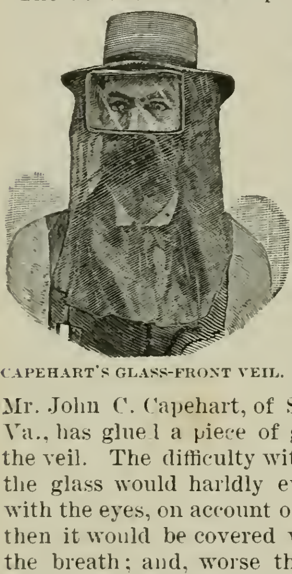
Our boys wear a broad-brimmed cloth hat, costing about 20 cents each. These hats are very light, and will fit any head, and can be folded so as to put in a coat-pocket. The under side of the brim is green. The upper side of the crown is of a drab color. This broad brim is supported and held out by means of a steel hoop; and when the veil is placed over the hat, if properly drawn down it can not touch the face or neck, and hence leaves no possible chance for stings. During hot days, when bees require the most attention in the apiary, a coat or vest is simply intolerable. In the absence of either one of these the corners of the veil are drawn under the suspenders, as shown. This is much cooler than coat-collar fashion, and just as secure from the attacks of bees. When the bees become quieted down you can lift the veil up out of the way. Should you, by a careless movement, arouse the ire of your pets, you can quickly draw the veil down and pull it under the suspenders in a twinkling. But this could not be done as quickly with the coat-collar. As the crown of the hat is only cloth, on very hot days the boys are in the habit of putting plantain or grapevine leaves in the top. These are an additional protection, and keep the top of the head cool.

HOPATCONG HAT AND VEIL.

One of our boys has used with much satisfaction what is called the Hopatcong. It is a hat that is worn in India and other hot countries, and is slowly working its way into this country, particularly in the South. It is made of palm-leaf, and it is supported above the head in the manner illustrated on preceding page. The cut will render further description unnecessary.

As light breezes can circulate above and around the head, it is perhaps the coolest sun-shade of any herein illustrated and described. If you can not secure one of these, and would like to get the ventilating feature, take an ordinary palm-leaf hat several sizes too large. On the inside of the hat-band sew four or five ⅜-inch corks that have been cut in halves lengthwise. These, if spaced at regular distances, will keep the hat from the head, and permit ventilation.

There are several descriptions of bee-veils.

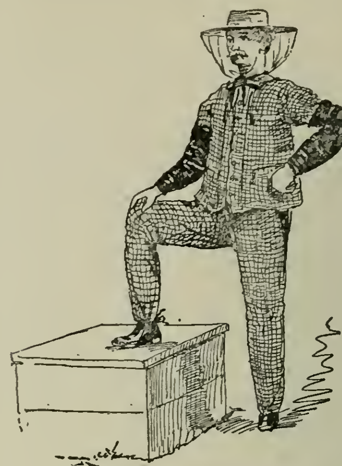


CAPEHART'S GLASS-FRONT VEIL.

I will now describe some of the bee-hats that have been suggested by some of the subscribers of *Gleanings*. I have before remarked, that one objection to bee-veils is the obstruction to the eyesight. To overcome this, Mr. John C. Capehart, of St. Albans, West Va., has glued a piece of glass in front of the veil. The difficulty with this was, that the glass would harldly ever be in range with the eyes, on account of its weight, and then it would be covered with steam from the breath; and, worse than all, it would get broken. The brussels net is open to none of these objections, and it is almost as transparent as glass itself.

Mr. J. H. Martin, of Hartford, N. Y., in *Gleanings* for March 1, 1889, illustrated and described not only his bee-hat, but his bee-suit. His description and illustration are as follows:

In a clothing-store I found what is called an engineer's suit — overalls and short coat, or blouse, made of blue and white checked cotton cloth, the whole weighing only 1¼ lbs.— cost "zhust von tollar, zhust a fit, and zhust the thing." The beauty of this suit is the certainty of complete protection to your Sunday clothes if you choose to wear them; and the price enables you to own two suits, and wash often, and to be always clean. Then there are plenty of pockets, fore and aft, for pencils, jack-knives, screw-drivers, queen-cages, toothpicks, etc. There are those who may possibly object to appropriating or adapting an engineer's suit to bee-keeping; but, friends, if a mortal man or woman, conducting an apiary of two hundred colonies of bees, isn't an engineer, who else, indeed, is worthy of the name? When extracting honey, or at work with stickiness that is certain to get on my arms, I put on an additional set of sleeves.



J. H. MARTIN'S BEE-SUIT.

For head-wear I prefer a stiff straw hat, with a 3½-inch brim, over which a silk brussels-net veil is worn in the ordinary way. To hold the veil snug around the neck, I prefer a stout cord with a slip noose.

Mr. W. L. Coggshall, of West Groton, N. Y., an extensive bee-keeper, having 600 colonies, in *Gleanings* for June 1, 1889, described a similar suit. He says of it:

COGGSHALL'S BEE-DRESS.

My idea of a bee-veil is shown in the accompanying photograph. It is simply a wide-rimmed straw or leghorn hat, with a stiff rim—I right here went and got my hat to give you the measurements. The rim of the hat is 4 in. wide; the length of veil, up and down, 18 in., and the material is bobinet, or millinet, black. I sew the veil on the under side of the rim of the hat, 2 in. from the outer edge of the rim, thus giving a 2-in. projection to shade the veil, so that I can see at any time; for if the sun strikes the veil, I can not see eggs in the cells. I use a flat shoestring for a shir, or take-up, around the neck, and have all of the gathering in the sides and back of the veil. I sew the veil fast to the string. The shoestring is long enough to tie under the collar, so it is impossible for a bee to get at your face. There is not much gathering in front to obstruct the vision.

When I am not in the bee-yard, or going from one apiary to another, I untie and tuck it in the crown of the hat, and it is out of the way, and all ready at a moment's notice, which we all know is very convenient sometimes.

For hand-gear or false sleeves I use colored shirting. After they are made, dip them in linseed oil; hang them in the sun till dry, then the bees can not sting through them. I have a rubber elastic in the upper end above the elbow, also the one that is around the hand. Have a thumb-hole worked in above the elastic, so that the hand is all covered, except the fingers and thumb (like a mit), only the fingers are all together. With sleeves made in that way, bees do not crawl up my arms and make me uncomfortable, and give me pain. W. L. COGGSHALL.

West Groton, N. Y., April 21, 1889.

Mr. Martin and Mr. Coggshall both make use of sleeve-protectors. Both will be found exceedingly useful for protecting the hands and wrists, and they prevent them getting daubed.

BEE-HATS FOR WOMEN.

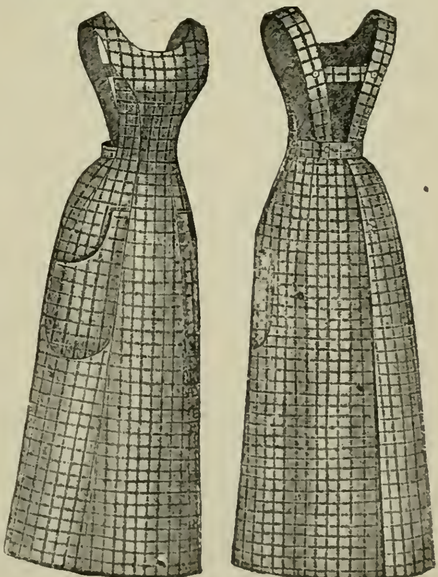
Mrs. L. Harrison, of Peoria, Ill., uses a bee-hat like the one illustrated above. The hat is made of green wire cloth; the top of pasteboard, and the bottom of calico.

Mrs. L. C. Axtell, of Roseville, Ill., another one of our prominent lady bee-keepers, one who produces large crops of honey, uses a head-wear like the one shown in the cut. It is simply a bonnet having a calico cape sewed to its lower edge and to its front. For the face, a piece is cut out large enough to receive a piece of wire cloth.

MRS. AXTELL'S BEE-HAT.

MRS. R. H. HOLMES' BEE-HAT.

Mrs. R. H. Holmes, of Shoreham, Vt., uses a bee-hat like that shown in the above cut. It is simply a straw hat with a broad rim, the veil being made of mosquito-bar, and the facing of brussels net. A strip of cloth lines the lower edge of the veil, and is made just large enough to fit snugly around the shoulders. A couple of cloth straps hitched to buttons pass under the arm-pits, and button on behind. Of the veils for women which we have shown, this one seems to me to be more desirable. Mrs. Harrison's hardly gives protection enough from the sun. Mrs. Axtell's would be too warm. Mrs. Holmes' is free from both objections, or, at least, to a great extent.



A BEE-APRON FOR LADIES.

The cut represents an apron preferred by Miss Emma Wilson, of Marengo, Ill. It has two large pockets. The pattern, No. 3696, can be obtained of the Butterick Publishing Co., of New York. This apron is large enough to cover the whole dress, with the exception of the sleeves. But detachable sleeves, something like those used by Mr. J. H. Martin, or Mr. Coggshall, as shown in the engraving just opposite, are preferred. Miss Wilson prefers to wear gloves, as does Mrs. Harrison. The gloves which seem to be preferred are something in the kid or dog-skin line. Rubber gloves do not seem to answer the purpose very well.

HOW TO GET ALONG WITHOUT A VEIL.

It is a very great convenience to be *able* to dispense with a veil altogether, when circumstances call for or permit it. The only obstacle in the way is a natural dread that a bee may possibly sting in the face if he had a chance. This dread has usually to be worn off as you become more and more accustomed to handling and working with bees. When you are without a veil, if a bee comes up, and, by his hum, you detect that he is angry, do not dodge or strike at him, but control the muscles of the face as perfectly as though you were not at all aware of his presence. A little wince of the cheek or of the eye will encourage his fighting qualities. A careless, indifferent behavior, on the other hand, shows him you are not afraid of him, and he therefore very sensibly concludes that there is no use in wasting a sting for nothing. Sometimes I put my hand up to my face when one of these rascals persists in his annoyance. Should he actually begin to sting, I smash him. In your community you will probably acquire the reputation of a bee-keeper, and, as such, when you are suddenly called upon to hive a swarm of bees without preparation, for a neighbor, it would be a little unbecoming, and perhaps a little humiliating, for you to show signs of fear. You should learn to "astonish the natives" barehanded and barefaced, and you need not incur risk, either, if you manage rightly.

VENTILATION. Bees get it, ordinarily, through the entrance, and through the cracks and crevices which are generally found in even the best-made hives, providing the hive is properly constructed in other respects considered under the head of WINTERING. I do not believe in holes made in different portions of the hive, and covered with wire cloth, because the bees persistently wax the wire cloth over, just as soon as they get strong enough to be able to do so. If we omit the wire cloth, they will, in time, build the holes up, by much labor, with walls of propolis, until they have effectually stopped the inconvenient drafts that the improved (?) ventilators would admit at all times through the hive. During extremely hot weather, a powerful colony may need more air than is afforded by an ordinary entrance, especially if the hive stands fully in the sun. In such a case I should much prefer giving the bees shade, to cutting ventilation-holes, which the bees will soon begin to use as entrances; and when the hot weather is over, and it is desirable to close these entrances, you confuse and annoy the bees by so doing.* On this account I would give all the ventilation that a strong colony might need to keep them inside at work in the boxes, by simply enlarging the entrance. This can be done very readily with the Simplicity hives, and I have frequently given them an entrance, under such circumstances, the whole width of the hive, and as much as two or three inches broad. The chaff hive with its entrance 8 inches by $\frac{3}{8}$ has always had all the ventilation it seemed to require, because the sun can never strike directly on the walls of the apartment containing the bees and honey. For the same reason, the house-apiary with its two-inch auger-hole entrance has never required any further provision for ventilation. The chaff cushions placed over the bees in winter are kept over the surplus frames for the greater part of the time in summer, to confine the heat during cool nights; and from their porous nature they allow of the escape of more or less air that comes in slowly through the entrance, the honey-boxes having no other covering than the wide frames that hold the sections and these same chaff cushions. I have obtained more surplus honey with this arrangement than with any other, and am firmly persuaded that a great loss of honey often results from allowing such a draft of air through the hive that the bees can not work the wax, unless during the extremely warm weather. To test this matter I covered a large colony in the house-apiary with woolen blankets while they were gathering clover honey, to induce them to remain in the boxes, even after the weather had turned quite cool. So long as the blankets remained on, the bees would remain in the boxes working wax; but as soon as the blankets were removed, at each time the experi-

*A colony in a chaff hive with a full-width entrance winters best.

ment was tried, they retreated to the body of the hive. The same thing was tried with thin-walled hives out of doors.[233]

SMOTHERING BEES BY CLOSING THE ENTRANCE.

Although bees will make out to get along, even with a very small entrance, we should be very careful about closing the entrance entirely, in warm weather, even for only a few minutes. Many are the reports we get almost every season, of bees destroyed by simply closing their entrance, while undertaking to stop their swarming for a few minutes, until some other colony can be attended to. See SWARMING, ENTRANCES, and ROBBING, especially the last head. *How to Stop Robbing.*

When bees have the swarming fever, as a general thing they are gorged with honey, and in a feverish state. They are like a man who has been taking violent exercise after a hearty meal, and require more than an ordinary amount of air. Their breathing-tubes are in different parts of the body, principally under the wings; and as soon as the entrance is closed, they crowd about it; and when the heat of so many becomes suffocating, as it will in a very few minutes, the honey is involuntarily discharged, wetting themselves and their companions, and most effectually closing their breathing-tubes, in a way that causes death to ensue very quickly. I have known of heavy swarms being killed in the short space of fifteen minutes, when the hive was thus closed on them. The heat generated by the smothering mass will often be great enough to melt down the combs, enveloping bees, brood, honey, and all, in a mass almost scalding hot. Bees are sometimes smothered in this way, in extremely hot weather, even when they have very large openings covered with wire cloth. In fact, I have once or twice had bees, when shipped by railroad, in July and August, get hot and smother, when the whole top of the hive was covered with wire cloth. I took a lesson from this, and put wire cloth over both top and bottom of the hive, and then put inch strips across, so the hive could not be set down in such a way as to cover the bottom. When thus prepared, I have sent the heaviest colonies, during the hottest of summer weather, with hives full of honey, and had no trouble. See MOVING BEES.

HOW THE BEES DO THEIR OWN VENTILATING.

If you watch a colony of bees during a warm day, you will see rows of bees standing around the entrance, and clear inside of the hive, with their heads all one way, all making their wings go in a peculiar manner, much as they do in flying; but instead of propelling their bodies along, they propel the air behind them, and a pretty strong "blow" they get up too, as you may tell by holding your hand near them. Well, if the air is very hot and close inside the hive, so much so that there is danger of the combs melting down, they will manage so as to send cooling currents clear to the furthest parts of the hive, and even up a small hole into honey-boxes, where honey-boxes are made after such old-fashioned patterns. This idea is not by any means new, and those who have invented patent ventilators will tell us, with a very fair show of reason, how many bees are thus employed blowing through the hive, that might just as well be out in the fields gathering honey. I once thought so, and that ventilators were needed; but after watching the matter longer, I concluded the harm done by excessive heat was far less than that from cold drafts when they were not needed, and that it is better to let a few of the bees waste some time in the middle of the day, than to have comb-building stopped entirely at night, on account of the drafts given by these thoroughly ventilated hives. The most prosperous colony I ever owned was one that was so completely enveloped in chaff that they sent a stream of warm air out of their hive during frosty nights in March, strong enough to melt the frost about one side of the entrance. Of course, a stream of cold air went in at the opposite side, as fast as the warm air went out. When I can get a hive into this condition of things, they always prosper; and it is on this account that I would have no other arrangement for ventilation than that furnished by the entrance. See WINTERING.

VENTILATING QUEEN-CAGES DURING SHIPMENT.

This is a very simple matter, during quite warm weather, for all we have to do is to have a broad surface of wire cloth, and they will then be sure to have enough air. When queens are to be shipped during cool weather, it is desirable to have them tucked up as warmly as may be, and still have all the air they need. Wood for cages is much better than metals, because it is a non-conductor of heat, and also because it prevents stickiness from their food, by absorbing portions that the metal would not absorb. If the bees or queens become daubed, they very quickly suffocate, for the reasons I have given above.

VINEGAR. This seems to merit a place in our book as being one of the legitimate products of honey, and, doubtless, in many localities it may be profitably manufactured. and sold as honey vinegar — especially since the recent low prices of extracted honey. As I have had but little practical experience in making vinegar from honey, I give you the following letters which have appeared in the back volumes of GLEANINGS:

We make several barrels of vinegar every year, and sell it to the folks in town, at 25 cts. per gallon, and have had no trouble so far to sell all we had. The demand is increasing every year, selling to some of our merchants' families who are selling vinegar at their stores, which they buy of the trade in Chicago. I asked one merchant's wife why she bought my vinegar. "Oh!" he said, "the store vinegar eats up my pickles." It takes two pounds of honey to make a gallon of vinegar, and two years' time to make. We make the most of ours out of refuse honey, or honey that we can not use for any other purpose, and would otherwise be lost or wasted. We retail a large quantity of honey; and when the honey is candied there will be considerable left sticking to the sides of the barrels. We always wash out all the barrels we expect to use again. The first washing that takes off the honey, we put in the vinegar. It is clean; it is nothing but honey and water. Then, again, when we are extracting honey we have a box with a wire-cloth bottom which we set over a barrel that has the upper head out. Into this box we put what cappings we have to drain out the honey. In 24 hours we empty those cappings into a barrel that has some water in it, to soak out what honey remains, straining them once or twice a day. The barrel will hold what cappings we get in a week. About once a week we strain out the water and put it in the vinegar and melt the cappings into wax, so there is nothing lost. I don't like to see any thing thrown away that we can use. Again, there is always more or less honey that can be made into good vinegar that is not just fit to sell for nice honey. In that way it is saved.

To know when the water is sweet enough for vinegar, put in a good fresh egg, and make the water sweet enough to float the egg so there will be a patch of the shell out of the water about as big as a silver 10-cent piece; then it is about right. We keep ours standing in barrels, with one head out, to give it air; for air it must have to make vinegar. Tie a square yard of cheese-cloth over the top of the barrel, to keep out dirt and flies, and other insects. Keep under cover out of the rain, in a warm dry airy place. We keep ours standing in one corner of our shop through the summer, and put it down in the cellar through the winter, and take it up again when spring comes. When we are changing either in the fall or spring, we find some that is fit for sale. We take it into our dwelling-house cellar and put it into our retailing barrels, which we keep there for that purpose. I have been thinking of late whether it would not be a good plan to make up all our cheap honey into vinegar; but I don't know how much it could be sold for at wholesale. I must look this matter up. It may be that we can do something in this direction to relieve the market of our low-priced honey. Honey is getting to be so plentiful and cheap that we must turn it into every channel that will take it.

Platteville, Wis. E FRANCE.

I can give my testimony in favor of honey vinegar. We have used no other for two years; and nearly every one who tastes our pickles asks my wife for her recipe for making them. When told that we used nothing but honey vinegar, they are surprised, and say that they have always heard it would not keep pickles. The only trouble that we have had is, it keeps getting stronger and stronger, and we have to occasionally put in some water. As we have used only the waste honey from extracting, we can not give the proportions of honey and water, but usually have it too sweet at first, and have to add more water. If it does not sour enough, we put it in a keg and set it in the sun with a black junk-bottle in the bung. G. W. GATES.

Bartlett, Tenn., May 29, 1876.

The following, which we extract from the *American Bee Journal* for 1883, page 143, contains several hints in regard to the matter of making vinegar from honey:

"The cappings should be put into a dripper and allowed to remain about 24 hours, then put into as much water as you may reasonably expect to sweeten a little sweeter than good new cider, with the cappings that you expect to have. I fill an ordinary whisky-barrel with water, and the honey from the cappings, in extracting 1000 of honey, usually makes it sweet enough. The cappings are left in the water an hour or two, then skimmed out and put into a strainer to drip dry, which they will do in 10 or 12 hours. The drippings are, of course, saved and put into the barrel.

"This slightly sweetened water soon begins to 'work,' and the scum may be taken off with a wire cloth, or other skimmer, as often as necessary, until nothing rises. This sweetened water passes through all the stages of fermentation, the same as cider, until it reaches the point called vinegar. One year, perhaps less, makes it such vinegar as you saw at Kalamazoo. We have used no other vinegar in our family for 20 years, except a year or two when we first came to Michigan, 14 years ago, when I had no bees.

"There is, probably, no profit in making honey vinegar from good salable honey, but in keeping bees there is often waste honey that is of little value. I know of no manner of getting cappings ready for making into wax that is so convenient and profitable, and the vinegar is known to be pure.

"I keep the barrel covered with a cotton cloth, and there is not much danger of getting the water too sweet. If very sweet, it takes longer to get it to vinegar; but it is better when it does get there."

Abronia, Mich. T. F. BINGHAM.

HOW TO MAKE A HONEY-VINEGAR HOUSE.

In *Gleanings* for April 1st, 1887, page 267, there are two articles on making honey vinegar. I have made and sold honey vinegar for the last four or five years, but I have never used good salable honey in its manufacture. I sell about 100 gallons a year to my neighbors, and the reputation of my vinegar is such that some of my customers have driven out to my apiary, three miles from Brandon, rather than buy vinegar at the stores.

When I read the articles mentioned, I noticed that there was quite a difference of opinion between the two authors. Since then I have been experimenting.

I built what I call my vinegar-factory. It is not a very large or pretentious building, but it is able to turn out 200 gallons of No. 1 vinegar in a season. The building is 5 x 7 ft. high on the south side, and 6 ft. on the north, with shed roof sloping to the north. The roof and sides are painted dark brown. There should be no shade to keep the sun from shining on it all day long. The sides are made of shiplap, which gives plenty of ventilation, and is bee-proof. There is a window, 2 x 7 ft., extending across the south side, 4 ft. from the bottom. The building cost about $6.00. On the inside there is a shelf 20 inches wide, one foot high, on which to set three barrels so that their tops will be even with the bottom of the window, and to permit the vinegar being drawn through faucets near the bottom of the barrels. The shelf is supported on stakes driven in the ground. There is a door in the north side, wide enough to admit a barrel. The barrels are covered with a piece of cheese-cloth, and on that a cover of thin boards is made.

For convenience in describing operations we will number the barrels in the vinegar-house 1, 2, and 3. I generally have about a barrel of partly made vinegar in the fall, which I keep in the cellar during the winter. In the spring, when the weather becomes warm, I put about half of this in barrel No. 3, one-third in No. 2, and the remainder in No. 1. When I have any waste honey or washings from honey-cans, or candied honey soaked from combs, it is put in No. 1. I test the sweetened water in No. 1 with the 35-cent hydrometer. When it sinks to 11 on the scale it is about right when it is not soured, and contains about 2 lbs. of honey to the gallon. If the sweetened water is soured some, the hydrometer should sink to 8 or 9. Good vinegar tests about 3 on the scale of the hydrometer. When that in No. 3 becomes good vinegar it is drawn off and put in the cellar, and that from No. 2 is transferred to No. 3, with enough from No. 1 to fill the barrel about half full. No. 2 is filled half full from No. 1. To obtain the best results, the barrels should be kept about half full. If the vinegar in the cellar is kept cool, and the barrels bunged tight, mother will not form on it, and it will keep almost any length of time. One pound of honey will make one gallon of vinegar, as good as most of the cider and white-wine vinegar that is sold; but to make strong No. 1 vinegar it requires 2 lbs. of honey to the gallon. Most of the honey that I use for making vinegar is the thin honey which I skim from the top of my extracted honey directly after extracting.

Brandon, Ia. G. D. Black.

Some one inquired whether honey vinegar is good or not. I will say yes; the best there is made. It will not die nor lose its strength like most other vinegars, and you can have light or dark vinegar as you take light or dark honey to make it from. You can make what are called sweet pickles with it, without any fear of spoiling. Last season a neighbor's family bought honey vinegar of me to do their choice pickling with when they had cider vinegar of their own make, as it was so much better, they said, than cider. I can not give any rule for making it, as I have made it from the washings of vessels used in extracting, and of the cappings after the honey was pretty well drained out. R. R. Murphy.

Fulton, Ills., May 6, 1876.

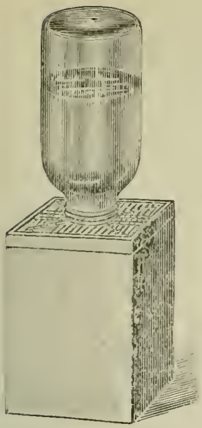
Another friend, H. A. Palmer, of Madora, Iowa, says, "One pound of honey will make three gallons of better vinegar than one can buy."[234]

W.

WATER FOR BEES. That bees need water, has been pretty well demonstrated; but the best means of supplying them has not been very satisfactorily settled. The amount of water needed depends much on whether they are rearing brood in considerable quantities or not, and whether their food is old, thick (possibly candied) honey, or new honey right from the fields. If the latter, it contains usually a large quantity of water that must be expelled before the honey can be considered ripened. See VENTILATION. Well, while the bees are gathering this thin, raw honey, as a matter of course they will not need much water, if any at all, besides what the honey affords them. This new honey is frequently so thin that it runs out of the combs like sweetened water, when they are turned horizontally; and when tasted, it seems, in reality, but sweetened water. The excess of moisture is probably — I say probably, for I do not know that we have positive proof on the matter — expelled by the strong currents of air the bees keep circulating through the hive, which takes up the watery particles, and speedily reduces the honey to such a consistency that it will not sour. If you will examine a hive very early in the morning during the height of the honey-season, you will find the blast of air that comes out, quite heavily charged with moisture; and when the weather is a little cool, this moisture often condenses and accumulates on the alighting-board, until it forms a little pool of water. Where the alighting-board was of the right shape to retain the water, I have seen it so deep as to drown bees in passing out. These bees, it would seem, were at least in no need of having water supplied them. While I am on the subject, I will mention another way which, as I have discovered, the bees have of expelling the liquid portions from very thin honey. I guess I will say it is the way in which I *think*[236] they do it, for I may be mistaken. I had several colonies in a small greenhouse for experiment. They were fed on sweetened water until they stored a large amount in their combs. When the sun warmed up the air in the morning, they would come out in great numbers and sport in the sunshine; and by taking a post where they came between my eye and the sun, I distinctly saw them discharge from their bodies what seemed to be only pure water. These bees had been fed until they had their hives so full of the thin syrup that they had even crowded out the eggs. When coming out of their hives, they seemed heavily laden; but those returning were so much reduced in size as to make quite a contrast to those going out. By watching the matter, it seemed quite plain that they took the thin food into their stomachs, and, after a time, longer or shorter, were able to expel the liquid portion while on the wing, and then return the thick portion to the cells. If I am in error in this, I should like to be corrected. It may be well to state in this connection, that honey, no matter how thin, will never sour while in the hive, under the care of a sufficient number of bees; but if a comb of this thin honey be taken away from them, and kept outside of the hive, it will sour very quickly.

OPEN-AIR FEEDER.

Get a board about a foot square, and with a saw, or saws, such as we use for grooving the ends of the pieces composing the section boxes, plow grooves from one end of the board to the other, being careful that they do not run quite out. Now with a single saw, cut a groove from each corner to the opposite one, and a couple more across the grain of the wood, near the middle, and the board is done. These grooves should be about ¼ inch deep, and about the same distance from each other. Invert the jar of water on the center of the board, and the grooves will keep just full of water, as long as any remains in the jar, and yet



WATERING-JAR AND BOARD, OR OPEN-AIR FEEDER.

they will never run over. The bees can stand on the walls of wood that separate the grooves, as well as on a sheet of their own comb, and with as little danger of getting daubed or wetted. Now, this arrangement makes perhaps the best feeder ever invented, for open-air feeding (see FEEDING and FEEDERS); for all we have to do is to use sweetened water, instead of water only. Put a pound of granulated sugar in the jar, fill up with water, cover it with your hand, and shake briskly, and it is ready for business. Lay a paper over the mouth of the jar, as before, invert it on the center of the board where the grooves cross, draw out the paper, and, if it is at a time when robber bees are hovering about, some one will soon find it. After the first bee has gone home with one load, he will bring others back with him, and pretty soon the board will be covered with them, sipping like a lot of pigs out of a trough. As the syrup goes down in the grooves, air will be allowed to come in, and you can see, by the bubbles rising in the jar, just how fast they are taking the syrup.

After the bees get well at work, a bubble will be on its way to the surface in the jar almost constantly, and the liquid is carried off by the little fellows at the rate of about 1 inch in 10 minutes. This empties the ½-gallon jar in about an hour and a half. Not a bee is daubed, and they flit away to their hives as easily as if they had loaded up from the blossoms on the trees. This feeder answers admirably for feeding grape sugar; for all we have to do is to fill the jar with lumps of it, and pour in water until it is filled, and then invert as described. The passage of the bubbles upward tends to dissolve the sugar rapidly. Old, thick, or candied honey may be fed in the same way; and when the bees stop, the feed stops coming down into the grooves. This will, perhaps, be the best arrangement we can have for feeding sugar to keep brood-rearing going on, during a season of drought or scarcity.

If you wish to give a supply of water that will last them a month or more, it may be well to get a large glass bottle or carboy, at the drug-store, and your bees will then have water during the season, all they can use. Where there is a spring near you that can be conducted to the apiary, a very pretty watering-place can be made. Be sure that it is so arranged that the bees can not get drowned. A little fountain, where the spring is high enough to allow it, is a very pretty addition to the apiary. I once had one made with an iron vase, perhaps eighteen inches across. This basin was always full, and overflowing slightly; and during the warm weather all summer long, bees would be sipping the water around the edge; sometimes they stood side by side clear around the edge of the vase, making a sight that was enough to call forth exclamations of surprise from almost anybody, bee-keeper or not. The fountain was supplied with water from a large pine box, placed on the roof of the wood-house, the former supplied

FOUNTAIN FOR GIVING BEES ACCESS TO WATER.

by the eave-spout from the upright part of the building. When the box was full it ran over on the roof and down into the cistern as usual, so the arrangement required no special supervision, so long as we had rain as often as once a week. The connection between the box and the fountain near the apiary was by ½-inch iron pipe. The bees never drowned in this fountain, because the vase was always full and overflowing. If a bee flew in, or got pushed in by his companions, he soon buzzed over to the side, and walked out, having no perpendicular sides to climb up.

A stop-cock, not shown in the cut, is at the lower part of the jet. This is to regulate the supply of water. During a dry time it is to be turned so as to just keep the vase full. and the same during windy days. when the water would be blown away. When we had still evenings, the jet was opened so as to throw a stream perhaps six feet high. Around the fountain we had flowers of different kinds. It is hard to imagine a prettier adjunct to an apiary than a watering-fountain surrounded with flowers humming with busy laborers.

During some experiments in the same greenhouse I have mentioned, I put a small colony into the lamp-nursery, and warmed it up until their hive indicated over 100 degrees. The bees then went out, and began flying around the room as if in quest of something. I fixed the same watering-jar I have mentioned in one corner of the room, and they pretty soon found it and were busy carrying water into the hive as fast as they could load up and unload. By turning the lamp up or down so as to increase or diminish the temperature, I could easily make them stop and commence carrying water, at pleasure. Does not this seem to indicate that hives should be shaded, during the extreme heat of the summer weather? Colonies in the same room whose hives were not warmed showed no disposition to gather water at all, although they were rearing brood in considerable quantities.

SALT WATER FOR BEES.

At times, bees unquestionably show a fondness for salt water, and I presume they should have access to salt in some way, as well as others of the animal kingdom. It is generally agreed. I believe, that horses, cattle. sheep, etc., must have salt, or they will suffer. I know of no reason why bees should not come under the same law. They seem to have a preference for it in a much diluted form, and are very often seen eagerly hovering over barrels containing refuse brine. I have seen them eagerly digging in the sawdust, where brine had been spilled or thrown out, showing their craving for it. During the preceding years, a great many plans have been given for feeding bees salt, but none of them are any simpler or easier than the one for giving them water, which I have already illustrated. It may be well to have two watering-places, one with the water salted, and the other of pure water.

If no place is furnished for the bees to get water, they usually go to creeks or puddles near by. Our own have quite a fashion of congregating about the kitchen pump, and Mrs. R. says she knows they hear the pump; for just after water has been drawn, they come in considerable numbers, and sip the water that is spilled around on the stones. A good many times this is quite a nuisance, and has been the cause in several instances of trouble between the bee-keeper and his neighbors. Mr. A. N. Draper, of Upper Alton, Ills., says that a weak solution of carbolic acid painted around the place where bees congregate—that is, around the edges of watering-troughs and the like, will keep the bees away entirely, and finally they will get out of the habit of coming. I have not yet tried the experiment. but believe it will work.

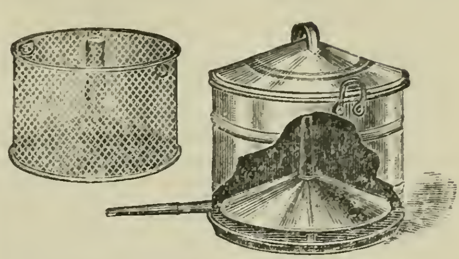
WAX. Whether bees make honey. or simply collect it, may be a subject of discussion ; but we believe there is no question in regard to wax, for bees do assuredly make it. If you have your doubts, however, just watch them closely during the height of the honey-harvest, or, what is perhaps better, feed a colony heavily on sugar syrup for about 3 days during warm weather. At the end of the second or third day, by looking closely, you will see little pearly disks of wax, somewhat resembling fish-scales, protruding from between the rings on the under side of the body of the bee ; and, if you examine with a magnifier, you will find these little wax cakes of rare beauty. Sometimes, especially when the bees are being fed heavily, these wax scales will fall down on the bottom-board and may be scraped up in considerable quantities, seeming for some reason to have been unwanted. During the seasons of the natural secretion of the wax, if the colony has a hive affording plenty of room for surplus, we believe these wax scales are seldom wasted. At the swarming-time, there seems to be an unusual number of bees provided with these wax scales; for, if they have remained clustered on a limb for only a few minutes, bits of wax are found attached, as if they were going to start comb. When they are domiciled in their new hive, comes the time, if the hive pleases them, for them to show their astonishing skill and dexterity in fabricating the honey-comb.

In the attempts that have been made to supply material for artificial comb, we have had a view of the wondrous skill with which nature supplies just what is needed for the safety and well-being of her creatures. Many substances seem, at first view, to have all the requirements needed ; but when we discover that the material must be sufficiently soft to be readily molded at the ordinary temperature of the hive, and yet be in no danger of melting down during the intense heat of midsummer, we see that perhaps no other material than just the wax they secrete can come anywhere near answering the purpose. Wax melts at about 145° in its natural yellow state, but becomes so soft that it may be molded by pressure at a temperature of about 100° or less. When this yellow wax is exposed to the sun and moisture in the shape of thin ribbons, it gradually loses its yellow color, and becomes white. Its melting-point is also raised by this change about 12°, yet it is still readily worked into comb if given to the bees during hot weather; and when raised up into cells, it has a most beautiful appearance of snowy whiteness. This, however, is soon soiled and colored, if left in the hive; for, neat as bees are said to be, they have a habit of running over the clean white combs with muddy, or at least dirty feet. With old and dark combs this might be unnoticed ; but in a hive furnished with combs made from bleached foundations, it becomes very apparent.

Like other folks, the bees seem more careful of their best rooms, for the surplus-honey boxes are kept much cleaner than the ordinary working-room, or brood-apartment, though this may not be intentional after all, for it is principally the young bees that have never been out in the fields, that work at comb-building and in the boxes. On this account, clean yellow wax, when used for foundations, will give very nearly as fine box honey, when filled and capped over, as does the bleached. As the latter is considerably harder than the yellow, it is not worked into comb as rapidly. When the bees are needing room they will frequently raise a whole sheet of yellow fdn. into very fair comb in a single night, while it would require nearly double the time, perhaps, to do the same with the bleached.

Until somebody shall discover a use for propolis, we shall have to consider the products of the apiary but two in number, wax and honey. It is true, bees and queens are now quite marketable commodities ; but as they are bought only for the wax and honey they may produce, they can hardly be considered as legitimate apiarian products.

The manner of getting the honey into a marketable shape has been very fully discussed, and great improvement has been made in this particular, within the past few years; but the operation of rendering the combs into clean nice wax, so as to be attractive to the eye of purchasers, has been very little improved since the time when our grandmothers used to boil them in a large kettle, and squeeze the wax from the melted mass through a cloth or bag, much in the way lard is expressed.



THE IMPROVED SWISS WAX-EXTRACTOR.

Our engraving given shows one of the best implements that was ever offered for sale. It is a modification of the original Swiss wax-extractor with the Jones improvement. The basket is made of perforated tin, and it is into this that the pieces of comb, cappings, etc., are to be put, and allowed to drain into a pan or some convenient vessel. It is true, you can put them into the extractor, honey and all, and then the spout will deliver both wax and honey into the pan or other vessel set to catch it; and when the wax is cold, it may be lifted from the honey below, in a solid cake ; but the honey is then dark, and fit only for vinegar, or for feeding bees ; whereas, if drained before being subjected to heat, we get the very best and nicest liquid honey, especially if it is cappings that are to be rendered ; because the honey that adheres to the cappings, is always that which has been sealed up. When the basket is filled with drained cappings, or bits of comb, the cover is to be removed, and the basket placed inside, resting on a conical-shaped piece of tin with a spout in the top. This funnel-shaped piece of tin (as shown where the side is cut away) is supported about an inch from the bottom by means of short legs. The wax dripping from the basket over the cone runs down into the shallow apartment below and out at the spout.

Now, to set the machine working we have only to supply steam through the basket. We do this by setting it over a pan or kettle of boiling water, or, what is better, a copper-bottomed steam-generator, often sold with the apparatus. The latter utensil will do very well to catch the drippings of the honey, if a cork is fitted tightly in the spout. I would advise you to keep the cover on and this tube corked at all times, if you do not wish robber-bees to learn that the machine is almost always a nice place for their depredations. If you do this, you can keep it in the apiary, and throw every bit of comb into it, as soon as found.

GALVANIZED IRON INJURIOUS TO WAX.

In making extractors, be sure there is no galvanized iron used. This, we have found by experience and to our sorrow, discolors the nice yellow wax, making it a greenish yellow instead of a bright color. I do not know that this discoloration renders it unfit for the bees; but you can never make nice yellow sheets of foundation of such wax. When melted into cakes, it does not present that nice pretty appearance that pure wax usually has.

CARY'S WAX-PRESS.

Mr. Wm. W. Cary, of Colerain, Mass., sends us the following description of a plan similar to the cider-press, which, I think, might prove of much value, if a large quantity of wax is to be got out, as is often the case where many stocks are transferred:

Make a boiler of good heavy tin, 18 in. square by 13 in. high, inside measure. Solder stout handles on two of the sides, and put a spout on one of the other sides, about 4 inches from the top. The spout consists of a tunnel, 3 in. in diameter at the top and 1 in. at the small end, and about 3 in. long, flattened at the large end so as to make it oval-shaped. This is for running off the wax, and the mouth of it should be 3 or 4 in. wide by 1 high on the inside of the boiler. Now cut out a hole on one side of the boiler, and solder on the spout, which will need a brace to hold it steady. Perhaps one of your molasses-gates for extractors would be a good thing soldered to this spout; we use a cork, however.

Now make 6 racks of pine strips, ½ inch wide by ⅜ thick. The slats should be planed on all sides. Cut them 17½ in. long, and take 2 strips ⅜ thick by 1 in. wide and 17½ in. long, and nail the other strips on crosswise, leaving ⅛ in. plump between them. Next, make a box 15½x15½, without top or bottom, and make it of ½-inch boards, 3 inches wide. This is what cider-makers call a form, or hoop, and is used for laying up the cheese. Now get burlap, such as the factories use for baling their cloth. Cut it into pieces 28 or 30 in. square. Five of these are enough, as 5 layers will fill the boiler. Now take the old comb and pound it up fine, lay down a rack, put on the form, spread on a burlap, and fill up with the comb; then double in the sides, raise all from the form, and place in the boiler. Fill 5 racks in this way, and put the 6th on top, and a board, for a follower, on top of this, with a block 6 or 8 in. square which should be fastened to the follower. Perhaps all this will make the boiler more than full, but it will soon settle down when it comes to a boil. A better way is to put the boiler on the stove, with 2 pails of water in it, before you commence. This saves time in heating, and the layers can be lowered in with hooks made of wire.

As soon as it has boiled 15 or 20 minutes, it is ready to press, which I do with a small jack-screw. You need a small frame, of course, to press in; this can be made with a screw in the upper beam, if desired, but the jack-screw does just as well. Now when your wax has boiled enough, take the boiler from the stove, place it under the press, and turn down your screw, and you will soon find the wax on top of the water. Proceed to draw it off by the spout. You will need a pailful or two of hot water to fill up with as the wax runs off. The wax should be all removed before the screw is loosened up, as it will stick to the racks and burlap. Skim the wax off with a paddle made of thin board or tin. If the screw is loosened once or twice, and the water allowed to soften up the pumice, it will get it out cleaner.

You need not be more than 15 or 20 minutes in pressing out a cheese, after it is boiled. A press of the size I have described will get out from 10 to 20 lbs. to a pressing, of as nice wax as you ever saw. If you have a good stove to heat on, you need not be more than an hour, or 1½ hours to a pressing, which gives a capacity of from 75 to 150 lbs. per day, more than 10 times the capacity of the steamer process; and again, it gets the wax out much cleaner. If you do not believe this, run some through the steamer, and then put it through a press of this kind. We had the bottom of a bee-hive full of pumice which had been through the steamer, and all the wax had been removed that we could get out by that process; then we put it through the press and got out 10 lbs. more. I tried the steamer for 3 or 4 weeks, and became disgusted with it, as it worked so slow. I got out more wax the first day after I made the press than I could in 10 days with the steamer.

Colerain, Mass., 1878. WM. W. CARY.

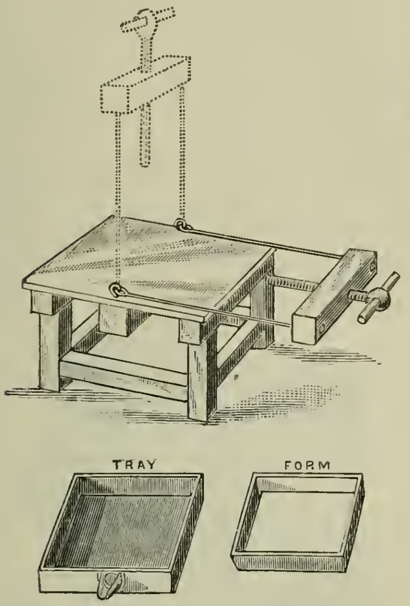
SOME FURTHER SUGGESTIONS ON ABOVE.

Perhaps you may remember I have always advocated the Cary wax-press as the best thing to get *all* the wax out of combs, especially if they are old. If any one has 100 lbs. of wax to render, the press will almost pay for itself on old combs; and for cappings and scraps of new comb it has the advantage of speed, as two hands can make from 200 to 300 lbs. in one day, while an extractor is crowded to make over 20 lbs. a day, with much fussing and annoyance to the women-folks. The press also has this advantage, that the wax is left in solid cakes, while the extracted wax must be caked after making, incurring another fussing job.

Last season I made my wax and some for my neighbors, on an improved press, which gave good satisfaction. I send you drawings, so you can give it to your readers if you like.

There all the combs are to be melted in the press-tank, which makes it very slow. My method is to melt the combs in another vessel, in my case a large kettle, out of doors, and then dip the melted combs and all that rises to the top of the kettle into the forms, and press at once. This makes the work continuous; for by the time one pressful is run out, another is melted in the kettle. Three or four pailfuls of water are kept in the kettle all the time; and when this once gets hot, wax soon melts in it. So much for the manner of working.

The improvement in the press consists, 1. in dispensing with the tank entirely, a tray with a "lip" taking its place, being only two inches deep; 2. the rigid side-pieces to the frame are hinged at the bottom so as to turn to one side out of the way while filling the press—two eyes, united at the bottom, making the hinge. In using the press in cold windy weather, an outside shell of boards to slip down over the "cheese" before pressing would be a help, for cold winds might cause the wax to congeal before running into the molds. Eighteen inches square is a good size for the tray, and 15x15 for the "forms." The form is made of $\frac{3}{8}$-inch stuff, 4 inches wide. The racks are made of three-cornered top-bars. The cloths are of burlaps, such as bran-sacks are made of. Wire nails, 1½ inches long, are used to pin the cloth together when building the "cheese." The screw is a common iron bench-screw, such as can be had at any hardware store.



HATCH'S IMPROVEMENT ON CARY'S WAX-PRESS.

Material to make a press should not cost over \$1.75, or \$2.00 at the outside. I am sure, if you would make one and use it on old combs, especially on scraps having much propolis among it, you would never want to "fuss" with a wax-extractor again.

Ithaca, Wis., Jan. 28, 1889. C. A. HATCH.

HOW TO RENDER WAX WITHOUT PURCHASING AN EXTRACTOR.

Get an ordinary wash-boiler that sinks into the fire-place of the stove. Put some strips of wood across, to keep the bags of wax from resting on the bottom, and burning. These strips are to be of such length that their ends rest on the ledge of the bottom part of the boiler. A frame similar to that mentioned by Mr. Cary would be very convenient; we have been using one made of wire cloth, but it is hardly stiff enough. Now, have some bags made of coarse strainer cloth, such as is known in the dairy regions as cheese-cloth. These should be about the size of grain-bags, but not as long. Squeeze your wax into balls in the hands, getting it into as small a compass as may be, and put it in the bags. Have bags enough to contain all the wax. These bags cost very little, as the cloth is only 8c. per yard. When you have as many packed into your boiler as you can get in, while the water is boiling, put on a board, with a heavy piece of iron on it. When the wax is all pressed out of the bags, the iron should be beneath the surface of the liquid; if it is not, add more water, or make the weight sink deeper. The wax, of course, is found swimming on the surface, and may be dipped off, or, if much is to be worked in this way, it will pay to have a spout or gate, as suggested by friend Cary. It is so difficult to clean the bags from the gum and propolis always found with old black combs, that I think I should throw them away, and use new ones each time. The more compactly the wax is put into the bags, the less number of bags will be needed.

Where one has cappings from the extractor, they should not be put with old dark combs, but worked by themselves, for they are almost pure wax. I have seen cappings from new white combs produce wax so nearly white that it would readily sell for bleached wax.*

The wax of commerce, when it is bought in quantities, is composed of cakes of all sizes and of all colors, from nearly white to nearly black, the intermediate shades comprising almost all the colors of the rainbow. Where it contains much refuse, it can be improved by putting it through either of the presses described above, and, in fact, almost any wax can be made cleaner and brighter by being put through the extractor two or three times. It has been our practice, in using it for fdn., to select the cleanest and nicest cakes for the thin fdn., to be used in the honey-boxes, and the darker for the brood fdn., for the latter, I think, is less liable to sag and stretch than the very light yellow. Wax, as it comes from the hives, varies greatly in hardness. Some specimens are so soft that it seems as if they could not stand the weight of the bees at all, when made into sheets of fdn., while others are so hard that it is difficult to roll them at ordinary temperatures. If I am correct, the soft wax can often be worked into comb better than the hard. This is because it does not continue

* JUNE, 1881.—We have just adopted a plan for rendering old combs by the use of steam, that is vastly ahead of all these given, both in quality of wax and rapidity of work. It is simply a large honey-barrel having a basket made of the perforated zinc suspended in it by a hoop that rests on the top of the barrel. A steam-pipe throws a strong jet of steam into this basket, and all one has to do is to shovel in the old comb in any quantity. The wax is found in the water below, and the refuse matter remains in the basket. The idea was partly furnished me by my friend D. A. Jones, of Beeton, Canada.

to soften, in the same proportion, as the temperature is raised. As an illustration, take paraffine. It is too hard to be worked ordinarily; but if warmed to the right degree, it makes beautiful-looking fdn. If given to the bees during moderate spring weather, it is worked out into beautiful comb, and filled with honey; but when the extreme heat of midsummer comes, these beautiful-looking combs, with their precious load of sweets, will soften and fall down into a heap. This fact I learned by experience that cost me a hundred dollars or more. The admixture of the least particle of paraffine is sure to give the wax a tendency to stretch and sag, and, on this account, I would not advise it; for it is a serious matter to send out fdn. that may endanger the life of a colony, by breaking down when heavily filled with honey. I have been told that, with wires stretched at frequent intervals, say every inch through the frame, it can be used without danger; but too many wires in a brood-comb are objectionable.

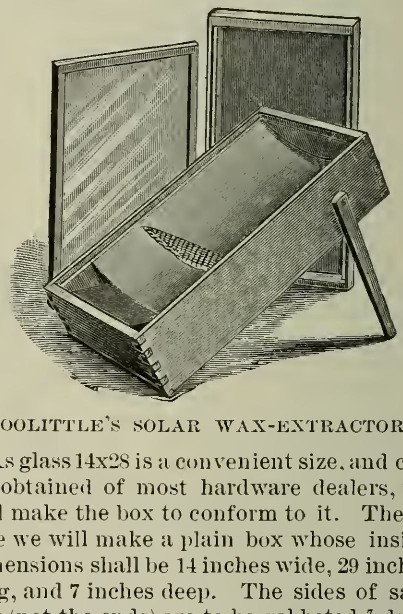
SOLAR WAX-EXTRACTORS.

For several years past, quite favorable reports have been received in regard to an arrangement for using the sun's heat. It is said, the idea first originated in California about the year 1862. At this time it was used for the purpose of extracting honey from the combs. The honey-extractor of to-day was then unknown, and so it is related that the early Californians extracted their honey largely by means of the sun's heat. They simply placed their cards of comb in large trays covered with glass, where old Sol, by the mere beaming of his countenance, did the work. As the combs melted, the honey and wax ran together, into a receptacle. In the evening, the wax, by reason of its lighter weight, is hardened and floating on the surface of the honey. The Californians thus practically accomplished two objects at one and the same operation, the extracting of both honey and wax—the latter already in marketable shape. As to the quality of the honey so separated from the combs, it is much better than one would suppose, being very nearly equal to the ordinary extracted.

Recently the use of the solar wax-extractor has been restricted to the melting of wax only. Among those who have, within a few years past, demonstrated the possibility and advantages of rendering old combs into wax by means of the sun's heat are J. P. Israel, O. O. Poppleton, J. A. Green, and G. M. Doolittle.

To a casual observer it seems almost incredible that wax can be melted by the aid of old Sol. It is well known to the bee-keeper, that little scraps of wax in summer weather will melt on a hive-cover exposed to the direct rays of the sun. If, therefore, we cover a shallow box with a sheet of glass, and place therein a piece of comb, said piece will utilize a much larger percentage of heat. Still further, if we collect more rays of the sun, and cast them into the box by means of a reflector (a sheet of tin, for example) a correspondingly greater increase of temperature may be expected.

These, then, are practically the principles of the solar wax-extractor, which I will now proceed to describe more at length. As the one devised by G. M. Doolittle, of Borodino, N. Y., seems to be the simplest, I will describe this one.



DOOLITTLE'S SOLAR WAX-EXTRACTOR.

As glass 14x28 is a convenient size, and can be obtained of most hardware dealers, we will make the box to conform to it. Therefore we will make a plain box whose inside dimensions shall be 14 inches wide, 29 inches long, and 7 inches deep. The sides of said box (not the ends) are to be rabbeted ⅜ deep and about ½ inch wide to receive the glass frame. The cover should be a similar box, but only 1½ inches deep, of the same dimensions otherwise, and is likewise rabbeted on the side rims. You will thus observe that the glass-frame 29 in. long and 14⅞ in. wide can be let down into the rabbets in the box, and that the cover slips over the whole thing, and makes a complete and neat box. The legs are 17½ inches long, and are pivoted with a screw, as shown in the engraving. The pan is simply a trough made of Russia iron, one end of which is closed up, and the sides are bent over a little bit so as to rest on the rabbets in the sides of the box. The wire screen is fastened about ⅓ of the way down, as shown in the engraving, or just far enough to admit of a Langstroth frame.

This extractor doesn't clog up, and the wax, when it melts, runs down an inclined plane, runs through the screen, and finally into the pan, and the pan is allowed to stand in the direct rays of the sun, the wax is kept liquid during the entire day, so that all foreign substances will settle to the bottom.

In this connection it may be interesting for my readers to know what temperature we are able to get. By use of Green's extractor, in Feb., 1886, with an outside temperature in the shade of 50° I obtained a temperature of 180°. On the 15th of March, with a somewhat warmer sun, the thermometer in the open air registered 65°; inside the extractor, 213°—1 degree above the boiling-point. In the afternoon of the same day I placed in a pan an egg which had been broken. A few minutes after, the egg was fried, but too hard and leathery to be fit to eat. Not being an experienced cook, I presume I left it too long.

With these facts before us, when we recollect that the temperature at which wax melts is from 145 to 150°, we can no longer doubt the efficiency of the sun in melting wax.

HOW TO USE THE SOLAR WAX-EXTRACTOR.

Locate in a convenient place (protected from wind) in the apiary remote from any possible shade, where it will not be necessary to go much out of the way to throw in scraps of wax as they accumulate while working with the bees. Possibly it may be desirable to revolve the extractor that it may keep pace with and face the sun as it advances across the sky. During hot weather, however, this precaution will hardly be necessary, as the heat of the summer sun is found to be sufficient for all purposes of melting wax.

Let us now consider some of the more important points of excellence in the sun wax-extractor as contrasted with those operated with artificial heat. With the former there is no daubing of your wife's stove or her floor, which she is so particular to keep scrupulously clean, nor is there any getting ready or building of fires. Again, it is cheaper to run it. Old Sol never charges any thing for his heat—he boards himself and works for nothing. The scraps, burrs, and cappings from combs when working among bees may be rendered out each day as they come (if the sun shines). Whenever you happen to pass by, throw in the pieces of comb you happen to have with you, and thus save general litter. Lastly, the quality of the wax rendered by means of the sun's heat is generally conceded to be superior to that taken by other means. I have taken some old dark tough combs, and have secured from them, with the sun wax-extractor, as nice and clean yellow wax as I ever saw. The action of the sun is to bleach as well as to render out the wax.

I have briefly considered the good features of the solar wax-extractor; and while I think there is nothing better for trying out small lots of old comb, yet, when it is desirable to melt a large quantity of wax at a time, those arrangements operated by artificial heat, I think, are the better, such as I have previously described, both under WAX and FOUNDATION.

CLEANING WAX FROM UTENSILS.

Perhaps the readiest means is to immerse them in boiling water until all the wax is thoroughly melted off, then drain, while kept hot, until the wax which adheres to them when being lifted from the water is thoroughly melted, and can be wiped off with soft newspaper. Where the article can not be easily immersed, benzine or a solution of sal-soda will readily dissolve the wax, so it may be cleaned off with a cloth. Benzine dissolves wax almost as readily as water dissolves sugar.

Caution in handling wax.—I have spoken about order, care, and cleanliness, in handling honey, candy, etc.; now, my friends, it is a much more serious thing to daub melted wax about the house, on the carpets and on your clothes, than it is to daub either honey or candy. You can very easily spoil a dollar's worth of clothing while fussing with 10c worth of wax, as I know by experience.[238] When you commence, bear this in mind, and resolve that you are going to have things clean and neat at every step, no matter what the cost. Newspapers are very cheap, and it takes but a minute to spread them all around the room where your wax may be dropped. Have every thing, at every stage, in such order that you would not be ashamed of your work, should visitors call unexpectedly. The greatest trials I have ever had with boys and girls, in trying to teach them neatness and order, has been with those in the wax-room; they *will* drop little bits of wax, and step on them. My friend, if you can not learn to avoid stepping on bees, or dropping and stepping on wax and honey while you are at work, you would better stop right here, and give up trying to be a bee-keeper. I do not know but you might also give up all thoughts of ever trying to be happy anywhere. You certainly can not be wanted in this world, and I am not sure you will be wanted in heaven, if you go about carelessly treading on things, and sticking and daubing honey and beeswax everywhere you go.

The article below, from the *American Bee Journal* of Oct., 1867, covers so many important facts in regard to wax, that I copy it entire:

WAX.

This is an organic product of both animal and vegetable origin, and occurring even as a mineral, though in this case, also, its original source is undoubtedly vegetable. The common properties of the substances included under this name are fusibility at a moderate heat; burning with much flame: insolubility in water and alcohol; solubility in alkaline solutions and ether; and in most cases a peculiar luster, to which the name of "waxy" has been given. The most important of these substances is beeswax, which was for a long time supposed to be simply collected by the bees from flowers, but has proved by the experiments of Huber and the Hunters, to be secreted by them. It is obtained in the cakes in which it appears in commerce, by boiling the comb, from which the honey has been drained or pressed out, in water, with frequent stirring, that the wax may not burn. When completely melted, the wax is strained by pressing through hair bags, and received in a vessel of cold water, which serves to cool it and prevent it from sticking. This is repeated two or three times, the bags increasing in fineness, and the wax is finally melted without water, and poured into molds wider at the top than at the bottom, and wetted to prevent sticking. After being filled, the molds are kept in a warm room till the wax has solidified, as otherwise the cakes are apt to crack in the middle. This process is, however, tedious and somewhat wasteful, and various attempts have been made to find a more expeditious one, of which Mr. Bagster's appears the most simple. The combs are placed in a conical earthen vessel filled with a mixture of one ounce of nitric acid to a quart of water. This is set over an open fire till the wax is completely melted, when it is removed from the fire, and allowed to cool gradually. The product becomes divided into three layers, the upper one pure wax, the lowest chiefly impurities, and the middle containing sufficient wax to be worth adding to the next melting. A marketable wax is thus obtained at a single operation, without straining or pressing. Beeswax obtained by either of these processes is yellow; has an agreeable, somewhat aromatic odor, and a slight, but peculiar taste; is rather soft and unctuous, though firm; has a granular fracture, but when cut shows the characteristic waxy luster; does not adhere to the fingers, or to the teeth when chewed; is rendered soft and tenacious by a moderate heat; melts at about 142° F.; and has a specific gravity of 0.960 to 0.965.

Wax is often adulterated with earth, meal, rosin, etc. The two first render it brittle and grayish, and may be detected and separated by melting the wax, when the impurities may be strained out. Rosin makes the fracture smooth and shining instead of granular, and may be dissolved in cold alcohol, while the wax remains untouched. Tallow or suet renders the wax softer, and gives it an unpleasant odor when melted.

Wax is bleached by causing it, when melted, to pass through a perforated trough upon the surface of revolving wooden cylinders half immersed in water, by which it is formed into films, which are then placed on webs of canvas raised from the ground, nd exposed to the action of the weather until perfectly white. It is, however, generally necessary to repeat the process so as to expose fresh surfaces before the wax can be completely bleached; and care must be taken to finally remove the wax from the webs of canvas only in dry weather, as if it is done in damp weather it retains a grayish tint, which much impairs its value. The films are finally melted and cast into thin circular cakes, known commercially as "virgin wax." When bleached by means of chlorine or its compounds, the color is destroyed, but the wax is rendered unfit for many purposes, and especially for candles. Another method of bleaching is to add one pound of melted wax, two ounces pulverized nitrate of soda, and stir in by degrees a mixture of one ounce sulphuric acid and nine ounces of water. When all the acid is added, it is allowed to partially cool, and the vessel is then filled up with boiling water, to remove the sulphate of soda and acid; it is then quite white, translucent in thin slices, shining, harder and less unctuous than the yellow, without taste or smell; becomes soft enough to be kneaded at 85° to 95° F., and fuses at 150° to 155° F., though it will remain liquid at a somewhat lower temperature; by great heat it is partially volatilized and partly decomposed, the vapor burning with a clear bright flame; it is insoluble in water, but slightly soluble in boiling alcohol and ether, which deposit most of it on cooling; easily so in the essential and fixed oils; and can readily be combined with rosin by fusion. It is very frequently adulterated with spermaceti, which destroys its peculiar luster, and renders it softer and more fusible; it is also adulterated with stearine, which may be detected by the odor of fat or tallow evolved when the wax is highly heated, and by the crumbly texture which it imparts.

White wax is composed of two principal substances: myricine, which is grayish-white without crystalline texture, fusible at 127° F., and almost insoluble in boiling alcohol; and cerine or cerotic acid, which crystallizes when pure, in delicate needle-like crystals, fuses at 172° F., is much more soluble, constitutes about twenty-two per cent of the entire weight of the wax, and has for its formula C^{54}, H^{54}, O^{4}. Wax also contains four or five per cent of a substance called ceroleine, which is soft, very soluble in cold alcohol and ether, and melts at 83° F.; and by dry distillation, and by the action of acids and alkalies on cerene and myricine, a large number of peculiar organic compounds may be derived from it. A specimen of beeswax from Ceylon was found by Mr. Brodie to consist almost exclusively of myricine.

Beeswax, though produced in almost every country in the temperate and tropic zones, is an article of foreign commerce in comparatively few. The European supply is principally derived from the Baltic, the Levant, Africa, India, and the United States. The Portuguese province of Angola, in Africa, annually sends to Europe about 1,500,000 arrobas, or 47,772,000 lbs. Japan also exports much. In the United States it has long been an important article of production and export. The census of 1840 gives the value of the product at $628,303, which would be about 2,000,000 lbs.; that for 1850 states the amount of wax and honey to have been 14,853,790 lbs., worth $2,736,606; and that for 1860 gives 1,357,864 lbs. of wax alone. The exports in 1859–60 were 362,474 lbs., worth $131,803. In 1861, 238,553 lbs. were exported from New York. In 1860 more than five-sixths of the exports were to France, England, and Brazil.

Besides beeswax, two kinds of wax of animal origin enter into commerce. The first, the insect wax of China, is found coating the surface of the *Rhus succedaneum* and some other trees. It is the product of a very small white hemipterous insect *(Coccus Sinensis)*, which about the beginning of June climbs up the plant and feeds upon it, depositing the wax upon the branches as a coating which resembles hoar frost. This is scraped off toward the end of August, melted in boiling water, and strained through a cloth. It is white and crystalline, resembling spermaceti, but harder, more brittle, and more fibrous, fuses at 181° F., is but slightly soluble in alcohol or ether, dissolves readily in naphtha, and has for its formula C^{108}, H^{108}, O^4. It does not contain cerotic acid ready formed, but by fusion with potash is decomposed into a mixture of it with a substance called cerotine (C^{54}, H^{56}, O^2.) The Chinese call it fe-la, and employ it for making candles, sometimes alone, but more commonly mixed with softer fats, and as a coating for other more easily fusible material, in order to prevent guttering. It is often colored red with alkanet root, or green with verdigris. It has been introduced into England for the manufacture of composite candles, and is found to answer the same purpose as beeswax, of destroying the crystalline structure, or "breaking the grain" of stearic acid. In China it is also employed as a medicine. The French have introduced the insect into Algeria. The price of wax at Ningpo some years ago was 22 to 25 cents per pound, and the annual production was estimated at 400,000 lbs. Another wax of animal origin is the Andaquiss wax of South America, which is produced by a small insect called *aresa*. It melts at 171° F., has a specific gravity of 0.917, and, according to M. Lewy, contains fifty per cent of ceroxyline, or palm wax, forty-five per cent of ceroxine, or sugar-cane wax, and five per cent of an oily substance.

Of the vegetable waxes, the Japanese, the palm wax of New Granada, and the myrtle wax of the United States are the principal varieties. The first is as white as bleached beeswax, more brittle, less ductile, and breaks with a smoother and more conchoidal fracture; its specific gravity is rather less; and its melting-point is about 127° F. Its chemical composition is not definitely known. The berries yielding it grow in clusters, like grapes, on trees from 15 to twenty-five feet high, and when gathered are roughly washed and boiled in water, when the wax rises to the surface, is skimmed off, and formed into cakes weighing about thirty pounds. It is said to require protracted bleaching before it is fit for market. Small quantities have been shipped to Europe for many years past, but it is only within four or five years that it has been exclusively employed for candles, etc. The amount exported is large and continually increasing. In 1859 a single cargo of 1,170,000 lbs. arrived in England. In 1860 the price at Nagasaki was $11 to $12 per pecul, or 8½ to 9¼ cents per pound. The palm wax of New Granada (ceroxyline) is obtained from the *Ceroxylon andicola*. The scrapings from the exterior of the tree are boiled by the Indians, and the wax rises to the surface. It is grayish white when crude, and after purification by digestion in alcohol is yellowish white, almost insoluble in alcohol, and fuses at 161½° F. The tree has been introduced into Algeria. Carnauba wax is derived from a palm growing in northern Brazil. It is soluble in alcohol and ether, and fuses at 182° F. The ocuba wax of Brazil is derived from kernels of the fruit of several species of *myristica*, especially the M. ocuba. It is yellowish white, soluble in boiling alcohol, and melts at 98° F. The Bicuhiba wax, also from Brazil, comes from the *M. Bicuhiba*, is yellowish-white, soluble in boiling alcohol, and fusible at 95° F. The myrtle wax, which for many years has been an article of commerce in the United States, also known as "candleberry wax" and as "bayberry tallow," occurs as an incrustation on the berries of the wax-myrtle or bayberry. The berries are inclosed in bags of coarse cloth, and kept immersed in boiling water until the wax collects on the surface, which is then cast into molds, and sold without further preparation. It varies in color from grayish-yellow to deep green, has a balsamic and slightly aromatic odor, a specific gravity of 1.004 to 1.006, fuses between 117° and 120° F., and is much harder and more brittle than beeswax. It is composed, according to Mr. G. E. Moore, of one-fifth part of a substance called palmatine, which exists in palm oil, Japanese wax, etc., and four-fifths of palmitic acid, with a small quantity of lauric acid. This wax appears, as a candle-making material, to be worthy of more attention than it has hitherto received. Its illuminating power is scarcely inferior to that of the best beeswax; it costs hardly one-quarter as much, can be obtained more free from color, is easily bleached, and from its superior hardness can be cast instead of being molded by hand like beeswax. The plant grows abundantly on the poorest soils along the coast of New England. Plantations of it have long existed in Europe, and its cultivation has lately been tried in Algeria. The berries of *myrica quercifolia*, natives of the Cape of Good Hope, growing on dry sandy plains along the coast, also yield a greenish wax, which can be bleached, and when made into candles gives a very good light. The sugar-cane yields a wax called cerosine, which is soluble in boiling alcohol, and slightly so in boiling ether. The sorghum also secretes on the surface of the native stalks a white resinous powder, from which candles could be made. A waxy substance called suberine has likewise been obtained from cork.

Several mineral substances resemble wax in physical properties, the principal of which are ozocerite and hatchettine. The principal use of the different kinds of wax are: 1. For the manufacture of candles, either from pure wax, the consumption of which is especially great in Roman-Catholic countries, or of wax mixed with stearic acid, palm oil, etc., as in composite candles; to which purpose every variety, whether animal, vegetable, or mineral, seems to have been employed in different countries; 2. As a vehicle for colors in certain kinds of painting, and as a protecting coat for them; 3. For giving a polish to furniture and floors, for both which purposes it is generally used in France and other parts of southern Europe; 4. In medicine, in which beeswax is employed as an internal remedy against diarrhœa and dysentery, as an ingredient in almost all ointments, cerates, and plasters, and also for filling carious teeth; 5. As a lute or cement of much utility for chemical and other purposes, and also as an impervious coating for vessels formed of porous materials; 6. As a material for modeling; and 7, formerly for seals instead of sealing-wax.

The process given above, of bleaching by the use of chemicals, I have tried repeatedly; but although I procured the purest articles, and used the utmost care, I have never been able to get wax enough whiter to make it any object, to say nothing of making white wax of it. The sun bleaching is the plan generally used, if I am not mistaken; but as I have said before, we certainly do not want white wax for use in the apiary. The plan of cleansing wax by the use of acids or vinegar is well known, I believe; but, as a general rule, I think it is more trouble than the plans I have given. Our friend Doolittle sent us some remarkably pretty wax, that he said was cleansed by the following process, which is taken from *Quinby's Bee-Keeping*, edition of 1866, page 283:

By adding an acid to the water in which the wax is melted, it may be separated much more readily. A quart of vinegar to a gallon of water, or a small spoonful of nitric acid, is sufficient.

ADULTERATION OF WAX.

The white wax of commerce, I am sorry to say, is to some extent adulterated with paraffine, which very much injures it for making fdn., as I have before explained. Within the past few years, another substance, called ceresin, has been imported in large quantities, and bids fair to take the place of wax to a great extent for many purposes. It, however, like paraffine, when used for combs, stretches so much as to make it worse than useless. Both of these substances can readily be mixed with wax, and the problem is to determine when there is such admixture. My method has been simply to chew a piece of the suspected wax; if adulterated, even slightly, with either, the wax will chew like gum; whereas, if pure it will soon crumble and break to pieces in the mouth, and will not make gum at all. In buying the ordinary cakes of wax of commerce, we are pretty safe from adulteration with either of these. I am sorry to say, that there is a species of fraud practiced by the country people themselves, by adding tallow to their cakes of beeswax, but, happily, this is not very common. The presence of tallow is detected by both taste and smell, and especially by chewing, for a very small per cent of tallow softens the wax quite perceptibly, and makes it like grafting-wax. Where we suspect a cake of wax, I have sometimes made a little of it into a piece of fdn., and hung it in a hive. If the cells made are regular, and do not stretch out so as to give the oblong appearance, I pronounce it pure wax; for, so far as I know, there is no other substance known that will stand the heat of the hive, as will wax, without bulging and stretching.[239]

WHITEWOOD (*Liriodendron Tulipifera*). This is often called the tulip-tree, I suppose from its tulip-shaped flowers.

After I had written the above, I concluded I did not know very much about the whitewood, especially the blossoms. So I traveled off into the woods. At length I found a tree, but there were only buds to be seen, not blossoms. It must be too early in the season; but, hark! whence come those sounds of humming-birds and humming bees? Whence, too, comes that rare and exquisite perfume? I looked higher, and, away in the misty top of the tree I thought I discerned, by the light of the setting sun, multitudes of bees flitting about. Oh that I were just up there! I looked at the rough trunk of the tree, and meditated that I was a boy no longer, but a man of 40, or would be in a few months more. I might get up to that first limb: after a good deal of kicking and puffing, I got up there. The next was a harder pull yet; but soon the limbs were thicker, and finally I began to crawl upward with about as much ease as our year-and-a-half-old baby goes up stairs, whenever she can elude maternal vigilance. Up, up, I went, until, on looking down, I really began to wonder what that blue-eyed baby and her mamma would do, should my clumsy boots slip, or a dead limb break unexpectedly. Now I was in the very summit of the tree, and, oh what a wonderful beauty I saw in those tulip-shaped blossoms that peeped from the glossy-green foliage all about me! No wonder there was a humming. Bumble-bees, gaudy-colored wasps, yellow Italians, and last, but not least, beautifully plumaged humming-birds, were all rejoicing in a field of sweets. Every now and then one of the latter paused before my very face, and, as he swung pendulously in mid air, winked his bright little eyes, as much as to say, "Why, what on earth can you be doing away up here in our domain?"

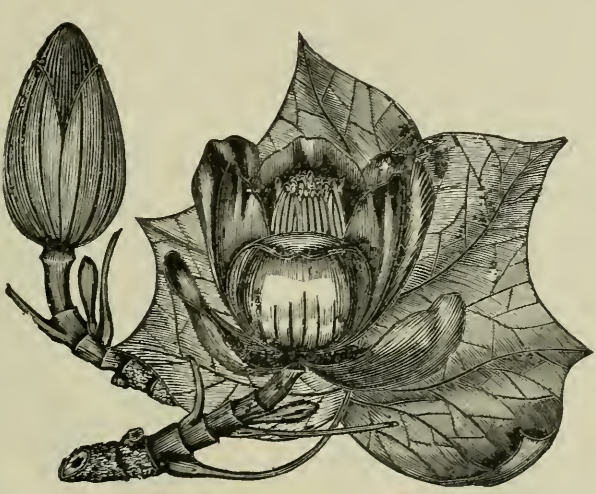
I picked off the great orange-colored, mottled blossoms, and looked for the honey. [240]I presume it was the wrong time of day to expect much; but the inside of those large petals seemed to be distilling a dark kind of dew that the birds and insects were licking off. It tasted to me more like molasses than honey. In the cut below our engraver has tried to show you what I saw in the tree-top.

As the sun had gone down, I commenced in a rather undignified way to follow suit, and, after resting a little, limped home. Although I was stiff and sore, I carried an armful of whitewood blossoms to surprise the good folks who, probably, had never dreamed of the beauties to be seen only in the tree-tops.

Our friends in the South have a great deal to say about what they call "poplar honey;" and, if I am correct, the poplar is the same tree which we call whitewood. It blossoms with them in April and May. I know what time it blossoms here, for I thought about its being the 27th of May, when sliding down out of that tree. Shortly after, I received some bees from G. W. Gates, of Bartlett, Tenn. The combs were filled and bulged out with a dark honey, such as I have described, and the bees had built fins of snow-white comb on the cover of their shipping-box. From this I infer the honey must be yielded in great abundance in those localities. I have seen it stated, that the large flowers sometimes yield a spoonful of honey each. As the tree is often used for ornament, I make the following extract from *Fuller's Forest-Tree Culturist:*

LIRIODENDRON TULIPIFERA *(Tulip-tree Whitewood).*

Leaves smooth, on slender petioles, partially three-lobed, the middle one appearing as though cut off; flowers about two inches broad, bell-shaped, greenish yellow, marked with orange; seeds winged, in a large cone-shape cluster, which falls apart in autumn. The figure shows a single seed as it appears when separated from the mass. It blooms in May and June, and the seeds ripen in late summer or early autumn, and should be sown as soon as ripe, in good, moderately dry soil. They may remain in the seed-bed two years, if desirable, but should receive a slight protection the first winter; tree of large size, sometimes 130 feet high, with a very straight stem; wood light color, greenish white, soft and light, not hard enough to receive a polish. It is much used in cabinet work, and for making panels for carriages, and for any inside work where toughness or a hard surface is not required. There is perhaps no native wood that will shrink more in seasoning than whitewood, for it not only shrinks sidewise, but endwise as well; but when once thoroughly seasoned, it remains fixed, and does not warp or twist like many of the hard and tough kinds of wood. There is also much difference in character of the wood coming from different sections of the country, and mechanics who are conversant with the various kinds and localities will readily tell whether specimens came from the West or East. The latter is of a light greenish color, grain not so smooth and soft, and sometimes rather tough. The wood is but little used, except for the purposes mentioned above, consequently it is only large trees that will be of much value. It is one of the most beautiful ornamental trees we possess, growing in a conical form, and producing an abundance of its beautiful tulip-shaped flowers in spring. The roots are soft and sponge-like, and it requires great care in removing to insure success.



LEAF, BUD, AND BLOSSOM OF THE WHITEWOOD, OR TULIP-TREE.

The question is often asked, "Is whitewood good for bee-hives?" It may do for sections and brood-frames, but it is very unsatisfactory for hives, for the reasons given in this extract.

WILLOW. As I have had little or no experience with this shrub, and as it does yield honey and pollen in some localities, I can do no better than to copy an article with the engravings. from the pen of G. M. Doolittle. as given in *Gleanings in Bee Culture*, p. 486, Vol. XVII.:

Among the pollen-bearers we have several kinds of what is known here as "pussy willow" (*Salix*) which puts out their blossoms quite irregularly. Some are a month earlier than others, and some of the buds on the same bush are ten days later than others. The kinds which seem to attract the bees most are the black willow, upon which the kilmarnock is budded, and those which produce a long cone-like flower similar to the black willow, the accompanying cut giving a fair representation of the latter, a week or so after it is through blossoming and has partially gone to seed. From these two kinds the bees obtain large quantities of pollen, but, so far as I can ascertain. no honey. As this pollen comes the first of any which we have which amounts to any thing, I esteem it of great value to the bees. Skunk-cabbage gives pollen a little earlier, but we do not have enough of it to amount to much, compared with what these willows give. The flowers are of a rich orange color, and consist of a center out of which spring hundreds of little thread-like filaments, upon which the pollen is supported. It is very interesting to see the bees work on these flowers, as you can see their motions so plainly, for the tree or bush does not grow so high but that some of the lower limbs are about on a level with the eye. Here is a peculiarity of the willows. for all those in this section which give pollen grow in a bush form, while all of those which yield honey grow to be quite large trees, often reaching six feet in circumference.

PUSSY WILLOW.

The pussy willow naturally grows on low swampy ground; but with a little culture to start, it will grow readily on dry ground. They grow readily from cuttings put in the ground in early spring, as does all of the willow tribe. The above are often set down as "honey-plants;" but according to Quinby and my own observation, they produce no honey. As they grow very plentifully about here, I have had much observation regarding them. To be sure, the bee is continually poking its proboscis into the blossoms, the same as they do when sucking for honey; but after killing many bees and dissecting them, I have been unable to find the least bit of honey in their sacs. This way, if used when the bees are at work on any of the honey-bearing flowers, never fails to reveal honey accumulating in their sacs.

HONEY-PRODUCERS.

Of these we have three kinds—the golden willow, the white willow, and the weeping willow, and they are of value as honey-producers in the order named, although the weeping willow blossoms about three days earlier than the others. This would make it of more value to the bees, even did it not yield honey quite so profusely, if there were enough trees to keep the bees busy; but as there are very few trees of this kind about here there is not enough to make any account of. None of the three willows mentioned here give any pollen that I ever could discover, for none of the bees at work on these trees ever have any pollen in their pollen-baskets. If there is any species of willow which yields both honey and pollen, I am not acquainted with it. The flowers are similar to those which grow on the birch and poplar, being of a long tag-like shape, as large as a slate pencil, and from one to two inches long. Those on the golden willow are the longest, and yield honey abundantly.

GOLDEN WILLOW.

The engraving presented herewith so nearly represents the golden willow that any one should know it in connection with its yellow bark, which distinguishes it from the other kinds of honey-yielding willow, as all of the rest, so far as I know, have a light-green bark. When these willows are in bloom, and the weather is warm, the bees rush out of their hives at early dawn, and work on it all day long as eagerly as they do on clover or basswood. The blossoms often secrete honey so profusely that it can be seen glistening in the morning sun, by holding the blossom between you and that orb, while the trees resound with that dull busy hum, so often heard when the bees are getting honey, from morning till night. As this is the very first honey of the season, I consider it of the greatest of value to the bees, for the brood is now crowded forward with great "vim," which brood gives us the bees which work on the white clover. while the honey often helps very greatly in piecing out the depleted stores of the hive. These willows blossom a little in advance of the hard maple, and hold out as long as they do; and from the fact that, when I kill a bee at work on these willows I always find honey in its sac, while when I do the same with a bee which is at work on the maple I never find any honey, I have been led to think that perhaps those reporting honey might be mistaken, and that the honey really came from the willows. Again, maple blossoms only every other year with us, while the willows never fail; and I have noticed for years that I got fully as much honey in the years when the maples did not bloom as I did the years when they did. From the few trees along a small creek near here, my bees frequently make a gain of from six to ten pounds of honey while the willows are in bloom, and one season they made a gain of 15 pounds. This present spring some of my best colonies gained 8 pounds, while on apple-bloom they did not get more than a living, with apple-orchards white with bloom all about. The honey from the willow is quite similar to that from the apple-bloom, and of a nice aromatic flavor. As the willows gave the first pollen, and also the first honey each season, it will be seen what a great help they are to all who have them in profusion near their bees. The only drawback there is, is in the weather often being unfavorable, for I do not think that more than one year in three gives good weather all through the time the willows are in blossom. So far as I know, honey and pollen are always present in the respective kinds when they are in bloom; but the trouble is, that it is so cold, rainy, cloudy, or windy for the bees to get to the trees so much of the time, at this season of the year, that honey or pollen from this source is not at all certain.

Borodino, N. Y. G. M. DOOLITTLE.

WINTERING. My friends, if you have been over faithfully what I have written in the preceding pages, you are nearly ready to sum up the matter of wintering with me, with but few additional remarks. Under the head of ABSCONDING SWARMS, in the opening of the book, I cautioned you against dividing, and trying to winter weak colonies. See *Absconding in Early Spring*, under the head mentioned. Also see *House-Apiary*, under head of APIARY. In regard to keeping bees warm through the winter with ARTIFICIAL HEAT, see that head. In regard to the effect of different kinds of food or stores on the welfare of bees during winter, see DYSENTERY, FEEDING AND FEEDERS, CANDY FOR BEES, and HONEY-DEW. In regard to fixing the size of the entrances to hives, and keeping them from getting clogged with dead bees, see ENTRANCES TO HIVES, VENTILATION, and PROPOLIS. In regard to starving bees, and taking away their sealed stores, allowing them only unsealed, late fall honey, see EXTRACTORS. For a consideration of the different sizes and shapes of frames for wintering, see NUCLEUS.

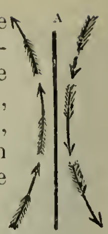
WHEN TO COMMENCE PREPARING BEES FOR WINTER.

If either bees or stores are lacking, they should be supplied during warm weather, so that all may be quiet and ready for the winter doze which nature intends them to take, long enough before winter weather has actually set in. In this latitude I should advise examining all hives the first of Sept.

In the first place, be sure that you have bees enough in each hive to winter; if you have not, unite until every colony is strong. I would not undertake to winter any colony, unless it would cover well as many as 4 L. frames. If your colony has not as many as 4 good combs, they must be supplied with fdn., and made to build them out. If they are to do it in Sept., you and the bees both must stir yourselves, I tell you. There must be no forgetting them, and you must be at home every day, to attend to it. Close the space up by chaff division-boards, until there is just comfortable room for the 4 frames, put in your fdn. where the combs are lacking, and then feed them every night, from half a pint to a pint of food. Open the hive every day or two, and see how things get along. You want a good queen and lots of brood started. Make them prosper, and build up. You will soon learn to know what prosperity means. They should be rearing brood, building comb, and getting full of bees, precisely as they do in June.[241] For winter stores, I would use granulated sugar (see FEEDERS AND FEEDING; feed them about 20 lbs. of syrup in one or two feeds. If you have the four combs average about 5 lbs. each, you will be on the safe side. If your colony is heavy enough to cover 6 combs, clear out to the ends, during a cool night, they will perhaps need 6 combs filled so as to average 5 lbs. each. When you get the bees and the stores, with the chaff cushions on each side, they are all ready to winter, by simply putting a thick chaff cushion over them. This arrangement is not as good as a regular chaff hive, but it has answered for several seasons past, quite well. If the winter is very severe, a colony that would cover densely 5 or 6 combs would be much safer than a smaller one. The main points are, a brood - apartment closely packed with bees, and plenty of good sealed stores. With these two conditions alone, the bees will generally winter all right, even in a hive made of inch boards. If the bees are not enough to fill the hive, reduce the size of the apartment until they do fill it. This is usually done by a division-board. If the walls of this wintering apartment are made of thin wood, the bees will then keep the thin walls of the hive, as well as themselves, warm all winter, and we shall then avoid the loss that often ensues by bees continually freezing in the outside combs. This is the purpose of the chaff hive; it is of about as much use to put chaff and straw over the outside of great heavy hives, as it would be to put your bed clothes on the roof of your house, instead of next to your body, on a cold winter night.

VENTILATION, AND ITS RELATION TO FROST AND DAMPNESS.

I think the subjects of chaff packing and ventilation are not clearly understood. Bees become damp because the walls of the hive are so cold as to condense the moisture from their breath. If these walls did not become cold, no moisture would condense on them, and no dampness would accumulate in the hives. On a cold winter night, frost sometimes accumulates on our windows until it may be ¼ inch in thickness. The amount of ice depends on the difference in the temperatures of the air on the two sides of the glass. If the air outside should be below zero, while that inside is 70 or 80, and at the same time is fully charged with moisture from the kitchen, perhaps, as is the case frequently on washing-days, or even from the breath of many persons, the accumulation of ice on the glass will be very rapid. If the room is kept warmed up, the ice will melt, and the water will run down until the floor becomes quite wet. While running a small engine one winter, in a room having large glass windows, the water accumulated so rapidly on the glass that we had to attach a tin trough to the window-sill to catch it, and in a little time we caught a pailful from the end of the spout. The cause is this: Warm air takes up and holds in solution a large quantity of water. This water is, of course, invisible, and we have scarcely any means of detecting it so long as the temperature of the air is unchanged by coming in contact with colder substances, or currents of air of a lower temperature. If the walls of the room are kept warm, there will be no perceptible dampness. Let them be chilled, as in the case of the window-pane, however, and we shall have the warm air dropping its water the very minute it comes in contact with the cold surface, in exactly the same way that dew is deposited on a hot summer day, on the outside of a pitcher containing cold water. The process with the window goes on, because currents of air are started both on the outside and inside of the glass, by the heat that passes through the glass. To make this plain, let A, in the cut above, represent the pane of glass.



The arrows represent the course of the currents of air. The greater the difference in temperature between the outside and inside, the more active are these currents, and the greater is the deposition of dew or ice on the surface of the glass on the inside.

HOW BEE-HIVES BECOME DAMP.

In the warm room you will see that the air is chilled as it strikes the window, and then falls because it is heavier; this gives place to more warm air, and keeps up the circulation. On the outside, the cold air next the window becomes warmed, and rises on account of being lighter, and this keeps up a similar action on the *inside*, the direction of the currents being reversed. When the temperature of the air is lowered it discharges its moisture. When the temperature is increased, the capacity of the air for holding moisture is increased also. Thus you see how the water from the air is condensed on the windows, and goes down into the pail. The air in the room would soon lose its moisture, were not more supplied from the breathing of living persons, or from the kettles on the stove, from damp air rising from the cellar, or from something of that kind. I need hardly state that the same operation goes on in the bee-hive, especially if the walls are thin, and the hive at all tight. If the top of the hive is a thin honey-board, with cold air above and warm air below, ice will be sure to collect over the cluster, and when it melts will dampen the bees. The sides of the hive will be covered with frost, and perhaps a heavy coat of ice, by the circulation of currents of air as I have explained. Now let us go back to the window, and place one of the chaff cushions I have advised for wintering, close against the window-glass, on the outside. This will stop the outside circulation, and the light of glass will soon become warmed through to such an extent that no ice, or dew either, will condense upon it. To make a further protection, suppose we put glass or boards on the outside of the cushion, or, in fact, make two walls, with chaff between them as in the chaff hive. A good colony of bees would warm up the thin walls next to them, sufficiently to prevent either frost or moisture from accumulating on them at all. Now, if the walls all around the bees are thus protected with chaff cushions, they can not well get frosty on the outside, and thus accumulate either moisture or dampness on the inside. As a proof of this I have wintered a colony nicely, with a covering of enameled cloth over them, that was almost absolutely impervious to air. To be sure, a thick chaff cushion was over this enameled cloth, or it would have been wet very quickly with the condensed moisture; in fact, several colonies became quite wet during frosty nights in the fall, before the chaff cushions were put on. Now, if the bees are to keep these walls about them so warm that moisture can not condense on them, the walls must be close to the cluster of bees, and certainly the material for them should be a non-conductor of heat, and they should be so thin that they will readily warm through. Although it may not be absolutely necessary that the walls and covering should be of some porous material, which will absorb any chance moisture from the breath of the bees, it will perhaps be better that they should be so, and many experiments seem to indicate that straw or chaff is the best material for this purpose. For the reasons I have named, the old-fashioned straw hive, which has for ages been emblematical of the honey-bee, seems to be very nearly what is wanted to protect them in the way they seem to demand. The straw next to them is warm, and therefore proof against condensation; it is thin, and hence easily warmed; is a non-conductor of heat; and while it may permit the air to pass through the porous walls slowly, it does not admit of a draft of cold air through the hive, as does a badly made wooden hive, or one that has cracks or fissures here and there.

STRAW HIVES.

Ever since the advantages of straw hives for wintering have been fully demonstrated, attempts have been made to make hives of straw, to hold the movable frames in common use. Such hives have answered the purpose very well, but they are inconvenient, untidy, expensive to make, and not durable after they are made. As they can not well be painted, they are soon destroyed by the weather; and if we make an outer shell to protect the straw, we have, virtually, a chaff hive, such as I have described. It is true, we might have straw next to the bees; but straw does not present a clean, smooth surface such as we wish to have next to combs to have them built true, and I can not discover, by experiment, that the straw is any the less effective with a thin board interposed between it and the bees, and a thin board on the utensil to outside it from the weather.

HOW TO WINTER BEES OUTDOORS PACKED IN CHAFF.

The majority of bee-keepers winter on summer stands. The reason for this is evident. It requires less skill; and while one might make an utter failure in the cellar or in some special repository, he will quite likely be successful outside by the method which I will now proceed to describe.

I have already hinted at some of the essentials, and it will be in order now to give some of the details of the method that we have employed successfully for nearly ten years back—yes, during times when almost every one else has met with failure, not only indoors but outdoors as well. Particularly was this true during the winter of 1884 and '85.

One of the requisites, though not necessarily an essential, is early preparation. If I had every thing to my liking I would have all colonies prepared for winter by the first of October for our latitude, 41. For a little further north, about the middle or first of September. A good many bee-keepers begin preparations as soon as the honey season is over; that is, in the middle of August. This preparation means early feeding to induce brood-rearing, so that the colonies may begin the rigors of winter with a large force of bees, the majority of which are probably young, and not old worn-out fellows that will die in a month or so. Many times circumstances are such that we are not able to begin preparations before November. We have fed our bees as late as the first of November, and packed them, and then had them winter successfully. But because we have done so one year, two years, or more, successfully, is no reason why we would urge beginners and others to put it off until that time. For particulars in regard to feeding, you are referred to that heading in the fore part of this work.

HOW MANY POUNDS OF STORES FOR OUTDOOR WINTERING.

Before the final packing, I would see that every colony had from 20 to 25 lbs. of sealed stores, the same distributed on from four to six combs. Some colonies are strong enough to cover eight, but usually almost all colonies can be contracted to six L. frames. As a general rule, give the bees as many combs of sealed stores as they will cover by the time we have frosty nights, and the days are just a little too cool for bees to fly very much—at least, before the latter part of the day.

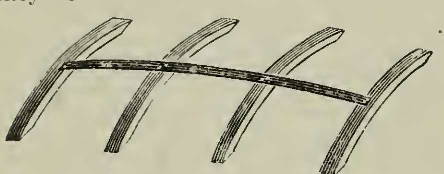
Put in a division-board, as described under that head elsewhere. to take up the space of the combs taken out; and this division-board should be put in before feeding has been entirely finished, and should be, if possible, put on the north side of the brood.

FULL-WIDTH ENTRANCE FOR WINTERING.

Always give the bees in chaff hives the full width of entrance. Years ago, bee-keepers thought it an advantage to contract the entrance at the approach of cold weather, to "keep in the warmth," as they said; but later years have demonstrated that this is a most fatal mistake. Ever since we have given a full entrance we have lost scarcely a colony in chaff hives. It has been ascertained that bees need plenty of bottom ventilation. Some of the box hives that used to winter the most successfully, year in and year out, were raised an inch from the bottom by means of a block under each corner. Again, the entrance will clog with dead bees, if contracted.

SHALL WE SPREAD THE BROOD-NEST?

A good many of those who winter successfully, urge that, before the final packing, the brood-frames should be spread from the regular breeding distance, that is, 1⅜ or 1½ inches from center to center, to about 1⅞. We formerly spread our brood-frames; but in later years, after trying both ways we can see no difference in result.[243] We now leave the frames spaced just as they were in summer.



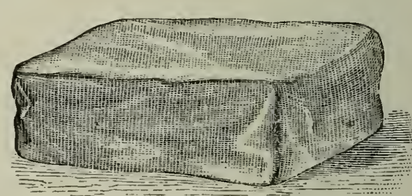
HILL'S DEVICE FOR COVERING THE FRAMES IN WINTER.

Some ten years ago we lost quite heavily one winter, and we attributed the cause largely to a lack of something over the brood-nest, to give the bees clustering space. At the suggestion of L. L. Langstroth, who at the time wrote us an article on the subject for *Gleanings in Bee Culture*, we put over each brood-nest a Hill device, shown in the cut above, and wintered successfully the following winter. It gives the bees an opportunity to pass from one comb to another as fast as the stores are consumed; and during the winter, if you lift up the burlap you will find, as a general rule, the bees are directly beneath the device. Some have advocated, in lieu of a Hill device, cutting holes or passageways through the combs to give the bees an opportunity to pass from one comb to another. With a shallow frame like the Langstroth, the cutting of holes is entirely unnecessary if the Hill device is used. With a deep frame it may possibly be an advantage.

The sticks are sawed on a circle, from half-inch basswood. They are sawed on a curve that would make a circle of about 11 inches in diameter. The stuff is held at an angle when sawed, so the outer surface is something like the surface of a sphere. The two inside sticks are 9 inches in length; the two outside ones, only 8. The back-bone, as it were, is a strip of very light hoop iron, like that used to hoop pails. It is about a foot long, which holds the ribs about four inches apart. Two wire nails are put through and clinched, at each stick.

WHAT TO COVER THE FRAMES WITH.

We have tried various quilts, enameled cloths, carpets, etc., but have come to the conclusion that there is nothing cheaper or better than a large piece ef burlap cut in the form of a square, and hemmed at the edges. This should be at least as large as the inside of the hive; and after the Hill device is put over the center of the brood-nest, the burlap is put on top, and carefully tucked down at the edges. On top of this we put a large chaff cushion which likewise should be a little larger than the inside dimensions of the hive, so that, when it is laid over the brood-frames, it will crowd up into the corners and shut out all possibility of draft. The whole top of the brood-nest will be made tight; for whatever air or moisture passes from the cluster must rise slowly through the chaff.



CHAFF CUSHION.

Take two pieces of burlap, mentioned above, 20 inches wide, and the other way clear across the roll. As the burlap is 40 in. wide, our two pieces will be each 20 x 40. Well, these two make the cushion by sewing them together in such a way as to make one single endless seam, and I think that a look at the cut above will tell you how it is done, without any further explanation.

In sewing it, leave the last corner open until the chaff is put in. It is not to be packed in tight, but just loosely; and, in fact, we prefer them with the cushion not quite full. Recent experiments seem to indicate that 6 inches of chaff over the cluster may be better than a foot or more. It is pretty sure that bees have many times died from being too heavily "blanketed," as it were. The cushions should at all times be perfectly protected from wet or dampness, for this very soon rots and destroys the cloth.

A few years ago we were in the habit of putting in about two inches of loose chaff on top of the burlap. We dished out the center so that the convex side of the cushion would fit down into it. But the loose chaff was a nuisance, in packing and unpacking, so we have latterly abandoned its use, and find we winter just as well without it. If your cushion is too small, and does not fill out the upper story of the hive, it would be advisable to use loose chaff to make up for its deficiency. We have several times lost colonies because the cushion was too small —the cold air circulating around the edges near the bees.

BEST KIND OF CHAFF.

After trying a great many kinds I have decided in favor of soft wheat chaff.[244] To get it free from dirt and the harder portions, I have had it run through a fanning-mill, and collected that portion which was blown furthest from the mill. This is soft and warm to touch, and it is easy to imagine how bees, mice, or any thing else, snugly tucked up in it, might pass the winter dry, warm, and in comfort. To Mr. J. H. Townley, of Tompkins, Mich., I am indebted for the idea of using chaff for a protection in wintering.

Now, then, if you have four or six combs of sealed stores, and bees enough to cover them, and a Hill device to put over the top, over this a burlap sheet, and over this, again, a large chaff cushion made of burlap carefully packed down at the corners, you may consider your bees as in fit condition to enter into winter, and I would not give ten cents to have them insured. For the past nine years we have so prepared our colonies, and our losses have amounted to only two or three per cent, and latterly less than one per cent. In giving these directions I have assumed that you use the chaff hive, described under HIVE-MAKING, elsewhere. I do not consider that this is the only hive that will winter bees successfully. Almost any double-walled hive will answer as well. Indeed, it is barely possible that the space between the double walls of the hive does not need to be packed. A couple of years ago, while we were renovating some of our chaff hives, we found two that had never been packed with chaff; and as we happened to remember the location which the hives occupied, we saw that each of these had wintered perhaps just as well as the others. After all, these experiments, being on so small a scale, would not be conclusive enough to prove that hives with double walls, with nothing but a dead-air space, would be equal to the same hives with the space filled with chaff. Until we do know, I would advise all beginners to use the chaff.

A good many winter successfully by having common single-walled hives, and putting over them a dry-goods box under which has been put a quantity of straw or chaff. Indeed, there are a number of prominent bee-keepers who use an outside wintering-case (see HIVE-MAKING) that comes down over the hive. Good wintering results are reported. Mr. Francis Danzenbaker, of Washington, D. C., instead of using chaff, uses several layers of old newspapers. His hive is telescopic, after the manner of the old American; that is, the upper story is just about half an inch larger than the lower one. Several layers of paper are laid upon top of the brood-nest, and the upper story is slid down over it. In the latitude of Washington, latitude 39, he has wintered successfully, and perhaps such packing will be sufficient for warmer climates; but in the latitude of Minnesota and Michigan, a thicker wall will doubtless be needed. This much we do know, that the chaff hive spoken of under the head of HIVE-MAKING winters bees successfully even as far north as the latitude of Southern Minnesota, latitude 44°, and in Canada. Mr. G. Sturgeon, of Kincardine, Ont., in the latitude of 44, uses the Simplicity chaff, and has wintered successfully 200 colonies some seven or eight winters. He tried the indoor plan, and met with failure almost every time.

WHAT TO DO WHEN COLONIES RUN SHORT OF STORES.

We will suppose that, from some cause or other, some colony has run short of stores. You ask, "How are we to know what ones are short?" Sometimes in filling orders for bees and queens, late in the fall, we are obliged to keep our colonies running till very near November, and we have to do our feeding on short notice. When it comes on cold weather, and we are unable to feed any more, we put a little stone on the cover, or some mark to indicate that this or that colony *may* run short of stores. On the first warm sunny day in mid-winter—when it is warm enough so the bees can fly—we go through the whole apiary. We simply lift the cushion, pull back the burlap, and peer down into the cluster. If they appear quiet, and there seems to be an abundance of sealed stores, we close the hive up immediately, and so on until we come either to a weak colony that needs uniting with another weak one, or a strong stock that has consumed so many stores in brood-rearing that they need feeding. As the weather may turn cold suddenly, we pick out of the honey-house a good comb of sealed honey, and lay it horizontally above the frames, with a Hill device under it, so as to keep it from closing up the passageway over the frames. We cover the whole with a burlap sheet; replace the cushion, and let them go until the next warm day, when we again make an examination; and if a little short, we turn the comb over and give them the benefit of the other side. If we do not happen to have the sealed combs, we give them a cake of maple sugar or candy (see CANDY), on top of the brood-frames, and all will go well;[245] but, as I stated before, it should not be necessary to feed colonies during mid-winter. They should have enough stores, say 20 or 25 lbs., to last them from October until the first or middle of May.

ADVANTAGES AND DISADVANTAGES OF OUTDOOR WINTERING.

(1) Outdoor colonies *can be* prepared in October, and left without examination until the first part of May, if prepared as they should be, providing you do not fill orders for bees and queens in the fall. (2) If the bees, from a long spell of cold, have contracted dysentery, the first warm day gives them an opportunity for a cleansing flight.[246] (3) Beginners and others who may not possess the requisite skill for indoor wintering will ordinarily be successful with the outdoor plan. (4) The colonies of the home apiary can remain year after year, and winter upon the same stand; and where one can afford it, an out-apiary of chaff hives does away with hauling bees in the spring and fall. (5) The chaff hive is always preferred, even for a cold day in late spring or early summer; whereas single-walled hives sometimes give rather meager protection after setting out. The outdoor colonies in chaff hives have been used to the rigors of winter; but the indoor colonies, being set out about the middle of April or first of May, many times receive a setback that takes them all summer to get over, by an unexpected cold wave.

The disadvantages are: (1) The first cost of hives. Every beginner, not knowing whether he can make the business successful or not, wishes to start out as economically as possible, and accordingly, is in a quandary as to whether he shall go to a greater expense and purchase chaff hives, or be more moderate and purchase the single-walled hives. (2) It seems to be generally agreed, that colonies indoors consume less stores than those out—just how much less, nobody seems to know exactly; some think half the stores or over; others, a third. The latter estimate is probably nearer correct. (3) Chaff hives, as I have already stated, are rather heavy and unwieldy; and in swarming, too, it becomes necessary many times to change the location of the hives. One person can hardly handle a chaff hive without the aid of a wheelbarrow, while he can, with comparative ease, carry a single-walled hive wherever he pleases. It sometimes happens that a bee-keeper discovers that a certain district is yielding for a time considerable nectar, while at home his bees are doing nothing. He desires to carry a large number of colonies to the place in question as soon as possible, to catch the flow. If he has chaff hives, he can not very well carry more than five or six at a time in a wagon; whereas he can load twenty-five or thirty single-walled hives; and when the flow has ceased, he can take them to another place. In these days of out-apiaries, chaff hives have the very disagreeable feature of being non-portable, or practically so. *Experienced* bee-keepers will winter in the cellar with perhaps less loss of bees and less consumption of stores than outdoors; and this brings us to the subject of

---

WINTERING IN CELLARS OR SPECIAL REPOSITORIES.

Years ago, bee cellars and special repositories became all at once very popular, and bee-keepers all over our land, especially in the northern localities, invested much labor and money in constructing good frost-proof cellars, or sawdust-packed buildings above ground. In 1868 I put up such a building, and packed the walls with 8 inches of sawdust, and also put sawdust between the floors and overhead, and wintered 48 colonies in it without losing a single one. A neighboring bee-keeper who used one similarly constructed had wintered in his for nearly a dozen years, and, at that time, had never lost a colony in it. These results seemed pretty nearly conclusive; but a few years later, when the spring dwindling, as it has been called, made its appearance, my neighbor and I both made the discovery, that bees taken out in March, in fair order, would often, in spite of us, become reduced, before the end of April, to a mere handful, and then perish outright, or leave their hives and swarm out as I have mentioned under the head of ABSCONDING SWARMS; while at the same time, good strong colonies left outdoors, without any especial care, would often be full of bees, and ready to swarm. I do not mean to say that such was generally the case, but there were always more or less in the neighborhood that would winter finely without care, while many so carefully housed would turn out disastrously. A neighbor who had devoted almost his whole time to his bees would be obliged, in spite of his well-made bee-house, to buy black bees in the spring to keep his Italians alive, and the strong colonies of black bees were invariably wintered almost without loss, in an open shed, in cheap, unpainted box hives.

Within the last few years, howe er, winter repositories have given better results. Instead of bee-keepers losing almost every winter, and having troubles from dysentery, bee-journals and bee-conventions have so disseminated information, and the records of careful experiments from bee-keepers all over our land, that indoor repositories are now wintering bees as successfully—perhaps more so—than outdoors, if we consider the matter of a lesser consumption of stores. Indeed, it would be a sad comment on bee journals and conventions if bee-keepers did not finally discover means whereby they could winter successfully, both indoors and out. Among the very first who were able to announce to the bee-keeping world that they wintered *every* ye r without loss was H. R. Bo dman, of East Townsend, Oh o. At the time it seemed a little remarkable. Very soon after, others began to report success. Whether these latter followed in the wake of our Ohio man, or from their own investigation were able to winter without loss, I am unable to say. It will be in order, then, to inquire what are the elements that contribute to successful wintering indoors, and at the same time glance briefly at some of the causes that contributed to failure years ago.

One of the first and most important causes was taking the bees out too early. As a general thing, the heavy losses came after setting the hives out, which was usually done some time in March; and March is a month in our locality that may be any thing from a bright, almost summer day, to a boisterous zero weather. Bees that have wintered successfully, and have been set out too early, are pretty apt to succumb before actual warm weather in May has set in. The reason bees were set out early, was because bee-keepers were unable to keep them quiet in the cellar; and if they seemed disposed to dysentery, the only thing to do was to set them out. The problem, then, remained to find some means to keep them quiet until the middle of April or to the first of May. It is generally agreed that there are thr e or four essentials to accomplish thi end. First, a temperature of about 45, a d not varying very considerably either way throughout the winter; second, plenty of bottom ventilat on, no top ventilation; third, though not nearly so important as the others, sealed stores; fourth, a cellar comparatively dry. A few, and a very few, claim that they can winter successfully in a cellar reeking with dampness if only the food is right;[247] but these claims have been very speedily set at naught by the fact that they who strenuously urged them have been among the heaviest losers.

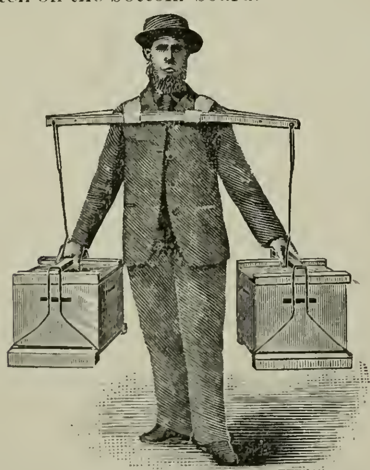
Having outlined briefly some of the essentials to indoor wintering, I will now proceed more in detail. As with outdoor wintering, early feeding is important. It will not be necessary to give the bees as large an amount of stores. Ten or fifteen pounds will answer very well; though, if convenient, I should prefer to let them have more. If the winter should be an open one,[248] some of the stronger colonies will rear brood during spring quite heavily, and consume all or nearly all their stores. What bee-keeper is there who likes to admit that his bees died from starvation? Starvation means, as a general thing, pure neglect.

WHEN TO PUT INTO THE CELLAR.

In November, in the latitude of 40 or 41, the bees should be prepared to be set into the cellar at a moment's notice. The covers should be sealed down with propolis, to make the top of the hive air-tight. It is not necessary that there be a Hill device or any thing else over the frames, to give a passageway — simply the cover over the brood-nest is quite sufficient.[249] Some few bee-keepers remove it and leave on an enamel cloth or quilt. If the cloth or quilt is sealed down tight, it will answer, pe haps, as well. But for reasons presently to be given, I would leave the cover on. Well, along about the 25th of November, in our locality, we put our bees into the cellar, the time being varied, of course, according to the peculiarity of the season. Whenever it turns cold and begins to snow, and the prospects seem pretty good for a continuance, we open up our cellar and proceed to carry them in.[250] Before doing so, however, with a screwdriver or cold-chisel we go around to each hive, puff a little smoke in at the entrance, and pry the body loose from the bottom-board, as it will always be stuck down with propolis.[251] It may yield with a little snap, and it will be necessary to use a little smoke to make the bees behave. The bottom-boards all loosened, with an assistant and a couple of hive-carriers we proceed to carry the bees into the cellar.

MANNER OF CARRYING BEES INTO THE CELLAR WITH HIVE-CARRIERS.

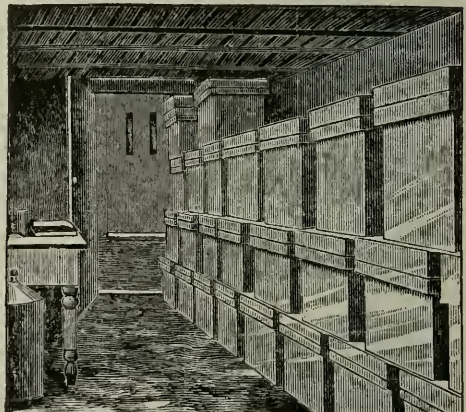
It is to be observed that our hive-carriers are simply a couple of lengths of wire bent in the shape of a letter V, an ordinary wooden-pail handle being slipped through to the middle of the wire. Both ends are bent down in the shape shown in the cut in the enlarged view. The ends are then bent in the form of a hook, and sharpened so as to catch on the bottom-board.



M'FARLAND'S NECKYOKE FOR CARRYING HIVES.

Where hives are carried to any distance, and help is scarce, the yoke will be better. One man can carry two heavy hives quite easily; ascend cellar-steps, and go through doors. The only objection is the rigging, and loading and unloading. For short distances we prefer the bails first illustrated. After you are once harnessed and loaded, the McFarland device is excellent.

Having picked up the hive or hives we proceed to the cellar, and deposit the hive near the place where it is supposed to stay through the winter. Along on two sides of the cellar we have previously laid scantling, say 14 or 15 inches apart, depending, of course, upon the length of the hive. We then pick the hive (just brought in) up by the hand-holes, lift it off its bottom, and lay it at one end on top of the scantling, and lay the bottom-board in one corner of the cellar. In like manner we bring in another colony, lift it off the bottom-board, and deposit it by the side of the other colony, leaving four inches between, and so on. We bring in other colonies until the scantlings are covered with hives four inches apart. We are now ready to commence another tier on top. The next hive that is brought in is piled on top of two others, in such a way that the bottom covers the space between two hives below, and so on we pile the rows of the hives. The next tier is followed up in the same manner, until we have three or more tiers high, each hive placed over the intervening space between the two below. When I visited H. R. Boardman in 1889 I took a photograph of his winter repository, an engraving of which I submit below.



INSIDE VIEW OF BOARDMAN'S REPOSITORY.

You will observe that his hives are piled up in the manner I have already described;

namely, each hive covering the space between two below. The reason for this manner of piling is, convenience in the first place; and in the second place, to give ample bottom ventilation You will now see an additional reason for leaving the cover on. If we removed the cover we could not pile the hives one upon the other so well.

Before I proceed further I wish to describe another method of carrying bees into repositories, where one person alone does the moving. The engraving below will fully explain itself.

In the engraving it is plain that it is simply an iron axle and a couple of cart-wheels. These are attached to a couple of 2 x 4 scantling, as shown above. The operator lifts the handles up, pushes them gently under the edge of the hive, and bears down until the same is suspended. He then pushes it to the door of his winter repository, when he afterward stations it where he wants it. This same device can be attached to hives with hand-holes when necessary.

From this digression we will return to the bees in the cellar.

They have been piled up as illustrated and described, and provided with ample ventilation from the bottom. The bottom-boards, as they are brought in, are piled up in any place convenient in the cellar, and are left to remain until it is again necessary to remove them in the spring. A good many, however, leave their bottom-boards out on their summer stands the year round. The hives are carried in without the bottom-board, and piled up as described. But some have complained that the bees fly out and bother. While we have succeeded perfectly in carrying them in without bottom-boards, yet we very much prefer to carry the bottom-boards in with the hives; first, because the bees are less liable to fly out and annoy; and, second, because the bottom-boards are protected from the action of the weather.

SHALL WE PUT THE HIVES BACK ON THE OLD STAND IN SPRING?

There is this advantage in leaving the bottom-board out: Mr. H. R. Boardman letters each row in his apiary, and numbers each hive, each body and bottom-board bearing the number and the letter of its respective position. In the spring, in carrying bees out he is able to deposit his hive right where it was the preceding fall. "C6," we will say, is to go directly to the C row, and on arrival it is replaced on bottom No. 6. Mr. Boardman does not attach very much importance to bees being put back upon their old stands; though if he can do it just as conveniently, he prefers doing so, because there will be some old bees that will go back to where they were the previous fall.

If one should desire to carry out Mr.

H. R. BOARDMAN'S HIVE-CART, AND METHOD OF CARRYING BEES INTO THE CELLAR.

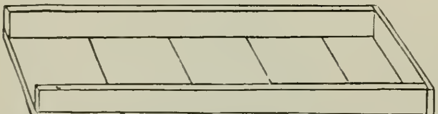
Boardman's plan of putting them upon the old location, and he should still like to carry his hives in with the bottom-boards, he can do so; but when he returns for another colony he is to carry the bottom back and deposit it in the same place whence he had just removed it a few minutes before. In the spring, before he goes in to get a colony, he is to take along with him a bottom, deposit the colony upon it, and carry it to the spot where the bottom-board had just been removed, and no time will be lost. On the whole, I should prefer to leave the bottom-boards in the cellar, piled up by *themselves*, and put the bees where it is most convenient. As most of the bees lose their old points of the compass, it does not make much difference where they are put the following spring. If they do not go back into their old hive it will not matter very much.

BOTTOM VENTILATION, AND HOW TO SECURE IT.

One of the prime causes of unsuccessful wintering in repositories is in leaving on the bottom-boards as they are in summer. The bees have only just what ventilation they can get through the entrance, ⅜ inch wide. The majority if not all of those who winter successfully in the cellar leave the bottom-boards off entirely.

OTHER METHODS OF GIVING BOTTOM VENTILATION.

I have given you our general plan of wintering bees in the cellar. Perhaps it would now be well to give you some of the methods employed successfully by others. Capt. J. E. Hetherington, of Cherry Valley, N. Y., the most extensive bee-keeper in the world, owning some 3000 colonies, I believe has a square hole cut in the bottom-board of his hive. Dr. C. C. Miller uses a reversible bottom-board, as shown in the cut below.



DR. MILLER'S REVERSIBLE BOTTOM-BOARD.

The drawing above will make the whole matter plain. By using one side of it he has simply a ⅜ space under the brood-frame for summer use. For winter use the bottom board is reversed, and this gives him two inches, or thereabouts, under the brood-frames, with entrance two inches deep, and the full width of the hive. The doctor likes this bottom-board, and during the past winter of 1889 he has had success with it. The only objection I have to it is, that it requires a more expensive bottom-board, and I am not sure that the change is worth the extra expense. If we can winter successfully and uniformly without bottom-boards, as practiced by H. R. Boardman and others —ourselves being included—I see no reason for adopting the reversible.

CELLARS VERSUS SPECIAL REPOSITORIES.

Cellars are more generally used than up-ground buildings. One reason is, that almost everybody has a cellar under his house. If the same can be darkened, and during warm days will not go much above 50 degrees, and cool off as much if any below 40, is perfectly dry, and can be partitioned off from where vegetables are kept, we have all that can be really desired.[252] But a good many may have only a damp cellar; or if they do not have that, it is so small that it can hardly be spared for the bees. Special up-ground or partially up-ground cellars are then usually constructed. The accompanying engravings show the repository that G. M.

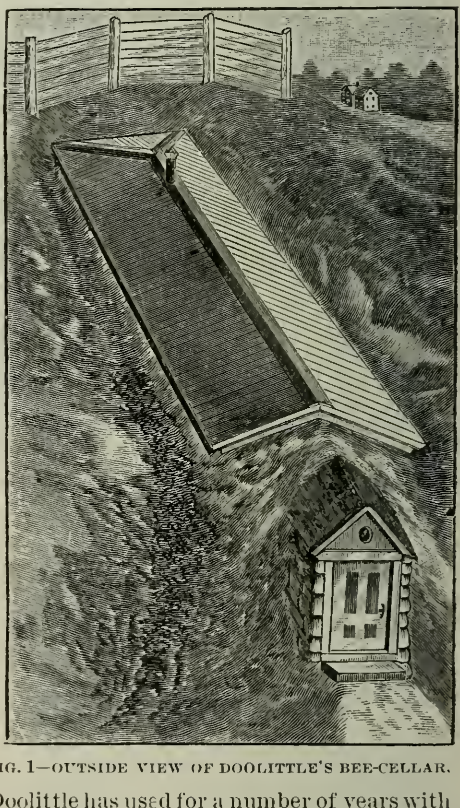
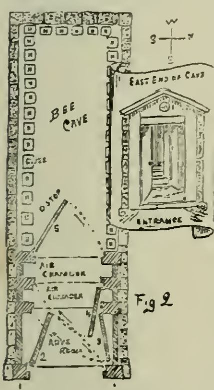


FIG. 1—OUTSIDE VIEW OF DOOLITTLE'S BEE-CELLAR.

Doolittle has used for a number of years with good success. It occupies a partial side hill. A fence is put in the rear so that snow will bank over the roof. Fig. 2 shows exactly the inside of the structure. You will notice that Mr. Doolittle has three doors.

Two, I think, are sufficient. The ventilation at 6 gives what little ventilation is needed.[254] The following is a description, taken from the pen of Mr. Doolittle.

Fig. 1 represents the outside appearance of the cellar, as viewed from the southeast. The ground should rise gradually from the foreground up to the fence, the back end of the roof at the peak being lower, or as low, as the ground opposite to it, on each side. The outer roof is hemlock boards battened. In Fig. 2, 1 represents the window in the gable end of the ante-room, so I can have a little light after I go in and shut the first door. In this ante-room (see Figs. 2 and 3) I light my candle, have the sawdust to carry in to spread on the floor, etc. In Fig. 3, 4 is the upper drain, or water-course, to carry off all surplus water coming from the roof and elsewhere, it being made in a large scoop form by taking dirt out to go between the two roofs, as illustrated in Fig. 1. The fence is shown in the rear. This causes the snow to drift on the roof. In Fig. 3, 6 shows the ventilator at the back end of the cellar.



GROUND-PLAN OF BEE-CELLAR.

Fig. 2 represents the front view, also the ground-plan of the ante-room and doors. 1 is the casing that the outer door hangs on, and against which it shuts; 2 is the outer door which swings in and around against the south side of the ante-room; 3 is the first door toward entering the cellar; and in opening, it swings out and round the north side of the ante-room, finding the position when open as represented; 4 is the next door, two feet further in, which in opening also swings around against No. 3, as shown; 5 is the door entering the cellar; and in opening, it swings into the cellar around against the south wall, unless the cellar is full of bees, in which case a stop is so placed that it will not hit the hives.

In entering the cellar I first go into the ante-room and shut the door, as I have explained; then I open Nos. 3 and 4, and step into the last dead-air space, closing No. 4 after me, but allowing No. 3 to remain open. I now open No. 5 and quickly step into the cellar, closing 5 after me. Thus it will be seen that very little change of air can take place by my entering, especially when I say that all is covered overhead and on all sides with dirt, except the ante-room.

Fig. 3 represents the inside of the cellar. 1 represents the floor, or cellar-bottom. This is always quite dry, as there is a drain under the wall, and below the bottom all around, being 8 inches deep at the southwest corner, and 20 inches deep at the northeast corner, or outlet. 2 represents the south wall. The hives are put up along both walls and west end, putting one on top of the other ones four deep, as seen at 8; also by H, H, etc., in Fig. 2.

In Fig. 3, 3 is the inner roof, which is made by using 2 x 6 stuff for rafters (which are a foot apart), with 1-inch boards* nailed on them at the top. 4 is the 3 ft. of dry earth between the two roofs, 5 representing the outside roof. 6 is the ventilator, showing the two elbows, which effectually exclude all light. The hole in it is 6 x 8 inches square. 7 is the sub-earth ventilator, which is 4 feet deep, as far as may be, and 100 feet long; but, as I have said before, this and the upper one are closed of late, winters, while the bees are in the cellar. As I have often expressed, I believe this is the best underground arrangement possible

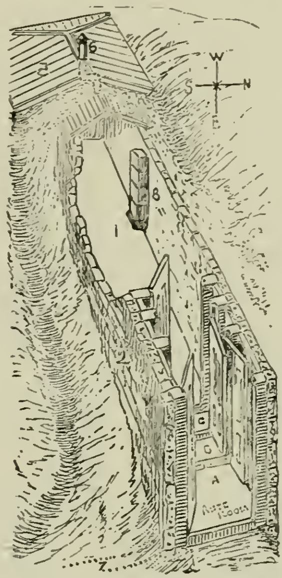
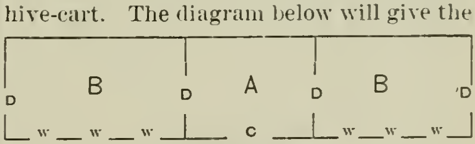


FIG. 3—BEE-CELLAR WITH ROOF TORN AWAY.

for wintering bees, and I have tried to make it all plain, so any person can build one who desires. The cost to me was not far from $80.00; but, of course, prices of lumber, stone, and labor, vary in different localities.[267] G. M. DOOLITTLE.

Borodino, N. Y., Jan. 7, 1888.

Mr. H. R. Boardman uses a repository like that shown in the engraving with the hive-cart. The diagram below will give the



GROUND-PLAN.

plan of the building. It is divided off into three compartments. A is an entryway; B B are places where the bees are kept. It is double-walled, 50 x 12 feet, one story, with walls 14 inches thick, packed. C is a doorway. To enter, you pass through C, close the door, and then enter the special compartments at D D. The entryway is 10 x 10 square, leaving B B each to be about 24 x 10, each being calculated to hold from 75 to 100 colonies. The diagram shown above gives

* In the summer of 1890 these boards had become rotted so much that the roof caved in. To prevent a recurrence of this, Mr. Doolittle uses stone flagging instead of the boards. If the latter were covered with tarred paper above and below, it might answer equally well, and, at the same time, be cheaper.—ED.

an inside view of one of the compartments. W, W, W, etc., are windows hinged at the middle in such a way that, by reversing to a horizontal plane, bees that are collected on the inside can easily pass out. An inside close wooden blind serves the purpose of darkening, as well as keeping out the extreme cold.

WHEN TO TAKE BEES FROM THE CELLAR.

If they do not get too restless, I would allow them to remain until the soft-maples, or willow and alder, begin to furnish pollen. Put them out very early, in the morning of a warm pleasant day, if you can tell what morning will develop into a pleasant day. Set each hive out so quietly that none of the rest will be disturbed, if you can.[258]

After they are all out, and nicely fixed as they were the fall before, keep a close watch that the weak ones do not swarm out, as they are quite prone to do, after their long confinement.[259]

DEAD BEES IN THE CELLAR.

Do not be alarmed if dead bees get on the cellar bottom. They may accumulate to the depth of half an inch, or possibly more, if you leave them. I would advise sweeping them up two or three times during the winter.[260] Those bees that come out are usually superannuated. They have served out the length of their days; and to rid the colony of their presence, they fly out on the floor and die. If you see bees on the floor that are swollen or distended, it indicates dysentery, or that something is wrong. Upon the other hand, if they are dry, all is well.

WHAT TEMPERATURE TO KEEP CELLARS.

While these special repositories are more convenient for carrying bees in and out (no cellar stairs), they have the one disadvantage of being subject to considerable range of temperature, those only partially under ground being perhaps excepted; and while those who use them winter successfully, yet it is more or less annoying to be obliged, during warm weather, to be continually opening and shutting doors to regulate the temperature. When I visited Mr. Boardman in February, 1889, he had to open the doors to lower the temperature to quiet the bees. A good cellar, on the other hand, would be less affected by outside temperature. The cellar that we used during the past winter (1889–'90) is shaded on three sides by a porch closely latticed under the floor. The temperature has never gone above 50, and rarely below 40; 45 seems to be the average temperature, and most bee-keepers would have this temperature if they could, and maintain it. Some go so far as to argue that the temperature should not vary one degree. Our own experience, as also that of Mr. H. R. Boardman, seems to prove that an absolutely uniform temperature is not essential, but that extremes are detrimental. I would not have the temperature go above 50 or 55, if I could help it, nor below 40. And this brings me to the subject of

ARTIFICIAL HEAT IN CELLARS.

A good many formerly used stoves in the cellar. G. M. Doolittle and Dr. C. C. Miller both used them pretty thoroughly. Mr. Doolittle has abandoned their use altogether. Dr. Miller still uses one,[392] and I am not so sure but they are a real benefit at times. When the temperature remains several degrees below zero, as is the case with Dr. Miller, and that continuously for a week or more, it is advisable then to raise the temperature, if it is below 38, by the use of artificial heat. As it will be inconvenient for many to make use of a common stove in their cellar, an ordinary coal-oil stove or a couple of good lamps will answer very well in lieu of it. The lamps or stoves, however, should be shaded by something on all four sides, so as to shut off the light. Instead of using lamps, some use ordinary square cans filled with hot water. If these are left in the middle of the cellar over night, they will make quite a difference in the temperature. On the whole I would dispense with artificial heat if possible; and I am not so sure that it is necessary, even when the temperature does go down as low as 35. Stoves in the cellar have probably done more harm than good.[261] But from what I am able to gather now from a large correspondence, and our own experience, I am inclined to think that it is beneficial, but only when the temperature has been below 38 for several days.

SUB-EARTH VENTILATORS.

The sub-ventilator should be from four to six inches in diameter, made of tile, about 100 feet long, and from four to six feet below the surface of the ground. The outer end is brought to the surface of the ground, and the inside end opens near the bottom of the cellar. The cold air entering the ventilator is warmed while in its passage under the ground; and when it enters the cellar it not only supplies the latter with pure air, but at the same time raises its temperature several degrees.

Almost all bee-keepers, though, who once used sub-earth ventilators have abandoned their use. It is generally considered now that they are a useless expense; and while they may be of advantage at times, they are more apt to be detrimental. Bees do not require so much *cellar* ventilation as was formerly supposed. If the temperature is a little high, and bees are restless, open the windows at night and close in the morning. The larger the number of colonies in the cellar, the more ventilation will be required. It should be borne in mind, that too much cellar ventilation is detrimental.

DOES IT DISTURB BEES TO ENTER THE REPOSITORY WITH A LIGHTED LAMP?

This question is often asked. At times it evidently does create some disturbance; but usually, if you enter the room quietly, being careful about making unnecessary jarring, and avoiding loud talking, and remaining for only a short time, little if any harm will result. I would not enter the cellar or repository unless necessary. If the temperature goes down *outside* to or about zero I would ascertain the temperature in the repository. If below 35 I would raise the temperature by artificial heat. If very warm outside, and the temperature is above 50 in the cellar, and the bees seem to be restless, ventilate at night, when it is cooler.[391]

HOW TO EXAMINE COLONIES IN THE CELLAR, WITHOUT BOTTOM-BOARDS, WITHOUT OPENING A HIVE.

With a small hand-glass and a lamp, enter the cellar quietly. Hold the glass beneath, and a little in front of one of the hives which are to be examined. With the other hand, hold the lamp so that the light strikes the bottom of the hive. Now tilt the glass at such an angle that the bottom of the hive can be seen in the glass. The condition of the bees can be very easily learned. If they are in a nicely compacted cluster you may rest assured that they are as they should be. As a general thing you will find them in plain sight on the central frames, just over the openings. Sometimes the ball will be hanging a little below. With a hand-lamp and a glass I find I can generally see nearly all parts of the hive inside. A dark lantern is much better than a hand-lamp; for with this you can shoot the light just where you want it. As the light is concentrated in one place only, it is less liable to disturb the bees elsewhere.

WHAT KIND OF STORES ARE PREFERRED?

I prefer stores made of granulated-sugar syrup sealed: but good combs of sealed *white* honey are nearly as good. As a general thing, bees will winter on dark honey, if well ripened and sealed. I certainly should not go to the expense of extracting it and then feeding syrup. Dark honey is a little more apt to give dysentery, but usually it does not.

ONE MORE HINT IN REGARD TO WINTERING.

Sometimes a colony may run out of stores unexpectedly, and, to all appearances, be dead from starvation, the greater part of the bees on the bottom-board, and others with their heads in the cells. Now, if they have not been in this condition more than three or four days, they can often be revived by taking them into a warm room. As soon as they begin to show signs of life, sprinkle them with diluted honey or sweetened water. In the course of 2 to 6 or 8 hours they will come to life, as it were, crawl up on the combs, and be nearly as well as if their mishap had never happened. Such cases occur most frequently in the apiary, when the nights are not very cold. Valuable queens may often be saved when but few or none of the worker-bees can be resuscitated: for it is a strange fact, that the queen's tenacity of life is greater than that of any of the workers.

In my earlier experience I was trying very hard one year to winter my whole apiary, of 48 colonies, without any loss. I did it, but one of them came so near being lost that it was saved only by the above treatment; therefore, friends, don't be in a hurry to decide that a colony is lost irretrievably.

SUMMING UP THE MATTER OF WINTERING.

Taking all things into consideration, my advice to the A B C class, and to all others who have not large apiaries and large experience, is to winter in chaff-packed hives, in the open air, on their summer stands.[398] If it were as pleasant and convenient to handle bees in the house-apiary as in the open air, I should say, have a house-apiary.

SPRING DWINDLING.

I do not know whether to style this a disease, or a condition of things that comes about naturally during cold and backward springs. I should incline to the latter, were not its ravages so uncertain: that is, it seems to affect a part of an apiary and not another part; and, at times, it will go all through one apiary, while another, a few miles away, will be entirely free from it. It is very certain that it afflicts weak colonies, as a general thing, more than strong ones, but there are exceptions even to this. It is much worse after a long, hard winter, and it disappears always at the approach of settled warm weather and new honey. Although it does not generally seem to affect stocks before March, I have seen them affected by it from Feb. until June. I have even known colonies to be listless and lifeless from its effects, until others in the apiary were sending out rousing swarms. Strong colonies that are raising brood vigorously seldom *seem* affected by it; but I suspect they *are* affected more or less by it, or by the condition of things, but have sufficient vigor and strength—animal heat, if you please—to pull through until there is plenty of warm weather, new pollen, and new honey.

It made us but little if any trouble in our apiary, during the spring of 1878; but we had such a siege of it in 1879 that an extract from GLEANINGS of that year, for May, will make a very good description of it.

SPRING DWINDLING.

A Report from the Battle-Field, by an "Eye-Witness."

To-day is the 15th of April, and scarcely a bit of pollen has been gathered. The buds of the soft-maple are open; but, for some reason which I can not give, not a bee is to be seen hovering near them; the slippery elm is also in bloom, but, strange to say, not a bee hums about it either. The weather has not been very warm, and there is a cool north wind which may account in part for the seeming indifference of the bees to blossoms. Last month I reported 85 colonies left. Since then, one after another, they have been dwindling down in a wonderfully short space of time, and stocks that were called fair, having brood on several combs a week ago, are now found with only a handful of bees, the brood dead by exposure, the unsealed larvæ starving and drying up in the cells, and a general air of discouragement all about the hives. Some colonies bring in a little pollen now and then, but the great part of them seem to have suspended work, and the bees are loafing idly about on the combs. Usually we find a row of cells of unsealed honey around the young brood, but now the heavy combs of sealed stores remain untouched, and not a cell of honey is placed close to the brood for immediate use, and every bee seems to have stopped work. When we open hives there is no need of a smoker, for the greater part of the bees seem too listless to care to show fight. Some cases seem to indicate that the black bees are less affected than the Italians; but, again, we find heavy stocks of blacks, in box hives, bought of some of our neighbors, all at once reduced to a handful, the queen gone, and the whole establishment an easy prey to robbers, if the robbers had energy enough to appropriate it. The dwindling is not in my apiary alone, but is also lessening the stocks of the farmers and other bee-keepers in our vicinity, and, in fact, all over our land. Not that everybody has lost thus, for many whole apiaries seem to have wintered as well as they ever did, but the losses seem to extend so widely that it is almost impossible to ascribe it to any special locality, or kind of stores. The chaff hives, it is true, were all right when the others were dying off at a rapid rate; but within the past week they, too, have begun to follow the rest, at a rate that is alarming.

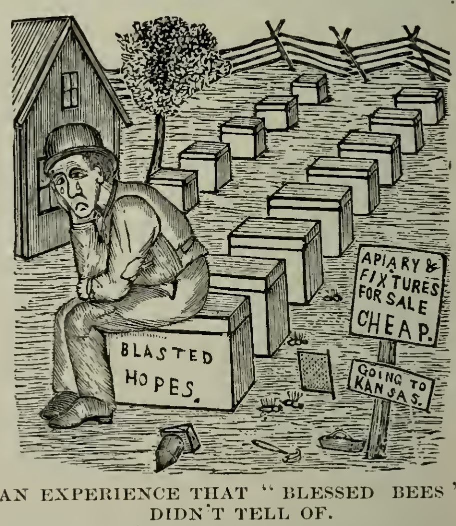
The house-apiary, somewhat to my astonishment, seems almost unaffected, only that they are making very slow progress in brood-rearing, and a very few stocks show signs of the universal dwindling. Even the flour candy seems to have lost its potency to start brood-rearing. I have had experience in this same line before, and it seems to me that nothing but new honey and new pollen can revive the drooping courage of our little pets. The bees have died close up to combs of sealed clover honey. No symptoms of dysentery are to be seen. Meal has been given them in fine weather, but their zeal for it has been nothing like what it is usually. There are now 55 "hives with bees in them," in our apiary. Perhaps a dozen of these have queen-cells, instead of queens. Four whole colonies, 9 nuclei, and 35 queens (48 in all) have been sold. I am thus particular in giving these details, because I think all who embark in bee culture should have a fair view of the obstacles they may have to contend with. We went into winter quarters with 166 colonies.

The following describes vividly the condition of my bees, except those in the house apiary.

Well, I went into winter with about 130 colonies of bees. To-day I think I can house all I have left, in a one-half bushel measure—yes, I believe I could put them in a peck basket. It would cost me about $500 to replace them. J. B. BRAY.

Lynnville, Tenn., Mar. 28, 1879.

April 25.—We have now had nearly a week of beautiful weather, and the troubles are all over. The bees are at work on the



AN EXPERIENCE THAT "BLESSED BEES" DIDN'T TELL OF.

maples; and under the influence of new honey and pollen, every thing is promising.

The weak colonies have still quite a propensity to swarm out, and, for some strange reason, our queens most unexpectedly turn up missing every day or two. This trouble seems mostly confined to the black queens in hives I have purchased, so we can not well ascribe it to artificial ways of managing. The farmers in the country round about us have lost most heavily. Our neighbor Shaw, of Chatham, strange to tell, has come through again this winter, without the loss of a single colony. His hives are not chaff-packed, but are double, with a dead-air space between the walls. Those of our neighbors who reared queens for sale last season have generally lost badly. Our engraver, who had quite a fine little apiary in the fall, has now but two colonies left. His imported queen went with the rest, and it was perhaps his sad experience that prompted the cartoon given above.

End of extract.

It may be well to state that the bees in 1879 were not as well protected as in the former year; but the fact that colonies in the chaff hives were eventually affected, proves that chaff, with all our pains, is not a positive preventive.

CURE FOR SPRING DWINDLING.

As I have said before, I know of no positive cure except warm weather, and this always does away with it entirely; were this not the case, I should hardly be willing to class this great drawback to successful bee culture, under the head of wintering. The question now arises, Can we not, by the use of artificial heat, bring about such a state of affairs as is produced by warm weather? In other words, can we not, by going to the necessary expense and trouble, save our bees and queens, even though seasonable weather does not come? Many experiments have been made in the matter, and some of them, apparently, have succeeded; but, on the other hand, many of them have signally failed. I have started healthy brood-rearing in every month in the year, by means of artificial heat; but to take a whole apiary that is running down, in the month of April, and build it up, prevent the colonies from swarming out, and the queens from deserting and dying, is something I have never succeeded in doing.

WHAT TO DO WHEN YOUR BEES GET "SPRING DWINDLING."

Look them over every other day, if necessary, and close up the division-boards, taking out all combs they can not cover. We used to advocate uniting when they became so weak; but we have found that uniting several weak ones does little if any good. Both Dr. Miller and G. M. Doolittle agree, as you will see by the comment,[262],[399]. If you have the real dwindling, you will find queen-cells started and queens missing, at almost every round you take among the hives. This is because the colonies have become disheartened and demoralized; and the only thing that will prevent this demoralization is to contract them until there are numbers enough to repel the frost.

It may be asked, What becomes of the bees? I believe, generally, they fly out of the hives, and never get back again. During cool sunshiny days they may be seen on the fences and sidewalks, on the grass and like places, often laden with pollen, showing clearly that they are trying to make a live of it, and doing the best they can.[263] I have sometimes thought they became so chilled in their meager clusters at home, that they had not sufficient vigor to withstand the chilly spring winds as a bee from a powerful and prosperous colony would. As the Italians are more eager for stores than the common bees, it may be that this is one reason why they are often said to be more liable to this dwindling than the common bees.

As explained in the extract, those who rear queens and bees quite largely late in the season are apt to suffer more from spring dwindling than those who let their bees alone after the honey harvest, providing that they were good and strong along in August and September. A good many contend that we must go into winter quarters with *young* bees. If it is the old bees that die off so rapidly on account of the loss of vitality, then the advice (that we should have young bees) is good. We have wintered bees well with only *old* bees, and that 200 colonies, one winter, without the loss of a single one. But the winter was favorable, and so perhaps that may not influence the argument one way or the other. However, I think it is safer to have as many young bees to go into winter quarters as possible. What I mean by "young" bees is those that have not borne the toil of the season, or at least the latter end of it.

NO SPRING DWINDLING SINCE 1881.

I have taken considerable space in regard to spring dwindling, because it is a trouble that might recur again as it did during the springs of 1879 and 1881. Since the latter date we have had none of any appreciable account in our own apiaries, and there seems to have been very little in other localities. In Wisconsin and York State they have had some trouble with it, but nothing as it was in 1881.

WHAT TO DO WITH COMBS FROM HIVES WHERE THE BEES HAVE DIED.

Put them safely out of the way of bees, either in tight hives or in a bee-proof room; and if you have not bees enough to cover them by the middle of June, or at such a time as you shall find moth worms at work among them, be sure that all the combs are spread at least two inches apart, as recommended in BEE-MOTH. Now, whatever other precautions you take, you *must* look after these empty combs occasionally. They are very valuable, and must not be allowed to be destroyed. A very good way to keep them is to put them in empty Dovetailed hives, piled one over the other. This keeps them perfectly protected, and yet you can quickly look them all over as often as once a week at least, until they are used. But, suppose they do get moldy, or full of worms, what then?

WHAT TO DO WITH COMBS THAT ARE SOILED, MOLDY, AND FILLED WITH DEAD BEES.

When I wrote the article on DYSENTERY I forgot to mention what should be done with the combs after the bees had died. Many times you will find the cells full of dead bees; and any one who has tried it will know what an endless task it is to try to pick them out. Well, do not try; but just take these combs and set them away until you want empty combs to build up stocks, and then hang them, one at a time, in the center of a populous colony. After a few hours, just take a peep at your comb, and see how the bees do it. If it is at a season when honey is coming in, it will have undergone such a transformation that you can scarcely believe your eyes, when you come to take a look at it. I have put in combs that were full of dead bees, filthy from the effects of dysentery, and moldy besides, and found them in the afternoon of the same day, clean, bright, and sweet, holes patched up, and partly filled with eggs, honey, and pollen. In one case I hunted the hive all over for my bad comb, and then came pretty near declaring somebody had taken it away; there was no comb there that could be identified as the bad one. Do not extract the honey, pick out the bees, or fuss to wash them off with water; just let the bees try their hand at it, and see. Do not give them too many bad combs at once, or they may get discouraged, and swarm out. Give them one; after a few hours, another; and you will very soon have them all right. How do they do it so quickly? Well, each bee takes a cell; and when he has his cell finished, they are all done. Suppose you had as many boys as there are hills of corn in the field. If all went to work, the field would soon be clean. Combs infested with moth-webs, and even live worms, may be fixed up in a twinkling, in the same way. If you stand in front of the hive, you may have the satisfaction of seeing the worms led out by the nape of the neck; to do this, you want a strong vigorous colony of Italians. See BEE-MOTH. A new swarm will usually clean out a hive of bad combs in the same way; but if too bad they may swarm out. Better take them in the way I have mentioned. To be *sure*, it pays to save such combs.[264]

THE LOSSES DURING THE WINTER OF 1880–'81.

The winter of 1880 and '81 was the most disastrous in the way of spring dwindling ever known. Probably three-fourths of all the bees in the Northern States were lost, and a great part of them were in pretty fair condition until April, when a very severe spell of winter, with a temperature below zero, was the occasion of the greater part of the losses. Bees that were in good warm and dry cellars during this siege fared better; but some very bad losses were reported, even with cellar wintering. While bees in the chaff hives suffered more than they ever did before, the testimony in favor of chaff hives over those unprotected has settled the matter of their superiority, beyond all question. At the same time, a great number of reports pointed strongly to the importance of more and better ventilation than we had been in the habit of giving. Hives where the section boxes were carelessly left on all winter, in many cases came through in good condition, while those closely packed with chaff cushions above, died. In our own apiary, we started into winter with about 140 colonies, and saved less than a dozen. It is proper to say, however, that few or none of these were really strong, first-class colonies. The young bees were shaken from the combs in the fall, and used to fill orders; and our trade in queens also kept many of the colonies queenless when they should have been rearing brood to stand the winter. Again, a part of the bees had been fed a mixture of grape and cane sugar. It has been demonstrated, in more recent years that such food is bad for winter. Still again, we made no use of the Hill device, or something similar. This last, probably more than the other cause, contributed largely if not altogether toward the severe loss.

For the winter of 1881 and '82 we prepared about 200 colonies, using the Hill device (see p. 294), and they came through almost without loss, but the winter was a much milder one than the preceding.

In the winter of 1883–'84 we carried 160 colonies through the winter, with a loss of only two. They were on natural stores, in chaff hives, Hill's device over the combs. The combs were spread more than we ever spread them before, many being fully two inches from center to center. We used a smaller number of combs in consequence, but these were filled almost solid with sealed clover and basswood honey.

Through the unusually severe winter of 1884–'85 we again succeeded in wintering toward 200 colonies, with a loss not exceeding five per cent; and the losses during the winter above mentioned were perhaps greater throughout the land than any winter before on record. Our bees were prepared according to the instructions given in the preceding pages, in chaff hives, out of doors, on their summer stands, though the greater part of their stores was sugar syrup fed before the cold weather came. One cause of the heavy losses during the winter of 1884–'85 was the great amount of honey-dew gathered; in fact, the amount was larger than in any other one season before on record; and coupled with the extreme cold weather it made bad work.* Having so many as we do in one locality caused the bees to consume the greater part of these honey-dew stores, so we were obliged to feed as above mentioned.

During the winter of 1885–'86 we lost less than three per cent of the 181 colonies wintered on their summer stands. They had nothing but natural stores, but were packed carefully in chaff.

During the winter of 1886–'87 we wintered 200 colonies without the loss of a *single colony*. They were packed on our summer stands as recommended in the foregoing pages. In consequence of the ravages of foul brood during the summer previous, and in consequence of the treatment we gave them as described under the head of foul brood, our colonies were greatly reduced; some of them were very weak. These weak ones we could not unite, because they each had valuable queens, and to unite would have meant the sacrifice of one queen, as we could not and would not sell queens to customers from diseased colonies. In spite of all these unfavoring circumstances, the bees wintered as above. Perhaps you would inquire how we made them come out so well. We simply followed the directions for outdoor wintering given in the foregoing pages, and did the *very best we knew how*. I would say, however, that almost every one was successful in wintering their bees in almost all localities during the winter mentioned.

During the winter of 1887–'88, we lost, in the chaff hives, only five-sixths of one per cent, and that out of a total of 240 colonies.

In the spring of 1889, out of 200 colonies in chaff we lost only two, making only one per cent.

In 1889 and '90 we lost one out of 150 colonies outdoors, though three or four others were weak and queenless. The rest were in excellent condition. In the fall of 1889 we put 42 in the cellar. We lost three. One starved, and the others were too weak to pull through, one of them being very weak and practically queenless, when set out.

In 1890 and '91 we had a touch of spring dwindling, and lost 15 per cent of those outdoors. In the cellar we lost 2 per cent, as we kept the bees in the cellar till after the bad weather.

I mention these instances to show that the directions which we have given for wintering colonies on their summer stands packed in chaff hives have stood the test. Hosts of A B C scholars, since the first few editions of this work were out, who have followed my directions, have reported success. But if such a winter and spring as distinguished 1880 and '81 should come with spring dwindling, neither you nor I must be surprised if we lose half our bees. I do not yet regard the wintering problem as *entirely* solved. Some of those who so constantly asserted it was, lost during the winter of 1887–'88, very heavily.

* During the spring and summer of 1884, honey-dew was gathered so largely in some localities near us that it was thrown out with the extractor to the amount of several tons. While the majority of people objected to this dark, queer-tasting honey, there were a few who liked it, so that it had a limited sale at 4 or 5 cts. a pound. As a rule, however, it did great damage to the sale of comb honey, for the bees would now and then put in a few cells, damaging the sale of the whole section.

CHAFF HIVE APIARY OF J. H. TOWNLEY, TOMPKINS, MICH.

The next 16 pages were by oversight paged wrong. So to make it right add 16 to them.

BIOGRAPHIES OF NOTED BEE-KEEPERS.

Believing that many of the A B C scholars would be interested in seeing the portraits, and in reading the biographical sketches of some of the prominent bee-men —men who have distinguished themselves in their line of apiculture—it is with no little pleasure that I now introduce them to you as far as it is possible to do so on paper. Dr. Miller, who, by reason of his natural fitness for the task, and who for long years has been more or less acquainted with the writings and doings of these men, has been detailed to write the sketches. The portraits executed by the Ives direct process of engraving are, I am happy to say, true to life, and have been so pronounced by those intimately acquainted with the subjects. Most of the wood-cuts are good. I now present to you a very natural likeness —an Ives reproduction — of the Rev. L. L. Langstroth, the father of American bee-keeping.

LORENZO LORRAINE LANGSTROTH.

Lorenzo Lorraine Langstroth was born in Philadelphia, Pa , Dec. 25, 1810. He graduated at Yale College in 1831, in which college he was tutor of mathematics from 1834 to 1836. After his graduation he pursued a theological course of study, and in May, 1836, became pastor of the Second Congregational church in Andover, Mass., which position ill health compelled him to resign in 1838. He was principal of the Abbot Female Academy in Andover in 1838–'9, and in 1839 removed to Greenfield, Mass , where he was principal of the High School for Young Ladies, from 1839 to 1844. In 1844 he became pastor of the Second Congregational church in Greenfield; and after four years of labor here, ill health compelled his resignation. In 1848 he removed to Philadelphia, where he was principal of a school for young ladies from 1848 to 1852. In 1852 he returned to Greenfield; removed to Oxford, O., in 1858, and to Dayton, O., in 1887.

At an early age the boy Lorenzo showed a fondness for the study of insect-life; but "idle habits" in that direction were not encouraged by his matter-of-fact parents. In 1838 began his real interest in the honey-bee, when he purchased two stocks. No such helps existed then as now, the first bee-journal in America being issued more than twenty years later, and Mr. Langstroth at that time had never seen or heard of a book on bee culture; but before the second year of his bee-keeping he did meet with one, the author of which doubted the existence of a queen! But the study of bees fascinated him, and gave him the needed outdoor recreation while engaged in literary pursuits, and in the course of time he became possessed with the idea that it might be possible to so construct a hive that its contents in every part might be *easily* examined. He tried what had been invented in this direction, bars, slats, and the "leaf-hive" of Huber. None of these, however, were satisfactory, and at length he conceived the idea of surrounding each comb with a frame of wood entirely detached from the walls of the hive, leaving at all parts, except the points of support, space enough between the frame and the hive for the passage of the bees. In 1852 the invention of the movable-comb hive was completed, and the hive was patented Oct. 5 of that year.

LORENZO LORRAINE LANGSTROTH.

It is well known, that, among the very many hives in use, no other make is more popular than the Langstroth; but it may not be so well known that, in a very important sense, every hive in use among intelligent bee-keepers is a Langstroth: that is, it contains the most important feature of the Langstroth—the movable comb. Those who have entered the field of apiculture within a few years may faintly imagine but can hardly realize what bee keeping would be to-day, if, throughout the world, in every bee-hive, the combs should suddenly become immovably fixed, never again to be taken out of the hive, only as they were broken or cut out. Yet exactly that condition of affairs existed through all the centuries of bee-keeping up to the time when, to take out every comb and return again to the hive without injury to the colony, was made possible by the inventive genius of Mr. Langstroth. It is no small compliment to the far-seeing inventive powers of Mr. Langstroth, that, although frames of different sizes have been devised and tried, and improvements, so-called, upon his hive have been made by the hundred, yet to-day no other size of frame is more popular than that settled upon by him, and in general the so-called improvements are one after another dropped into oblivion, and thousands of hives are to-day in use among the best bee-keepers, scarcely varying, if varying at all, from the Langstroth hive as first sent out.

As a writer, Mr. Langstroth takes a high place. "Langstroth on the Hive and Honey-Bee," published in May, 1853, is considered a classic; and any contribution from the pen of its author to the columns of the bee-journals is read with eagerness. Instead of amassing the fortune one would think he so richly deserves, Mr. Langstroth is to-day not worth a dollar. He sowed, others reaped. At the date of his invention he had about 20 colonies of bees, and never exceeded 125.

In August, 1836, Mr. Langstroth was married to Miss Anna M. Tucker, who died in Jan., 1873. He has had three children. The oldest, a son, died of consumption contracted in the army. Two daughters still survive.

Since his 20th year, Mr. Langstroth has suffered from attacks of "head trouble" of a strange and distressing character. During these attacks, which have lasted from six months to more than a year (in one case two years), he is unable to write or even converse, and he views with aversion any reference to those subjects which particularly delight him at other times. Mr. Langstroth is a man of fine presence, simple and unostentatious in manner, cheerful, courteous, and a charming conversationalist.

In reply to a question, he writes, under date of March 26, 1888: "I am now a minister in the Presbyterian church. Although not a settled pastor, I preach occasionally, and delight in nothing so much as the Christian work. My parents were members of Mr. Barnes' church, in Philadelphia, the mother Presbyterian church in the United States."

MOSES QUINBY.

Moses Quinby was born April 16, 1810, in Westchester Co., N. Y. While a boy he went to Greene Co., and in 1853 from thence to St. Johnsville, Montgomery Co., N. Y., where he remained till the time of his death, May 27, 1875.

Mr. Quinby was reared among Quakers, and from his earliest years was ever the same cordial, straightforward, and earnest person. He had no special advantages in the way of obtaining an education, but he was an original thinker, and of that investigating turn of mind which is always sure to educate itself, even without books or schools. When about 20 years old he secured for the first time, as his own individual possession, sufficient capital to invest in a stock of bees, and no doubt felt enthusiastic in looking forward hopefully to a good run of "luck" in the way of swarms, so that he could soon "take up" some by the aid of the brimstone pit. But "killing the goose that laid the golden egg" did not commend itself to his better judgment, and he was not slow to adopt the better way of placing boxes on the top of the hive, with holes for the ascent of the bees, and these boxes he improved by substituting glass for wood in the sides, thus making a long stride in the matter of the appearance of the marketable product. With little outside help, but with plenty of unexplored territory, his investigating mind had plenty of scope for operation, and he made a diligent study of bees and their habits. All the books he could obtain were earnestly studied, and every thing taught therein carefully tested. The many crudities and inaccuracies contained in them were sifted out as chaff, and, after 17 years' practical experience in handling and studying the bees themselves as well as the books, he was not merely a bee-keeper but a bee-master; and with that philanthropic

MOSES QUINBY.

character which made him always willing to impart to others, he decided to give them, at the expense of a few hours' reading, what had cost him years to obtain, and in 1853 the first edition of "Mysteries of Bee-Keeping Explained" made its appearance. Thoroughly practical in character and vigorous in style, it at once won its way to popularity. From the year 1853, excepting the interest he took in his fruits and his trout-pond, his attention was wholly given to bees, and he was owner or half-owner of from 600 to 1200 colonies, raising large crops of honey. On the advent of the movable frame and Italian bees, they were at once adopted by him, and in 1862 he reduced the number of his colonies, and turned his attention more particularly to rearing and selling Italian bees and queens. In 1865 he published a revised edition of his book, giving therein the added experience of 12 years. He wrote much for agricultural and other papers, his writings being always of the same sensible and practical character. The Northeastern Bee-Keepers' Association, a body whose deliberations have always been of importance, owed its origin to Mr. Quinby, who was for years its honored president—perhaps it is better to say its *honoring* president, for it was no little honor, even to so important a society, to have such a man as president. In 1871 Mr. Quinby was president of the N. A. B. K. A.

It is not at all impossible that the fact that so many intelligent bee-keepers are found in New York, is largely due to there being such a man as Mr. Quinby in their midst. The high reverence in which he was always held by the bee-keepers, particularly those who knew him best, says much, not only for the bee-master, but for the man.

On the occasion of the first meeting of the Northeastern Society, after the death of Mr. Quinby, Capt. J. E. Hetherington said, in his address, in a well-merited eulogium on Mr. Quinby: "Of the great amount of gratuitous labor performed by him, to advance the science of bee culture, the fraternity as a whole will never know, nor can they realize the information imparted to the numbers who flocked to see him personally, especially in the busy season."

"His life has been in every sense a life of usefulness, and not wholly devoted to the interests of bee culture, for he took a living interest in any movement he thought would benefit society; and as an advocate and helper in the temperance work he did no mean service. He possessed true kindness of heart, and regarded it as a religious duty to make all better and happier with whom he came in contact, and regarded that life a failure that did not leave the world the better for having lived."

ADAM GRIMM.

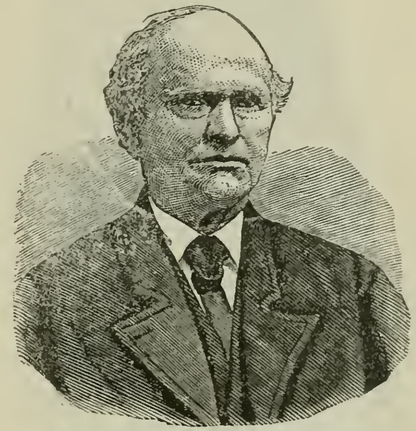
Adam Grimm was born in Germany, in 1824. His father kept a few hives of bees, in which Adam took deep interest, and did not rest satisfied till he himself became the owner of a few colonies. He emigrated to this country in 1849, settling at Jefferson, Wis., on a farm where he remained until his death, which occurred April 10, 1876. Soon after settling at Jefferson he obtained a few colonies of bees, and was so successful with them that at one time, when all other crops failed, his bees came to the rescue and helped him over the most critical time of his life.

In 1863 he had increased his apiary to 60 stocks of black bees in all sorts of box hives, and in 1864 he commenced to use frame hives, and transferred all his bees into them. In the same year, 1864, he bought his first Italians, and, as rapidly as possible, Italianized his apiary, and then sold large numbers of Italian queens all over the country.

About 1869 or '70 he imported, personally, 100 Italian queens, 60 of which were alive on their arrival at New York. Of this number he introduced 40 in his own apiaries. He increased his stock regardless of cost, every year, but had larger returns especially in late years, both from the sale of honey and bees. Queen-rearing he thought unprofitable. He had an intense enthusiasm in the business, and worked so hard in the apiary as probably to shorten his life. His success was the cause of many others engaging in the business.

He established a bank at Jefferson, of which he was cashier (his bees having provided the capital); but during the honey harvest he left his bank to the care of employés and went from one apiary to another, personally supervising all that was done.

We shall not soon forget two or three pleasant visits which we made at his home, with his interesting family. He told us that his wife remonstrated with him for working so hard, telling him that he now had a competence, and could give up his bees with the laborious care of so many; but he seemed to think the returns were large for the amount of labor, making the work still a pleasure, although no longer a necessity. He reached the number of 1400 colonies; and on one of our visits, when he had nearly 1000 colonies, he said, with a half-comical expression, "What would I do if all should die in the winter?" And then, the comical look giving way to one of German determination, he said, "I would buy some more; and with so many hives full of empty comb I would show you how soon I would fill them up again."



ADAM GRIMM.

His daughters, Katie and Maggie (both since married), were his able and faithful assistants; and the son, George, since his father's death, has assumed the principal care of the bees, for which he is well fitted by his previous training.

Mr. Grimm was trim built, of medium size, pleasant in manner, but especially impressing one as of great earnestness. He was very methodical, and kept an exact account of his business, showing, in a single year, $10,000 as the result of his bee-keeping.

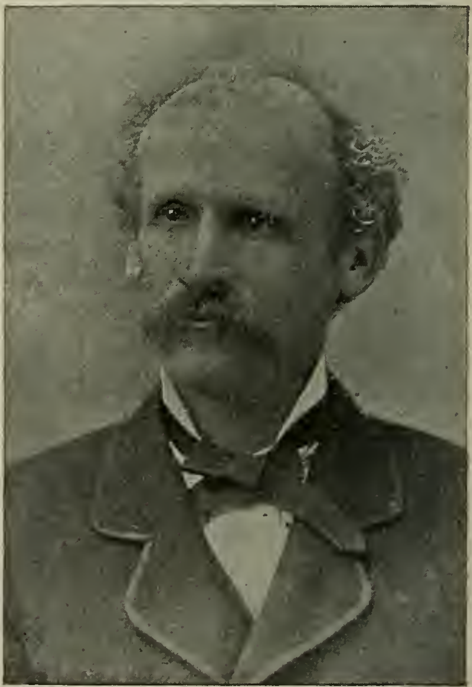
CAPT. J. E. HETHERINGTON.

The reputation of being the most extensive bee-keeper in the world—a reputation which no one in the fraternity would lightly esteem — belongs to John E. Hetherington, better known as Captain J. E. Hetherington. He was born Jan. 7, 1840, and is one of the very few who have never had any other residence than the place of birth—Cherry Valley, N. Y. His bee-keeping career commenced at the early age of twelve years, when, with $5.00 earned for that special purpose, he bought a colony of bees, and at seventeen had marketed honey by the ton, averaging nearly 60 lbs. per colony, and this was secured in glass boxes, although box hives and the brimstone-pit were then in vogue. At this same time, in 1857, he invented a double-walled hive, with confined air-space between walls, applying for a patent on it; but after using two or three hundred of them he had the unusual good sense to discard his own invention when he found it did not come up to his expectations. He then used very successfully a straw hive, having at one time 1200 of them With these hives he devised a system of artificial increase, not requiring the use of movable combs, and was so successful therewith that whole apiaries passed through the season without a single swarm.

CAPT. HETHERINGTON DURING WAR TIMES.

In 1861, at his country's call he took up the life of a soldier, abandoning what was then the most extensive bee-business in the country. He enlisted as a private in Company D, 1st Regiment U. S. Sharpshooters, and advanced to the position of captain. His record shows that the position was fairly and honorably earned by his bravery. Three times he was wounded, and in 1864 was discharged from service on account of disability from his wounds. His army life broke down his health so completely that, for two years, the question of his life was one of great uncertainty. However, he took up bee-keeping with his old-time zest. Wide awake to the matter of improvements, always on the lookout for any thing better, a trial of movable frames soon convinced him they were indispensable, the new Quinby hive being adopted. The problem of preventing increase engaged his deepest attention. Every device heard of or thought of was tried, only to be condemned, until he settled down upon the plan of removing the queen at swarming time.

After a good many years' experience with outdoor wintering, with different hives, with and without packing, he was forced to the conclusion that the severity of his winters made outdoor wintering a risky business, and he abandoned it. Although more generally known as a producer of comb honey, he was one of the first to use the extractor, and considers it a great boon to bee-keepers. He believes in producing honey of whatever kind and in whatever style the market demands. Two years before the date of Wagner's patent he began experimenting with comb foundation, entering into the matter with great enthusiasm. To prevent the foundation from sagging, he tried, in turn, cloth, paper, and wood, as bases. None of these were satisfactory, and finally, in 1875, he experimented with wire. The difficulty of impressing sheets of wax with wire imbedded, without laying bare the wires in some places, suggested to him the feasibility of having the base flat instead of rhomboidal, as in natural comb. Perhaps he was led to this partly from the fact that, several years previous, Mr. Quinby and he had made complete comb of thin metal coated with wax; and he was the more ready to adopt this, because, in his experiments with metal combs, the bees had used the cells with flat base. Having abstained from the use of foundation in raising comb honey on account of the objectionable "fishbone," he now saw that, with flat-bottom foundation, he could keep up his well-earned reputation for producing comb honey of the finest quality; for with such foundation the finished product had a base even *more* delicate than that produced wholly by the bees. Upon this invention the captain secured a patent, covering all kinds of wire supports for foundation, including wired frames. He receives a royalty upon flat-bottom foundation from the manufacturers, Messrs. J. Vandeusen & Sons; but the very valuable use of wired frames is freely given to the public; and for this, grateful recognition should be cheerfully granted to the inventor.



CAPT. J. E. HETHERINGTON.

Captain Hetherington is an excellent mechanic, making all his own supplies, extractors, box making machines, etc., even to the dozen or more wheelbarrows used in his different apiaries. At the Centennial, his exhibit took the first prize. Previous to this he had made a large shipment of comb honey to England — no such extensive shipment, probably, having been made before. His bees have been increased to about 3000 colonies, kept in twenty-one apiaries, from two to twelve miles distant from his home. He hires the ground and takes all care of the bees, visiting them as often as may be necessary, whether his visits be two days or two weeks apart, although in the busy season it is a rare thing that each apiary is not visited each week. In the fall, all the bees are hauled home, weighed, equalized in stores, and prepared for winter.

Capt. H. was one of the founders of the New York State Bee-Keepers' Association, at that time called Northeastern, and, after Mr. Quinby's death, was its president. He was one of the original members of the National Society, and was one year elected president, an honor which he declined, on account of poor health.

The captain's personal appearance is in keeping with his title, tall and commanding. He is an earnest temperance worker, an officer and worker in the Sabbath-school, which his children—two boys and a girl—attend, and is a regular attendant of the Presbyterian church, of which his wife is a member. He has a dislike for notoriety, and some have an impression that, like a turtle in its shell, he holds himself sullenly aloof, keeping valuable secrets to himself. Nothing can be further from the fact. He is remarkably genial and social, and has no secrets of any kind pertaining to bee culture that he would not gladly give to any one whom they might benefit. It is to be regretted that so little is seen from his pen. Possessed of an easy and pleasant style, and with an experience exceptionally extensive, whatever he does write is of value, and it is to be hoped that he may give fuller scope to his gift in that direction.

PROF. A. J. COOK.

Albert J. Cook was born Aug. 30, 1842, at Owosso, Mich. Those who are intimately acquainted with the man will not be surprised to learn that his parents were thoroughly upright Christians. The daily reading of the Bible, with comments by the father, re-enforced by the constant example of a chaste, honest, and industrious daily life, left its impress for life on the character of the son.

At the age of 15 he entered Michigan Agricultural College, where he graduated at 20, having been obliged during his course to suffer the sharp disappointment of suspending study a whole year on account of sickness, his health always having been rather delicate during his earlier years. Upon his graduation he went, on account of poor health, to California, where for three years he labored very successfully as a teacher. He then studied a portion of two years at Harvard University and Harvard Medical College with Agassiz, Hazen, and Dr. O. W. Holmes as teachers. In 1866 he was appointed instructor at Michigan Agricultural College, and in 1868 Professor of Entomology and Zoology in the same college.

He has done and is doing a work unique in character, for he instructs the students, not only about insects in general, but about bees in particular. Every student that graduates goes all over the theory of bees, studies the bee structurally from tip of tongue to tip of sting, and goes through with all the manipulations of the apiary—that is, if there is any honey to manipulate; handles the bees, clips queens, prepares and puts on sections, extracts, etc. Probably in no other institution in the country, if in the world, is this done.

Prof. Cook is an active and influential member of the North American Bee-Keepers' Association, of which he has been president; was one of the originators of the Michigan State Bee-Keepers' Association, of which he was president for a number of years, and helped start the State Horticultural Society, being a member of its board for some years. He is widely known as a writer. His "Manual of the Apiary" has reached a sale of 15,000 copies, and "Injurious Insects of Michigan" 3000 copies. He is also the author of "Maple Sugar and the Sugar-Bush," of which 5000 copies have been published. He has written much for bee-journals, as also for the general press. He is a clear, practical writer, with a happy style.

PROF. A. J. COOK.

In the battle waged against insect foes, he has rendered valuable service. Remedies which he first advised are now common, and he was probably the first to demonstrate the efficacy and safety of Paris green for codlin moth.

Prof. Cook is of average height and weight, a charming conversationalist, and an intensely interesting lecturer. His very pleasant manner is only a fair index of a genial and loving spirit that, in an unusual degree, strives to put the best construction on the conduct and motives of every one, and throws a mantle of charity over their faults. His spirit of kindness extends to the brute creation; and on his farm, in which he is much interested, he has some fine-blooded stock; and in attempting to engage a hand to work upon the farm, the writer once heard him stipulate as essential that the employé must be kind to animals, and free from the use of liquor, tobacco, and profane language.

Prof. Cook is a great home lover, and proud of his wife and two children. An earnest Christian worker, he has for a number of years done a most important work in conducting a Sabbath-school class containing thirty or forty college students. It is to be regretted that excessive work has told unpleasantly on his health.

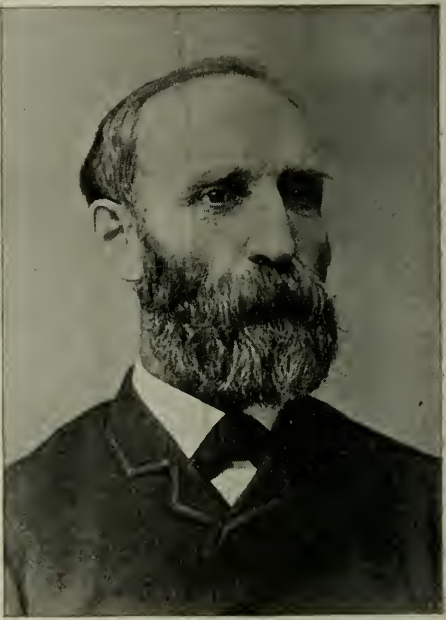
LYMAN C. ROOT.

Lyman C. Root was born in St. Lawrence Co., N. Y., Dec. 19th, 1840. The better part of his education was obtained in "brush college;" but before entering this he had two terms in the academy, two in St. Lawrence University, and a course in Eastman's Business College, where he graduated in 1865. The eight years following he was with Mr. Quinby, for the last five years his partner. It was his high privilege to be associated with him during what may be called the transition period of modern bee-keeping; during the time of the most rapid changes from box to frame hives; the time of the dissemination of the Italian bee, the introduction of the honey-extractor, the invention of the Quinby bee-smoker, the adoption of the one-comb section, and the perfecting of the new Quinby frame and hive. The various experiments that ended in the adoption of comb foundation were then in progress, and Mr. Quinby could have had no young man with him more enthusiastic and more helpful than the energetic L. C. Root, who released him from business cares, and gave him the needed leisure for study and invention. These were golden days for Mr. Quinby, well improved; and for Mr. Root nothing less, as he recalls the results obtained. Their supply-business rapidly grew to large proportions, and it was common for them to buy from three to five hundred colonies in box hives in the spring, transfer them to the new hive, and sell them to their customers in the different States. This necessitated a very large amount of exhausting work; but at this time Mr. Root knew nothing of sparing himself, and often did in one day what the average man would have taken two days for accomplishing.

In 1873 it was discovered that a rest was needed, and in the fall of that year he retired from the partnership and removed to Mohawk. But it seems impossible for a man of his temperament to rest, and we shortly find him extending his bee-business, going out in the early morning with his assistants to a bee-yard half a dozen miles away, and returning late at night with from two to three or more thousand pounds of extracted honey—the same process to be repeated the next day.

After the death of Mr. Quinby, Mr. Root took his supply-business. To all of this must be added his literary work as regular contributor to the *American Agriculturist* and the *Country Gentleman*, with frequent articles to all the bee-journals of the country; his presidency of the North American Bee-Society, and of the Northeastern Association, with his long and laborious exertions in establishing the latter, and finally his re-writing Mr. Quinby's book—a task on which he expended a greater amount of careful, conscientious work, and which caused him greater anxiety, than though it had been entirely his own. For this last work Mr. Root was peculiarly fitted by his long residence with Mr. Quinby, and knowledge of his methods.

In keeping bees Mr. Root has preferred to raise extracted honey, and to keep about forty colonies in a yard. His crop was usually as much per yard as his neighbors' who kept twice the number in a place. The most of this success was due to skillful manipulations, improved honey-gatherers, and wise selection of locations; but after subtracting all these there probably remains something to be credited to moderate-sized yards. One fall he put into the cellar at the Hildreth yard forty stocks, took the same out in the spring without the loss of a single colony, and produced from them 9727 lbs. of extracted honey, 4103 lbs. of which was gathered in just seven days. Is better evidence needed that the author of the "New Bee-Keeping" is a practical bee-keeper?



LYMAN C. ROOT.

Mr. Root takes an active part in every good work in the community in which he lives, and he is ready to make any possible sacrifice in working to elevate humanity. He takes great interest in temperance work, and has been an active member of the Good Templars since 1865. My first knowledge of Mr. Root came from his making a ten-mile trip and back after dark, over almost impassable roads, to our little village, for the purpose of organizing a lodge of Good Templars. Mr. Quinby and himself were two of those who voted the first Prohibition ticket in St. Johnsville, and he has been an active supporter of that party ever since.

In 1869 he was married to Mr. Quinby's only daughter, and his home is one in which intelligence, refinement, and happiness reside. I never met any one who appreciates his home, family, and friends, more than does Mr. Root. His wife has been a true helpmeet to him; and in the re-writing of Mr. Quinby's book she took a prominent part in the composition of the same—a service she had also rendered her father in his last revision. Mrs. Root has had entire charge of the education of their two daughters, the elder of whom has just passed from the home instruction into the high school, while the younger will take another year to graduate in the home course.

There are very few men who have had the large and varied experience with bees such as has fallen to the lot of Mr. Root. I suppose all such could be counted upon the fingers of one hand, for there is no branch of bee culture, either theoretical or practical, with which he is not familiar. He has been an extensive producer of both comb and extracted honey; is thoroughly familiar with the details of a large supply-business, including the purchasing of bees in box hives, and transferring and Italianizing the same; the rearing and shipping of queens, together with a large experimental knowledge and a large experience as writer and author. For the past year he has resided at the sea-shore, and, his numerous friends will be glad to learn, with health much improved; and we all unite in wishing that he may be spared to the bee-keeping fraternity for many years.

P. H. ELWOOD, *Gleanings, June, 1888.*

DR. A. B. MASON.

Dr. A. B. Mason was born in the town of Wales, Erie Co., N. Y., Nov. 18, 1833. His father and maternal grandfather were soldiers in the war of 1812. Dr. M. was raised on a farm, and all six of his brothers are farmers. At 17 years of age he taught successfully a school in DeKalb Co., Ill., for $14 00 a month, and "boarded around." At the close of this school he attended several terms at Beloit (Wisconsin) College. He then commenced the study of medicine, attending lectures during the winters of 1857 and 1858 at the University of Michigan, at Ann Arbor. In '62 he moved to Waterloo, Ia., and, the practice of medicine not being to his taste, he adopted dentistry as

DR. A. B. MASON.

his life profession, having studied it in connection with medicine. He was president of the Northern Iowa Dental Association for two years.

In his 19th year he united with the church, and is an earnest Christian worker. For years he was an active, if not the most active, member of the church to which he belonged, being at one time superintendent of the Sabbath-school, church clerk, a trustee, and clerk of the board of trustees. He was a leader in Sabbath-school work at home and in adjoining counties. One year he was secretary of eight different organizations, four of them religious. Dr. Mason has always been an earnest temperance worker, neither he nor any of his children using tea, coffee, tobacco, or liquor in any form.

In 1869, a brother left in his care two colonies of bees till convenient to move them. Watching these aroused an interest in bees, and, as usual, the way to bee-keeping in full was not long. In 1873, frequent and severe attacks of rheumatism obliged him to give up the office practice of dentistry, and he has since made a specialty of bee-keeping, making it a source of revenue.

In 1874 he moved to Ohio, where he has always been prominent in apicultural matters. Through his efforts the Tri-State Fair Association at Toledo was induced to offer premiums for the display of the products of the apiary, and this display has increased in attractiveness each year since. He was appointed superintendent of the department the first year, and still holds the position. He was chosen superintendent of the Apiarian Department of the Ohio Centennial Exposition, held at Columbus in 1888. In 1882 and '3 his apiary of 75 colonies suffered from foul brood, nearly every colony being infested in the latter year; but he cured it, and has had no return of the disease. Dr. Mason is a poultry-fancier, and was for four years secretary of the Buckeye Union Poultry Association.

Large in size, and of fine form, Dr. Mason is always prominent at conventions, where he is still more conspicuous by his never-failing joviality and good nature. In 1887 he was made president of the North American Bee-Keepers' Society. He was re-elected to that position for 1888–89.

A. E. MANUM.

Augustin E. Manum, whose picture is herewith presented, was born in Waitsfield, Vermont, March 18, 1839. When the war broke out he enlisted in Co. G, 14th Vermont regiment, as a nine-months' man. He served at the battle of Gettysburg, where his comrades in line on either side were killed; his own gun was shattered, and he was hit four times.

In March, 1870, a friend desired to lend him "Quinby's Mysteries of Bee-keeping." Reading the book, his enthusiasm upon the subject was kindled, and he immediately purchased four colonies of bees and began the study of apiculture. Having a natural aptitude for the business, and a love for the bees, he was successful from the first. His apiary so rapidly increased, that, at the end of four years, when he had 165 colonies, he sold out his harness-business and began the pursuit as a specialist.

Since 1884 Mr. Manum has devoted all his energies to the production of comb honey, increasing his plant until his bees now number over 700 colonies in eight apiaries. He always winters his bees out of doors, packed in the "Bristol" chaff hive. For the eight years previous to 1887, his average loss in wintering for the entire time was only 3½ per cent. He uses exclusively a frame about 12¾ x 10 inches, outside measure, which he considers the best for practical purposes in his apiaries. His hive, the "Bristol," is almost entirely his own invention, being specially adapted to the perfect working of the system upon which his bees are managed. In 1885 his production was 44,000 pounds of comb honey, an average of 93¾ pounds per colony, all made in twelve days from basswood.

A. E. MANUM.

Because of the failure of the honey sources the past season, about 14,000 pounds of sugar syrup was fed the bees to prepare them for winter. He still has much faith in the pursuit, although the past three successive poor honey years have told heavily upon his enthusiasm.

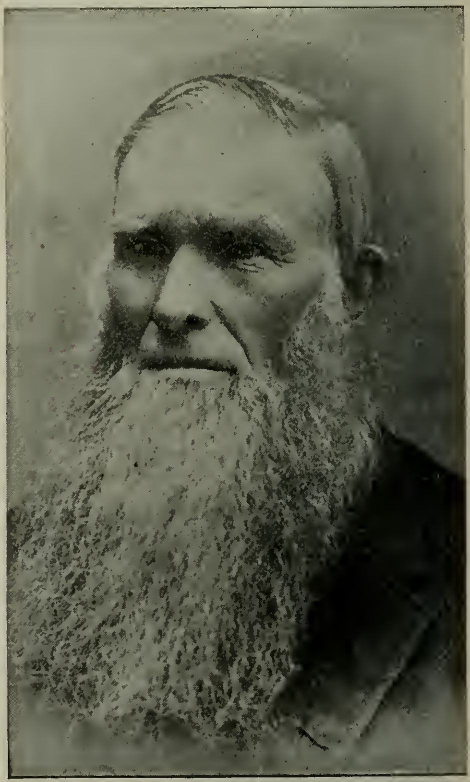
Mr. M. is of medium height, with dark complexion, hair, and eyes. A kind friend, an upright gentleman, and a thorough business man, he has attained an enviable position among the bee-keepers of Vermont, where he is so universally known. His extensive operations, his uniform success, and his practical writings, have also given him a national reputation. J. H. LARRABEE.

In Gleanings, page 301, Vol. XVII.

EDWIN FRANCE.

Edwin France, of Platteville, Wis., is noted as a producer of extracted honey on a large scale. He was born in Herkimer Co., N. Y., Feb. 4, 1824. His father was a furnace-man, molding and melting iron; and, having a large family to support, had difficulty in making both ends meet. At the age of eight, young Edwin was sent to live with his mother's brother, returning home at 16. He then served an apprenticeship of four years at the furnace, when his father bought forty acres of timber, which they cleared up as a farm, working at the furnace winters. At the age of 24 his father died, leaving him the main stay of the family. He gave up the furnace, and worked part of the time making salt-barrels summers, and cutting sawlogs winters. About this time he got, and kept on this little place in the woods, a few hives of bees.

At the age of 32 he took the "Western fever," and settled on a 200-acre prairie farm in Humboldt Co., Iowa, marrying and taking with him a wife, leaving his mother in care of her older brother, a single man, amply able to care for her. Here again he kept a few bees. He lived here six years, farming summers and trapping winters, when the breaking-out of the war brought prices of farm products down to a ruinous point, and he went on a visit to Platteville, Wis., intending to return when times brightened. Desiring some employment, he answered an advertisement, "Agents wanted, to sell patent bee-hives," and was soon the owner of the patent for his county. He made the hives himself; and as at that time nearly every farmer kept bees, the business paid well, and he soon bought two more counties. In his trades he got some bees, his starting-point as a bee-keeper. These he increased until in 1871, when he went into winter quarters with 123 colonies, bringing out 25 in the spring, and 14 in the spring following. Enlarging his hives, and studying the wants of the bees, led to better success, reaching 500 colonies in the spring of 1888, kept in six apiaries. In 1886, from 395 colonies he took 42,489 lbs. of honey, increasing to 507. In 1885 his 320 colonies averaged 113 lbs. each, and his 410 colonies in 1887 averaged 12 lbs. each. He owns eleven acres in the city limits of Platteville, devoted to garden truck and berries.



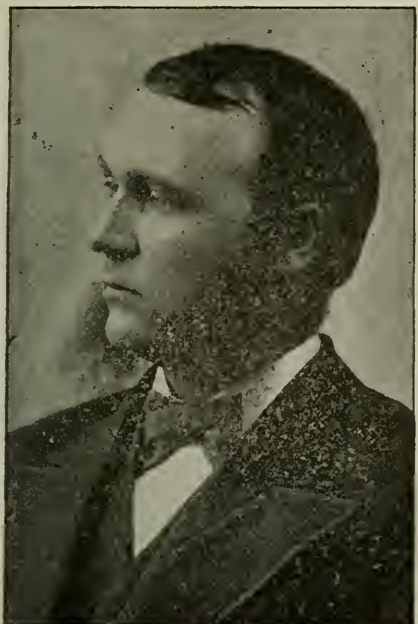
EDWIN FRANCE.

Mr. France and his son do all the work, except during a few weeks in the busy season, when he hires eight assistants from 12 to 18 years old. The whole ten go to one of the different apiaries each day, making a sort of picnic, and returning at night.

Mr. F. has not written much for the press; but what he has written bears the marks of ripe experience.

PHILIP HENRY ELWOOD.

Philip Henry Elwood is a good illustration of the healthfulness of bee-keeping as a vocation. At the age of 23 he was advised by his physicians to abandon a college course and choose some outdoor occupation, and now P. H. Elwood the bee-keeper is



P. H. ELWOOD.

known as a man who tips the scales at 225 lbs. Soon after leaving school he was offered a desirable position as teacher of natural sciences in a high school in Michigan, but the offer was refused. In 1872, at the age of 25, he commenced bee-keeping as a partner of Captain Hetherington. This partnership was profitably continued for five years, when he removed a distance of ten miles to Starkville, Herkimer Co., N. Y., where he has since remained, to carry on the business of raising honey. He was happily married in 1879. Mr. E is a conservative bee-keeper, little inclined to rush after new things simply because they are new, and is sometimes accused of being at fault in not placing sufficient confidence in the recommendations of others. He cares more to be sure that his plans and implements are such as experience proves the best, than to be constantly trying to invent something new. He uses the small Quinby hive, and, after giving a thorough trial to outdoor wintering, he winters exclusively in cellars. The larger part of his comb honey is put up in two-pound glassed boxes, and it was his honey that took the first premium at the Paris World's Exposition, exhibited in the same packing-cases in which it was shipped from his apiary. He prefers Italian hybrids, and keeps about 130) colonies.

Conservative in most things, he was the first man in his county to cast a Prohibition vote, and in 1887 was run for member of the Assembly. However earnest he may be in other things, he believes that the preparation for the life to come is of infinitely more importance than any thing else in this life.

GILBERT M. DOOLITTLE.

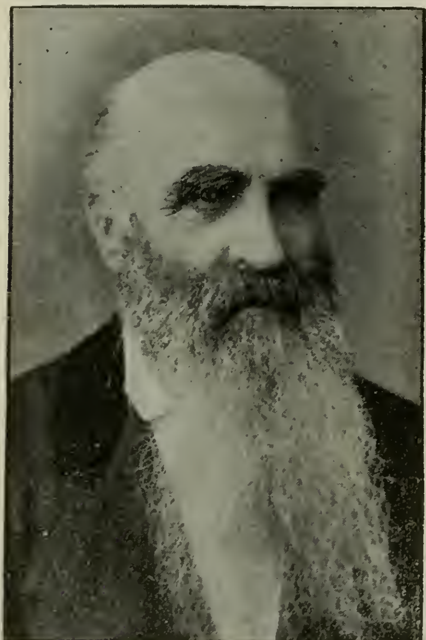
Gilbert M. Doolittle was born Apr. 14, 1846, in Onondaga Co., N. Y., not far from the home of his later years at Borodino, N. Y. During his childhood he often did duty by watching swarms from 10 to 3 o'clock, and at the age of eight was given a second swarm for the hiving. A thief, however, emptied the hive of its contents; and as foul brood prevailed in that region during several of the succeeding years it was not till the spring of 1869 he laid the foundation of his present apiary by purchasing two colonies of bees. Like many others he commenced with great enthusiasm, diligently studying all the books and papers obtainable, but, unlike many others, he has never allowed his enthusiasm to die out, and is to-day a diligent student of the ways of the busy bee. It is rare to find any one so familiar with what has been done and written relative to bee-keeping. As a business, Mr. D. has made bee-keeping a success, although he has never kept a large number of colonies, principally if not wholly because he prefers to keep no more than he can manage without outside help. In 1886 he wrote in the *American Bee Journal*, "From less than 50 colonies of bees (spring count) I have cleared over $1000

G. M. DOOLITTLE.

each year for the past 13 years, taken as an average. I have not hired 13 days' labor in that time in the apiary, nor had any apprentices or students to do the work for me, although I have had many applications from those who wished to spend a season with me. Besides my labor with the bees, I take care of my garden and a small farm (29 acres); have charge of my father's estate, run my own shop and steam-engine, sawing sections, hives, honey-crates, etc., for myself and my neighbors; write for seven different papers, and answer a host of correspondence." Mr. D. works for comb honey, and also makes quite a business of rearing queens for sale. Although a prolific writer, his fund of information never seems exhausted, and he is uniformly practical and interesting. His writings give evidence of the close and careful thinker. In personal appearance Mr. D. is of commanding presence, being large and well formed, of sandy complexion, and in manner he is a genial Christian gentleman.

CHARLES DADANT & SON.

Charles Dadant was born in a village of the old province of Champagne (now department of Haute Marne), France, May 22d, 1817. When a young man



CHARLES DADANT.

he was a traveling agent for a dry-goods firm, and afterward became a wholesale dry-goods merchant himself, subsequently leaving this business to associate himself with his father-in-law in the management of a tannery. In 1863 he came to the United States, intending to make a business of grape-growing, with which business he had been familiar from childhood, as it was the leading business of his native place. He did not know a word of English at this time; but by the aid of a dictionary he became acquainted with it, so that, four years later, he could write articles for the papers, but he never learned to pronounce English correctly.

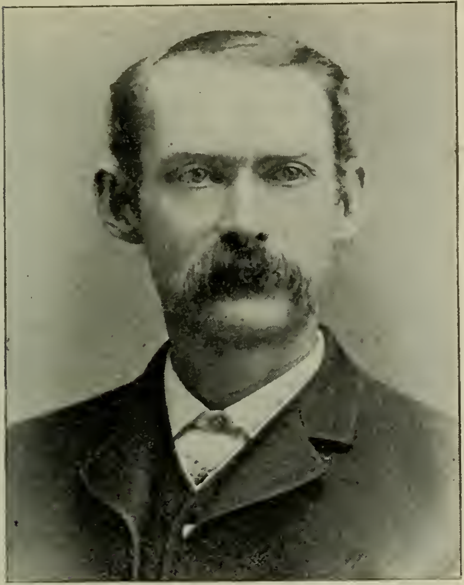
In 1864, a love for bees, which had shown itself in childhood, asserted itself anew, and he obtained two hives of bees, from a friend. After trying movable-frame hives side by side with the old European "eke" horizontally divided hives, the latter were cast aside, and in 1868 he tried to get the French apiarists to try the Langstroth system, but was rebuked by M. Hamet, the editor of a French bee-journal, who has never ceased trying to fight against the invading progress of movable frames, although other bee-magazines have started in France which have done the work he might so well have done. About this time Mr. D. tried to import bees from Italy. In 1873 he went in person to Italy, but was not entirely successful till 1874, when he succeeded in importing 250 queens. These importations were kept up for years. In 1871 he started an out-apiary, and steadily increased the number of his colonies from year to year. In 1874 he took into partnership his son, Camille P. Dadant, then 23 years old, who had been raised in the business. Since 1876 they have kept five apiaries, of 60 to 120 colonies each. They have built up a large trade in extracted honey—the product of their bees in 1884 having been 36,000 lbs. Messrs. Dadant & Son are among the largest, if not the largest, manufacturers of comb foundation in the world. Commencing with 500 lbs. in 1878, they reached in 1884 the enormous amount of 59,000 lbs. Both father and son have written no little for the American press. Mr. C. Dadant is better known as a writer for European publications, and has been one of the main expounders of American methods in Europe; and the Langstroth-Quinby-Dadant hive, introduced by him into the Old World, is largely used under the name of the Dadant hive.

CAMILLE P. DADANT.

He published a *Petit Cours d'Apiculture Pratique* in 1874, in France. To him was committed the task of preparing a revised edition of Langstroth's book, and this he has also translated for publication in the French language. The English edition contains 520 pages, and has been fully brought up to the times. For further particulars see book notices elsewhere.

JAMES HEDDON.

James Heddon was born Aug. 28, 1845, in the Genesee Valley, New York. Early in life he removed to the West; and for years Dowagiac, Mich., has been a name well known to bee keepers, because it is the home of James Heddon. Endowed by nature with a mind of remarkable vigor he lacked the advantages



JAMES HEDDON.

of much training in schools, and possibly also its disadvantages. His entrance into the ranks of bee-keepers, about the year 1869, may probably be traced to the fact that he married Miss Hastings, the daughter of a bee-keeper, serving a year's apprenticeship with the father. Few have shown such faith in bee-keeping, for Mr. H. was the first in the State, and one of the first in the country, to make a specialty of that pursuit, and few have shown that their faith was so well founded; for, commencing with nothing, he credits his capital, amounting to thousands, entirely to the aid of the little busy bee. His apiaries have some years contained between 500 and 600 colonies. In 1879 he added the supply-business.

Mr. Heddon is slight and wiry in figure, below the medium size, of sandy complexion, and intensely nervous in temperament. This nervous tendency leaves its strong impress on his writings, and more especially on his speaking. To that, and to the state of health resulting from it, may perhaps be attributed a fierceness in controversy, especially in his earlier writings, that would hardly allow one, who had never seen him, to give him credit for the affability that he really possesses. As might be expected, both in writing and speaking he is possessed of great vigor. He is a prolific writer, and, when not too much carried away by controversy, eminently practical. In 1885 he published "Success in Bee Culture," a practical work, giving his plans of bee-management, as also a description of the Heddon hive invented by him — a hive having the brood-chamber horizontally divided in two sections, with the intention of making manipulation by hives rather than by frames. He is also editor and publisher of the Dowagiac *Times*.

Among his inventions, aside from the Heddon hive, are the Heddon surplus case and the slat honey-board, so extensively used. He is the father of the "Pollen Theory." Mr. Heddon is by no means guided by what is merely popular, seeming rather to take a delight in the opposite, and for a time championed box hives and black bees after their general abandonment. He now prefers a carefully bred cross of Italians and blacks.

D. A. JONES.

Most prominent among the bee-keepers of Canada is Mr. D. A. Jones, of Beeton, Ontario. If for no other reason, his name deserves a place in the history of bee-keeping as the man who undertook to scour foreign lands and the isles of the seas for new races of bees. Few would have undertaken such a daring enterprise as that of Mr. Jones, when, in 1879, he set out in person, at great expense, and amid dangers and exposures, visited Cyprus and Palestine in search of the races of bees which he not only sought but found. As a fitting adjunct to this undertaking he established, on separate islands in the Georgian Bay, apiaries where the different races might be kept in purity, or crossed at will. Such things as these, of which the public enjoys the benefit, are usually undertaken by government; but Mr. Jones drew on his private purse, and estimates that he was poorer by several thousand dollars for the operation.

D. A. JONES.

Oct. 9, 1836, D. A. Jones was born near Toronto, Canada. Until of age he worked on the farm with his father. He then engaged in different occupations, bringing up in Illinois about 1860, where he worked a few months with a stockman. In the fall of the same year he attended a large exhibition at Chicago, where he was intensely interested in seeing a man exhibiting the Langstroth hive, manipulating the combs covered with bees, and explaining the advantages of movable combs. Mr. Jones took measurements of the parts of the hive, a fresh interest being awakened, for his father had been a bee-keeper. and among his earliest recollections was that of being carried by his father to the hives to watch the bees. At the age of five he was fairly versed in what was then generally known as to the habits of bees; and before the age of fifteen he hunted and captured bees, without the aid of his father.

Mr. Jones married and settled in Beeton, where he engaged in merchandising, afterward becoming so much interested in real-estate affairs and improvement of his village that he sold out his store, and thus had leisure to gratify his taste for bees, and commenced with two colonies in Langstroth hives. Afterward he established a much larger store, became profitably interested in railroads and other matters, but still found time to give attention to bees, until his two colonies became several apiaries. He has built up a large trade in extracted honey, and has given great impetus to exhibitions of honey at fairs, especially in very small packages.

In 1878 he commenced in a small way to manufacture supplies, and about six years later built a large factory. In 1886 the business had grown to such proportions that a company was chartered, with the title, "The D. A. Jones Co., Limited," and a capital of $40,000.

The *Canadian Bee Journal*, the first dollar weekly in the world, is another child of Mr. Jones, in which he may justly take pride.

Mr. Jones, in spite of his earnestness and energy, is a very sociable and jovial person, always ready to communicate to others the result of his investigations He is of medium size, rather inclined to stoutness, and of sandy complexion. He is still active in public affairs, but, better than all, is a professing Christian.

W. Z. HUTCHINSON.

W. Z. Hutchinson is one of the many, who, although born in the East, have spent in the West all of life that can be remembered. Born in Orleans Co., N. Y., Feb. 17, 1851, he was taken, four years later, with his father's family, to the dense forests of Genesee Co., Michigan, where his father literally hewed out a farm. W. Z. had the full benefit of pioneer backwoods life; and although hunting, trapping, etc., had a full share of his time, his natural bent was toward machinery. This passion for machinery was, as he advanced in his "teens," put to practical use by building a turning lathe, and beginning the manufacture of spinning-wheels and reels. These he continued to make for several years, peddling them out in the surrounding country. At eighteen he began teaching school winters. While thus "boarding around," a copy of King's "Text-Book" fell in his way. It was to him a revelation. He learned that the owner had about fifty colonies of bees down cellar, which he was not long in asking to see, and for the first time he looked upon a movable-comb hive—the American. The next season, in swarming time, he visited this friend, and the charms of bee-keeping appeared greater than those of any other business. Although not really owning a bee till the lapse of many months, he became then and there in spirit a bee-keeper, reading all he could find on the subject, and visiting bee-keepers. The introduction of woolen-factories compelled him to abandon the spinning-wheel trade; and one afternoon in June, while peddling out his last lot, he made a sale to a farmer about 16 miles from home; and although it was only about four o'clock, he begged to be allowed to stay all night, urged thereto by the sight of a long row of brightly painted hives. This bee-keeper had an only daughter, and the reader can weave his own romance, upon being told that the father, Mr. Clark Simpson, became the father-in law of Mr. Hutchinson.

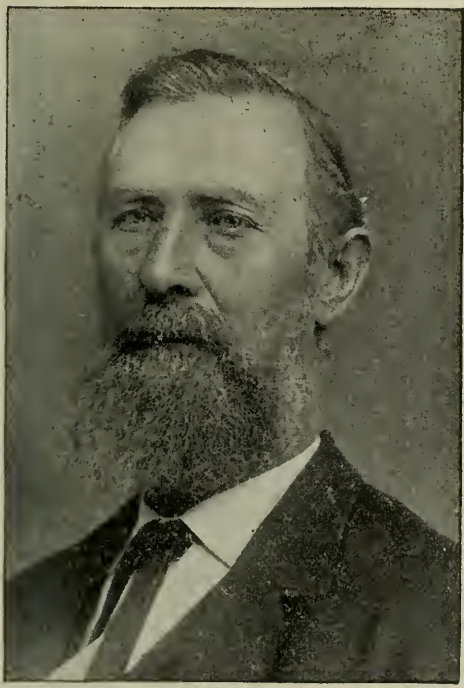
In 1877 he began bee-keeping with four colonies, and an excellent theoretical knowledge of the business. Mr. H. has never kept a very large number of colonies, but has made a comfortable living by the sale of comb honey. In 1887 he removed from Rogersville to Flint, Mich., where he established the *Bee-Keepers' Review*, which fills a place not previously occupied, and is edited with the ability that might be expected from one who has been so favorably known through his many articles published in the bee journals and other papers.

W. Z. HUTCHINSON.

In appearance, Mr. H. might more readily be taken for a professional man than for a farmer or bee-keeper. Tall, straight as an arrow, with side whiskers, and rather dark complexion, he presents a conspicuous figure at the gatherings of bee-keepers, where he is always in office, whether the gathering be local or national.

CHARLES F. MUTH.

Charles F. Muth is one of our veterans in bee culture. Years ago, when we first began to talk about movable-frame hives and Italian bees, he was one among us, and a man always posted. Of late years he has been pretty well known by his articles on the treatment of foul brood; and as he succeeds in curing it in his own apiary, we think it fair to presume he would in any apiary, if he had proper facilities. Although for many years friend Muth's apiary was on the roof of his store, or, rather, store and dwelling, it is now situated in a sort of open veranda, the open side being next to the river. Through this open side the bees go out and in. The hives are placed a convenient distance from the floor, and arranged with alleys between them. Although he has some thirty or forty colonies grouped together quite closely, they seem to go out and in, and find their respective hives just as well, for aught we could see, as those located in the open air. The bees we saw there in 1882 were beautifully marked, and very docile. We herewith present you his picture.



CHARLES F. MUTH.

Friend Muth has, of late years, been more widely known as a great honey *buyer*, than as a *producer* of honey on a large scale. Perhaps no man in the world has bought and sold more honey than he has; and one very pleasant thing about it is, that in all these large business transactions all his customers seem to be warm personal friends.

While at the convention last fall, the subject of the palmetto honey of the South came up. Friend Muth was called upon to tell what he knew about it. In order to impress upon us that the honey was of excellent quality, he made the remark that on one shipment which he had engaged for 8 cents a pound, he afterward paid the man 10, because it went so much beyond his expectations. At this point Prof. Cook arose and interrupted him.

"Friend Muth," said he, "I wish to ask just one question right here."

"Very well, go on," said our jovial friend.

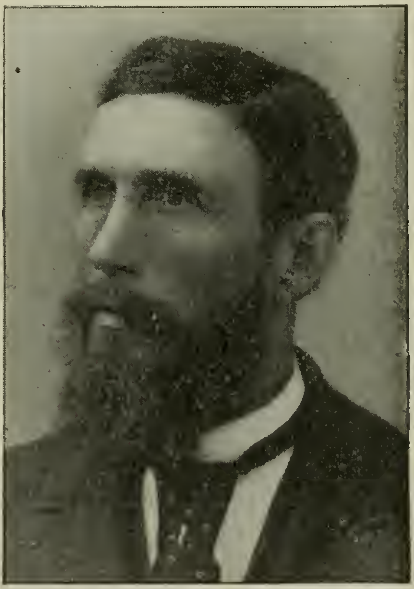
"I want to know," said friend Cook, "if the convention are to understand that this is the kind of a man you are."

"It is the kind of a man I was *that* time," was the prompt reply. And we really believe that that *is* the kind of a man friend M. has always been, and we trust always will be. *Gleanings, June, 1883.*

H. R. BOARDMAN.

H. R. Boardman was born Apr. 2, 1834, in Swanzey, N. H., and at about one year of age he was taken to what was then the wilderness West, and during nearly all his life his present place of residence, East Townsend, Ohio, has been his home. The district school was his only college, unless we take into account the opportunities for development afforded by an acquaintance with the wild woods, abounding in deer, turkies, and other wild game. Mr. Boardman says, "The wild woods have ever possessed a charm for me. The pages of Nature's great open book have furnished me much with which to make life pleasant; and it is this æsthetic taste, no doubt, that has led me to my present occupation of bee-keeping." Mr. B. has a cabinet of mounted specimens of birds, prepared by his own hands, in which he takes a pride next to that which he takes in his apiaries.

Mr. Boardman's training as a bee-keeper commenced at a very early age. His father was a bee-keeper of the old school, and a very successful one. By means of box hives and the brimstone-pit he secured honey for the family table, and also some to sell, nearly every season. Later on, boxes were put on top, the boxes sealed around with lime mortar or moist clay, to exclude the light entirely, in order to induce the bees to commence work in them. One year his father bought 25 colonies of bees early in the season, away from home; and as there was no one to watch them at swarming time, he tiered them up by putting an empty hive over each colony, there



H. R. BOARDMAN.

being a hole through which the bees could pass into the hives above. In the fall the bees were brimstoned, and the honey hauled home, nearly a ton! Considerable *wild* honey was also obtained from the trees. The abundance of these wild bees before tame bees were abundant, suggested, Mr. B. thinks, that they were native.

Mr. Boardman is a careful observer, doing his own thinking, and adhering to plans which he has found successful. He produces comb honey, and keeps 400 or 500 colonies in four apiaries. He is *remarkably* successful in wintering. He aims to secure a moderate yield with moderate increase, and has thus carried on a profitable and increasing business.

Mr. B. is of spare figure, hardly up to medium size, earnest in manner, suggesting a person of great decision and activity. Although not a prolific writer, whatever has come from his pen is practical and valuable.

THOMAS G. NEWMAN.

For fifteen years the *American Bee Journal* has remained under the management of one man; and, aside from being edited, its general make-up and clean typographical appearance impress one strongly, that, somewhere connected with it, is a man who is well up in the art preservative of all arts. The secret of it is, that Thomas Gabriel Newman, its proprietor, is himself a thorough practical printer. Born near Bridgewater, in Southwestern England, Sept. 26, 1833, he was left fatherless at ten years of age, with three older brothers and a sister, the mother being a penniless widow by reason of the father's endorsing for a large sum.

THOMAS G. NEWMAN.

The boys were all put out to work to help support the family. Thomas G. chose the trade of printer and book-binder, serving an apprenticeship of seven years, and learning thoroughly every inch of the business from top to bottom, in both branches.

Early in 1854 he came to Rochester, N. Y., where he had relatives; and before noon of the day of his arrival he secured a permanent situation in the job-room of the *American*. Within two months he took the position of assistant foreman on the *Rochester Democrat*, then the leading Republican paper of Western New York. Later on he spent seven years editing and publishing a religious paper, called the "Bible Expositor and Millennial Harbinger," in New York, and published a score or more of theological works, some written by himself. In 1864 he moved it to Illinois, sold out the business, and, for a "rest," took his family to England. Returning in 1869 he located at Cedar Rapids, Iowa, where he published and edited its first daily paper. In 1872 he sold this and removed to Chicago, where he embarked in the business of publishing *The Illustrated Journal*, a literary serial printed in the highest style of the art, and magnificently embellished. The panic of 1873 ruined this luxury, bringing upon him a loss of over $20,000. It was revived in 1889 under the name of the *Illustrated Home Journal*.

In 1879 he went to Europe, at his own expense, as American representative to the various bee-keepers' societies, and attended conventions in England, France, Italy, Austria, Germany, etc., and was awarded several gold medals for exhibitions of American apiarian implements. He has been elected an honorary member of 14 bee-keepers' associations, and is also life member of the North American Bee-Keepers' Society (of which he was twice elected president), and treasurer of the Northwestern Bee-Keepers' Association.

In 1885 he was elected the first manager of the National Bee-Keepers' Union, which, under his management, has successfully defended a number of bee-keepers in suits at law brought against them. His successive re-election each year gives evidence of the satisfactory manner in which he has performed the duties of his office.

He has been twice elected Grand Commander of Illinois of the "American Legion of Honor," and is an officer of some ten different societies in Chicago, social, fraternal, insurance, etc., and spends much time in visiting the sick and relieving the distress of those in fraternal and social relations with him, thus fulfilling the injunctions of the Book of all books, of which he is a diligent student.

MRS. LUCINDA HARRISON.

Among women, no bee-keeper is more widely or favorably known than Mrs. Lucinda Harrison. Born in Coshocton, O., Nov. 21, 1831, she came, in 1836, to Peoria Co., Ill., her parents, Alpheus Richardson and wife, being pioneer settlers. Public schools in Peoria at that time were undeveloped, and educational advantages few; but her parents gave her the best that could then be had in private schools. Her brother Sanford was a member of the first class that graduated from Knox College, Galesburg, Ill., and she then spent a year at an academy taught by him at Granville, Ill. She taught school from time to time till 1855, when she married Robert Dodds, a prosperous farmer of Woodford Co., Ill., who died two years later, leaving her a widow at 25. In 1866 she married Lovell Harrison, one of the substantial citizens of Peoria, from that time making Peoria her home.

Mrs. Harrison thus describes her entrance into the ranks of bee-keepers:

"In 1871, while perusing the Reports of the Department of Agriculture, I came across a flowery essay on bee culture, from the graceful pen of Mrs. Ellen Tupper. I caught the bee-fever so badly that I could hardly survive until the spring, when I purchased two colonies of Italians of the late Adam Grimm. The bees were in eight-frame Langstroth hives, and we still continue to use hives exactly similar to those then purchased. I bought the bees without my husband's knowledge, knowing full well that he would forbid me if he knew it, and many were the curtain lectures I received for purchasing such troublesome stock. One reason for his hostility was that I kept continually pulling the hives to pieces to see what the bees were at, and kept them on the war-path. Our home is on three city lots, and at the time I commenced bee-keeping our trees and vines were just coming into bearing, and Mr. Harrison enjoyed very much being out among his pets, and occasionally had an escort of scolding bees. Meeting with opposition made me all the more determined to succeed. 'Nothing succeeds like success.' I never wavered in my fixed determination to know all there was to know about honey-bees; and I was too inquisitive, prying into their domestic affairs, which made them so very irritable."

MRS. LUCINDA HARRISON.

Her perseverance was rewarded. In time Mr. H. ceased opposition, became himself interested in the bees, and helped take care of them, saying he believed that bee-keeping would add ten years to their life. For a number of years her apiary has contained about 100 colonies, she being prevented from doing as much with the bees as she otherwise would, by ill health and family cares; for, although childless herself, she has been a mother to several orphan children.

Mrs. H. is best known as a writer, her many contributions to the press being marked by vigor and originality, with a blunt candor that assures one of her sincerity. She has been bee-editor of the *Prairie Farmer* since 1876, and has written for Colman's *Rural World*, and occasionally for other papers. She has held important offices in the N. A. B. K. A., and also in other societies. She credits bee-keeping with making life more enjoyable, opening up a new world, and making her more observant of plants and flowers.

MRS. SARAH J. AXTELL.

Mrs. Sarah J. Axtell is one of the women prominently known among bee-keepers, although she protests that her husband, Linus C. Axtell, rather than herself, should have the prominence. Mr. Axtell is a farmer living at Roseville, Warren Co., Ill., his wife having been an invalid most of her life. In 1871 they got their first colony of bees. As these increased, Mrs. Axtell's interest in them increased, and with increase of interest in the bees came increase of health, Mrs. A. finding that, after a summer spent in the open air with her bees, her health is so much improved that she is able to withstand the winter confinement to which she might otherwise succumb. Since 1877 the bees have been kept in two apiaries. Mr. A. hires help to do the work of the farm, which he superintends, but spends most of his time in apiculture. At the beginning of the season he goes daily to the out-apiary, doing the work there; comes back in the evening, and makes preparations for both apiaries for the next day. Mrs. A., with the help of the hired girl, takes care of the home apiary, puts starters in sections, and does other light work pertaining to the business. By harvest-time, swarming is nearly over and the work is reversed, Mrs. A. going daily to the out-apiary, while Mr. A. takes care of the home apiary and helps harvest the farm crops. Their success has been varied, the yield per colony ranging from almost nothing to more than 216 lbs. per colony in 1882, when from 180 colonies were taken 39,000 lbs. of comb honey. Mrs. A. is deeply interested in the work of missions, and an additional reason for the beneficial effects of bee-work upon her health lies in the fact that she has constantly with her the delightful stimulus of the thought that every pound of honey secured allows her to devote

MRS. SARAH J. AXTELL.

an additional amount to the cause so dear to her heart. Although not a prolific writer, Mrs. Axtell is practical and interesting.

DR. C. C. MILLER.

One among the very few who make bee keeping their sole business is Dr. C C. Miller, of Marengo, Ill. He was born June 10, 1831, at Ligonier, Pa. With a spirit of independence, and a good deal of self-denial sometimes bordering upon hardship, young Miller worked his way through school, graduating at Union College, Schenectady, N. Y., at the age of 22. Unlike many boys who go through college self supported, running into debt at the end of their course, our young friend graduated with a surplus of some seventy odd dollars, over and above his current expenses at school; but, as we shall presently see, it was at the expense of an otherwise strong constitution. He did not know then, as he does now, the importance of observing the laws of health. Instead of taking rest he immediately took a course in medicine, graduating from the University of Michigan at the age of 25. After settling down to practice, poor

DR. C. C. MILLER.

health, he says, coupled with a nervous anxiety as to his fitness for the position, drove him from the field in a year. He then clerked, traveled, and taught. He had a natural talent for music, which by hard study he so developed that he is now one of the finest musicians in the country. If you will refer to the preface to Root's Curriculum for the Piano (a work, by the way, which is possessed or known in almost every household where music is appreciated), you will see that this same Dr. Miller rendered "much and important aid" to the author in his work. In this he wrote much of the fingering; and before the Curriculum was given to the printers for the last time, Mr Root submitted the revised proofs to the doctor for final correction.

His musical compositions are simple and delightful and you would be surprised to learn that one or two of the songs which are somewhat known were composed by Dr. Miller. Speaking of two songs composed by friend M., especially to be sung at a bee-keepers' convention, Dr. Geo. F. Root, than whom no one now living is better able to judge, said, "They are characteristic and good." Dr. Miller also spent about a year as music agent, helping to get up the first Cincinnati Musical Festival in 1873, under Theodore Thomas Dr. M. is a fine singer, and delights all who hear him. Upon hearing and knowing of his almost exceptional talents for music, we are unavoidably led to wonder why he should now devote his attention solely to bee keeping; and this wonder is increased when we learn that he has had salaries offered by music-publishing houses which would dazzle the eyes of most of us But he says he prefers God's pure air, good health, and a good appetite, accompanied with a smaller income among the bees, to a larger salary indoors with attendant poor health.

As has been the case with a good many others, the doctor's first acquaintance with bees was through his wife, who, in 1861, secured a runaway swarm in a sugar-barrel. A natural hobbyist, he at once became interested in bees. As he studied and worked with them he gradually grew into a bee-keeper, against the advice and wishes of his friends. In 1878 he made bee-keeping his sole business. He now keeps from 200 to 400 colonies, in four out apiaries. All the colonies are run for comb honey, and his annual products run up into the tons He is intensely practical, and an enthusiast on all that pertains to his chosen pursuit. Though somewhat conservative as to the practicability of "new things," he is ever ready to cast aside the old and adopt the new, providing it has real merit. Although he claims no originality, either of ideas or of invention, he has nevertheless given to the bee-keeping world not a few useful hints, and has likewise improved devices or inventions otherwise impracticable.

As a writer he is conversational, terse, and right to the point. Not unfrequently his style betrays here and there glimmerings of fun, which he seems, in consequence of his jolly good nature, unable to suppress. His "Year Among the Bees" (see Book Notices), his large correspondence for the bee-journals, and his biographical sketches preceding this, as also his writings elsewhere in this work, are all characteristic of his style.

Of him as a man, a personal friend, and a Christian brother, it affords me great pleasure to speak. Physically he is rather under the medium height, thick-set, and of an exceptionally pleasant face. To know him intimately, and to feel his intense friendship, is to know a near kinsman indeed There are few more devoted Christians than Dr. C. C Miller. He has always been active in Christian work, and is now superintendent of the Sunday school of the church which he attends regularly as might readily be imagined. He uses his voice and his talents for music to the glory of God, in a way which would seem sure to bring conviction to the unconverted. I have heard him sing for Christ, and I know whereof I speak. May he live long to benefit bee-keepers, and to glorify Christ!

As it would hardly be appropriate for the doctor to write his own sketch, he has requested me to do so. I will therefore sign myself as below. If you wish to know who *he* is, see preface.

ERNEST.

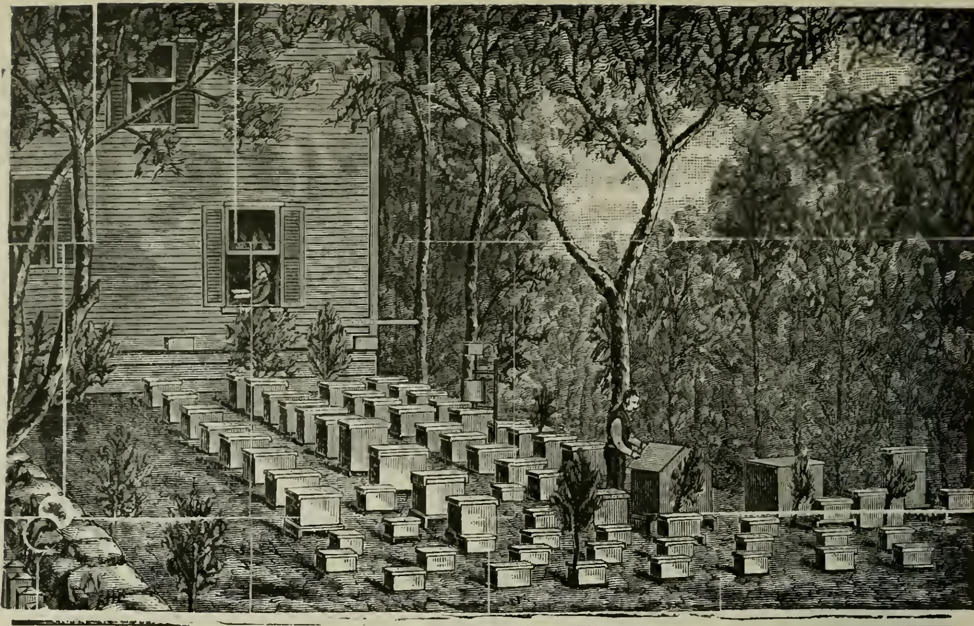
A B C PICTURE GALLERY

—OF—

APIARIES AND BEE-EXHIBITS.

During the years since our journal. *Gleanings in Bee Culture*. was started, a large number of fine and beautiful engravings of apiaries and of bee and honey exhibits have been presented to our subscribers. These engravings were executed at considerable cost; and as they are instructive, and suggestive of many ideas in regard to apiaries and exhibits, I have thought best to put the better part of them in permanent form right after our biographical sketches. Instead of going to a large expense in visiting different apiaries, you can see how different bee-keepers arrange their hives, and how their apiary looks. The apiary below is very suggestive, on account of its being on a side hill. The owner. Mr. A. E. Manum, can, from any part of said apiary, see whether swarms are out, or whether robbers are attacking a weak colony. So each engraving in order will be found to contain some hint or distinctive feature which I trust will be found valuable. As our space is limited I am unable to give even a brief description of the engravings But reference to *Gleanings*. at the bottom of the page, will give you the key. If you do not happen to have the required back number, send 10 cents, and the page and volume. and we will send it.

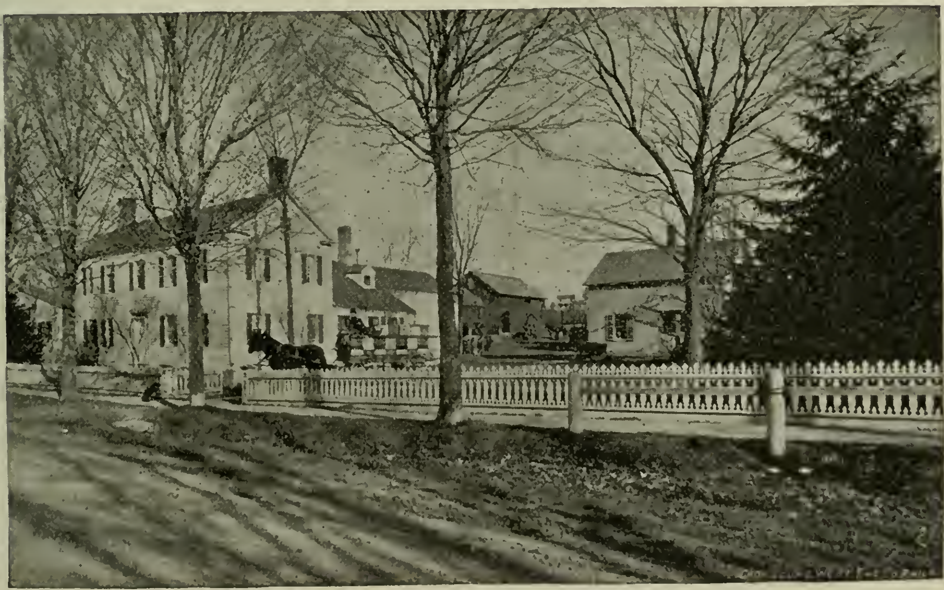
A. E. MANUM'S SIDE-HILL APIARY; SEE GLEANINGS, PAGE 665, VOL. XVII.



F. BOOMHOWER'S APIARY, GALLUPVILLE, N. Y.; SEE GLEANINGS, PAGE 83, VOL. XIII.

APIARY OF W. H. SHIRLEY, GLENWOOD, MICH.; SEE GLEANINGS, P. 561, VOL. XI.

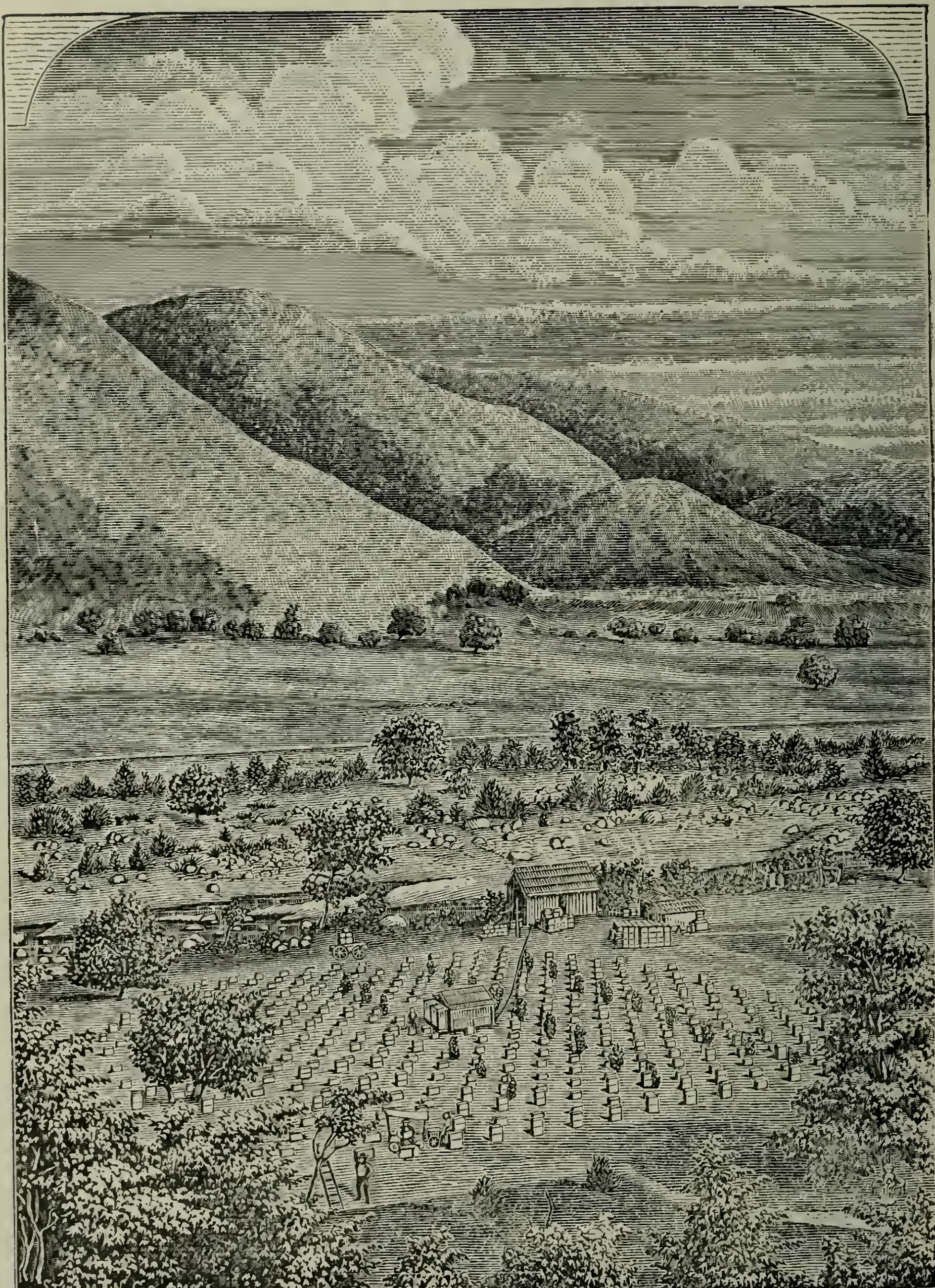
M. H. HUNT'S CHAFF-HIVE APIARY, BELL BRANCH, MICH.; SEE GLEANINGS, PAGE 625, VOL. XVII.



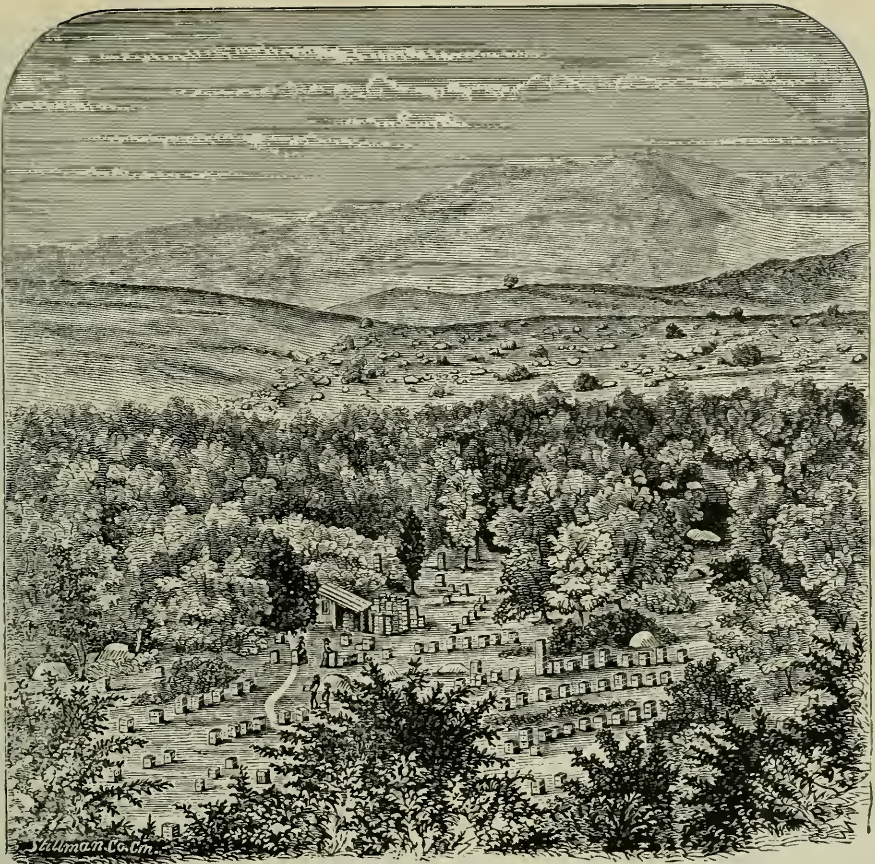
CAPT. J. E. HETHERINGTON'S HOME, CHERRY VALLEY, N. Y., WITH LOAD OF 32 COLONIES IN THE FOREGROUND.

APIARY OF H. R. BOARDMAN, EAST TOWNSEND, OHIO ; SEE GLEANINGS, PAGE 882, VOL. XVII.

OUR FRIEND FRANK BENTON AND HIS BEE-KEEPING COMRADES IN BEYROUT, SYRIA.
A Bee-Keepers' Convention with the Representatives of eight different languages present.



R. WILKIN'S HEXAGONAL APIARY, SAN BUENAVENTURA, CAL.; SEE GLEANINGS, P. 340, VOL. VII.



J. ARCHER'S BEE-RANCHE, SANTA BARBARA, CAL.; SEE GLEANINGS, P. 113, VOL. VI.

O. M. BLANTON'S APIARY, GREENVILLE, MISS.; SEE GLEANINGS, PAGE 341, VOL. XIII.

E. R. NEWCOMB'S HONEY EXHIBIT ON THE FAIRGROUNDS, POUGHKEEPSIE, N. Y.; SEE GLEANINGS, PAGE 929, VOL. XIV.

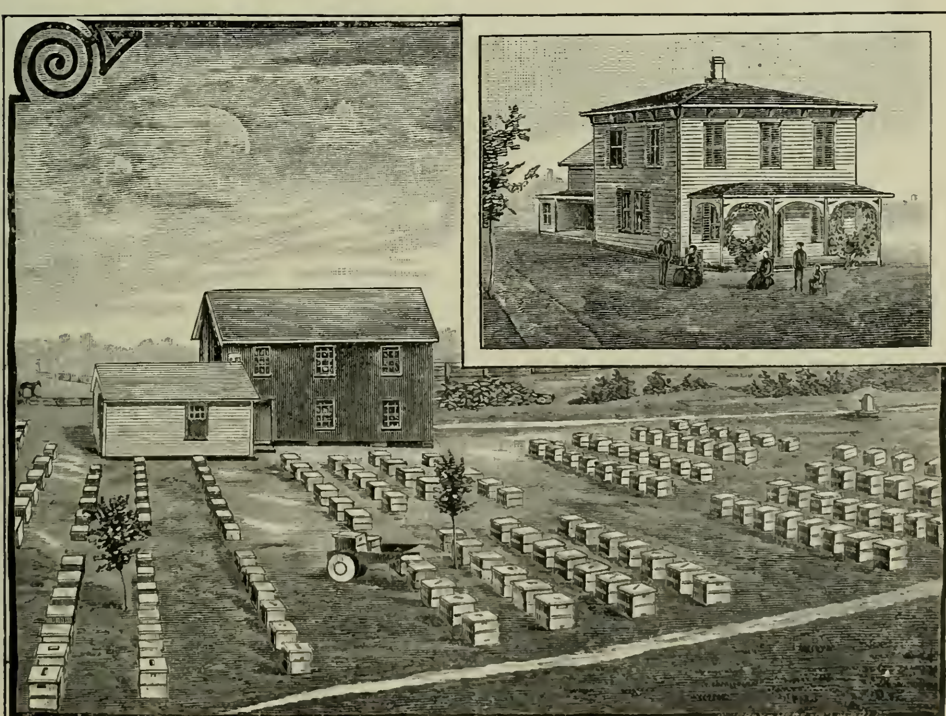
RAILROAD APIARY BELONGING TO M. A. WILLIAMS & CO., BERKSHIRE, N. Y.; SEE GLEANINGS, PAGE 533, VOL. X.

APIARY OF J. M. YOUNG, ROCK FALLS, NEB.; SEE GLEANINGS, PAGE 300, VOL. XV.

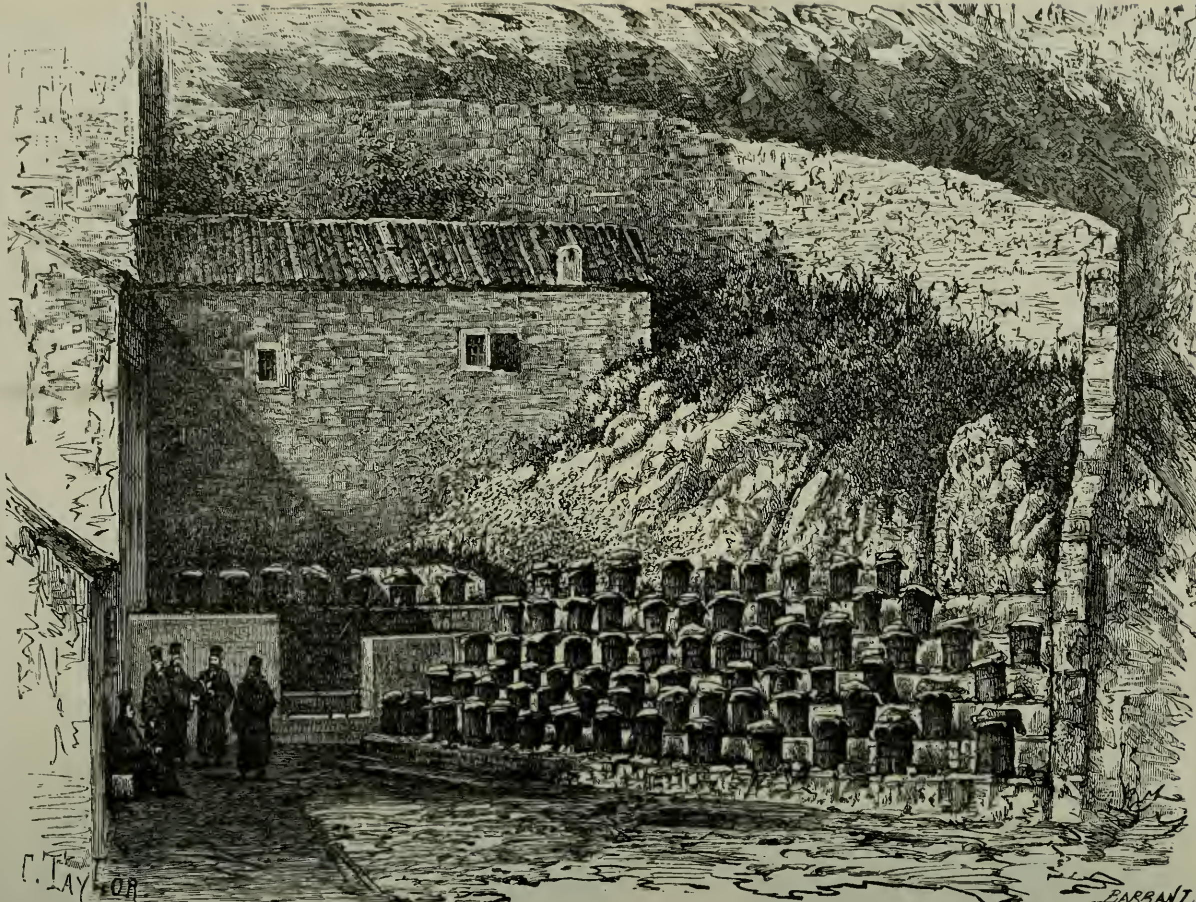
A. E. MANUM'S HOME APIARY IN WINTER; SEE GLEANINGS, PAGE 885, VOL. XVII.

A. E. MANUM AND HIS HELPERS IN HIS BEE-YARDS; SEE GLEANINGS, PAGE 665, VOL. XVII.

L. E. MERCER'S EXHIBIT AT VENTURA, CAL.; SEE GLEANINGS, PAGE 16, VOL. XVIII



T. P. ANDREWS' APIARY, FARINA, ILL.; SEE GLEANINGS, P. 14, VOL. XV.

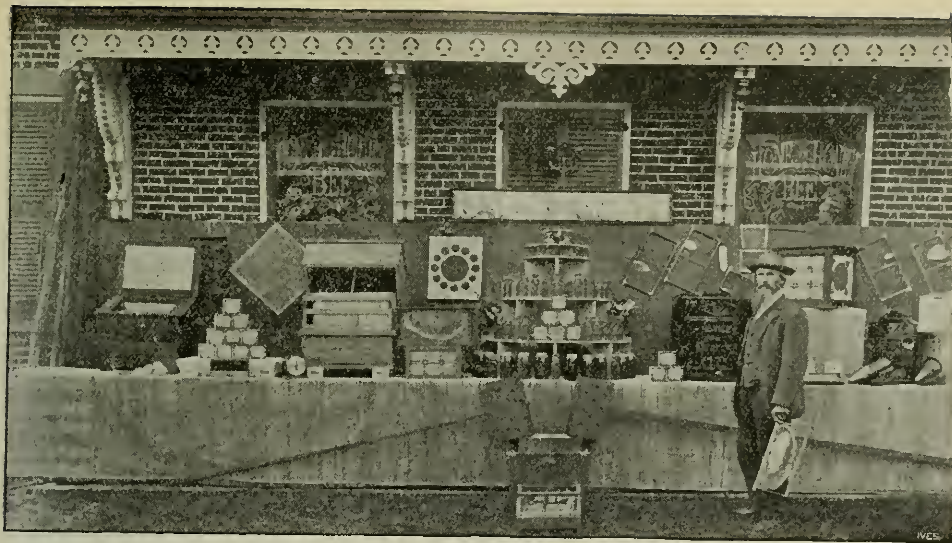


AN APIARY IN CETTIGNE, MONTENEGRO, TURKEY; SEE GLEANINGS, PAGE 595, VOL. X.

W. S. HART'S APIARY, HAWKS PARK, FLORIDA; SEE GLEANINGS, P. 625, VOL. XVIII.

J. H. MARTIN'S APIARY, HARTFORD, N. Y.; SEE GLEANINGS, P. 424, VOL. VIII.

C. OLMSTEAD'S SIDE-HILL APIARY, EAST BLOOMFIELD, N. Y.; SEE GLEANINGS, P. 423, VOL. XIX.



J. W. NIMAN'S EXHIBIT, SPRING MILL, O.; SEE GLEANINGS, PAGE 122, VOL. XVII.

A SCOTTISH APIARY; SEE GLEANINGS, PAGE 179, VOL. IX.

THE BRANTFORD INTERNATIONAL BEE-KEEPERS' CONVENTION ; SEE GLEANINGS, PAGE 135, VOL. XVIII.

GLOSSARY.

Abdomen of Bee.—The terminal division of the insect, composed of a variable number of rings.
Absconding, or Abnormal Swarm.—One that, from any cause, leaves its hive and starts for parts unknown, either without first clustering or because neglected when clustered.
After-Swarms.—Those issuing after the first swarm.
Alighting-Board.—A board in front of the entrance to a hive, on which the bees alight.
Apiarian.—An adjective of or relating to bees. Often incorrectly applied to one who keeps bees. *Apiarist* is preferable.
Apiarist.—See *Apiarian.*
Apiary.—A spot of ground where bees, hives, and all the paraphernalia are kept.
Apiculture.—The culture of bees.
Apis (Latin).—The family to which bees belong.
Aphis, pl. *Aphides.*—A genus of plant-louse that emits a liquid sometimes gathered by bees, and called honey-dew. (See Aphides.)
Artificial Fertilization.—Impregnation of queens in confinement, or by mechanical means.
Artificial Heat.—Warmth artificially produced, and applied to bees.
Artificial Pasturage.—Plants and trees cultivated for the honey they yield.
Artificial Pollen.—Rye meal or other substances fed to bees as a substitute for natural pollen.
Artificial Swarm.—A colony made by the division of one or more swarms.
Balling.—The manner in which bees cluster about a queen, in attempting to sting her.
Bee-Bread.—See Pollen.
Bee Culture.—The care of bees.
Bee-Dress.—A suit adapted to prevent stinging by bees.
Bee-Escape.—A device for getting bees out of supers. See Comb Honey in the body of the work.
Bee-Gum.—Term applied to that part of a tree or log which is, or has been, occupied by wild bees. Applied, by our friends in the South, to all kinds of bee-hives.
Bee-Hive.—A box, or other receptacle, made by man, to be used as a home for the honey-bee, and usually containing but one swarm. (See Bee-Gum and Skep.)
Bee-House.—A house for bee-hives. Also applied to the rude sheds seen about the country, where one or more hives are crowded together.
Bee-Line.—The most direct route between two places.
Bee-Moth.—A grey miller, ¾ inch long, the larvæ of which feed upon and destroy combs.
Bee-Plants.—Plants which are valuable as honey-producers.
Bee-Space.—"A space that will admit of the passage of a bee," and "in which bees are least apt to build burr-combs." It is a scant ¼ of an inch.
Beeswax.—See Wax.
Bee-Tree.—A tree occupied by a swarm of bees.
Black Bees.—A variety of the species *Apis mellifica*, whose color varies from dark brown to black. They are natives of Germany.
Bottom-Board.—The floor of a hive.
Box Hive.—See Hives.
Box Honey.—Honey stored in old-fashioned glass boxes.
Brace-Combs.—Often incorrectly called "burr-combs." Spurs of wax, built between brood-frames during the honey-season.
Brimstoning.—Fumigating with sulphur. See Fumigate, and Taking up Bees.
Broad Frame.—A frame used for holding section boxes—now generally called "wide frame."
Brood.—When applied to bee culture, larvæ in all stages. Not applied to bees after emerging from the cell, however young they may be.
Brood-Comb.—Either worker or drone comb used for breeding; usually applied to worker-comb.
Brood-Nest.—The space inside the hive, occupied by eggs and brood, extending in all directions from the center.
Brood-Rearing.—Raising bees.
Bumble-Bee, or *Humble-Bee*, a large noisy insect; a species of the genus *Bombus.*
Burr-Combs.—Bits or spurs of wax built on the top of thin top-bars. See Thick-top Frames, under Hive-Making.
Candied Honey.—Honey that has solidified.
Capped Brood.—Brood with a thin film of wax covering the cell after the larva has assumed the imago state.
Capped Honey.—Honey in cells that are sealed with wax.
Cappings or Caps.—The covering of brood or honey in cells.
Carniolans.—A race of black bees from the region of Carniola, Austria. Though much resembling the black bees, they are perhaps a little larger, and are said to be very gentle.
Cell.—A hexagonal depository for honey, and apartment for brood-rearing, made by honey-bees, of wax; two sizes. See Honey-Comb, and Wax.
Chaff Hive.—A hive having double walls filled with chaff at all seasons.
Chrysalis.—State of brood in transition from larva to a fully developed bee. Termed, also, pupa and nymph.
Climbers.—Apparatus to assist one in climbing bee-trees.
Closed End-Frame.—See Fixed Frames, in the body of the work.
Closed Top-Frame.—See Hive-making.
Clustering.—Manner in which numbers of bees cling together.
Colony.—A stock of bees, consisting principally of worker-bees; but which has, when perfect, one queen and sometimes a number of drones.
Comb.—See Honey.
Comb-Basket.—A tin receptacle, with handles and a close-fitting cover, for containing combs, or carrying them from place to place.
Comb Foundation (Abbreviated, fdn.).—Thin sheets of wax, which have been passed between the two rollers of a fdn. machine, having the shape of the bottoms of cells, with their edges partially raised. An artificial foundation, or partition, upon which bees build comb.
Comb-Foundation Machine.—A machine consisting principally of two metallic rollers engraved with such accuracy that thin sheets of wax passed between them will have the form of the bottoms of cells.
Comb-Holder.—An apparatus to hold a frame or frames. See Stings, in the body of the book.
Comb Honey.—Honey which has not been removed from the comb; i. e., honey in its natural state.
Comb-Guide.—Generally a wooden edge, or a strip of comb, or fdn., in the top of a frame, or box, on which comb is to be built.
Cushion.—A case or bag filled with some soft and porous substance, as chaff, for covering brood-frames on top or side.
Cyprian Bee.—A native of the island of Cyprus.
Davis' Transposition Process.—See Grafting Cells.
Decoy Hive.—One placed in position to attract and catch passing swarms.
Dividing.—Separating a colony into two or more, by removal of combs or bees, or both.
Division-Board.—A board, of the same length and height as the inside of hive, used for contracting the size of the apartment.
Dollar Queen.—Fertile queen, not necessarily fertilized by a pure drone, that has been laying less than 21 days, and reared from a pure Italian mother.
Drone.—A male bee, larger than the worker. Useful for nothing except filling the sexual office.
Drone-Brood.—Brood in drone-cells (see Cell), from which drones are hatched.
Drone-Egg.—One that is unimpregnated, laid by a virgin queen, or fertile queen, or fertile worker.
Drumming Bees.—Driving from hive, by pounding on the outside.

Dysentery.—A disastrous disease affecting bees in the spring; a diarrhœa.
Dzierzon Theory (pronounced Tseer'-tsone).—The theory of Dzierzon, formulated into 13 propositions, treating mainly of queens, their virginity, fecundation, and fertility.
Embryo.—The rudiments of existence of any plant or animal.
Entrance.—An opening in the hive for the passage of bees.
Entrance-Blocks.—Three-cornered pieces of board, for regulating the size of the entrance.
Egyptian Bee.—If it differs from the Italian, it is in being lighter colored, and exceedingly cross.
Extracted Honey.—Honey taken from the comb by means of an extractor.
Extractor.—See Honey-extractor and Wax-extractor.
Fdn.—Abbreviation for comb foundation.
Feeders.—Arrangements for feeding bees.
Fertile.—Productive, laying; as, fertile queen or worker.
Fixed Frame.—See Fixed Frames, in the body of the work.
Fertile Worker.—A worker that lays eggs which produce only drones. See Worker.
Foul Brood.—A malignant, contagious disease, being a species of fungoid growth which affects brood.
Foundation.—See Comb Foundation.
Frame.—A movable structure of slats, generally four-cornered, in which bees build comb which may, by this device, be changed about inside, or removed from, the hive at pleasure. It was brought into use by Rev. L. L. Langstroth, in 1851. See cut, and Hives.
Fumigate.—To expose to smoke; to apply the fumes of sulphur.
Gallup Hive.—See Nuclei, in the body of the work.
Glucose.—See Grape Sugar.
Grafting Cells.—A process of exchanging eggs in a queen cell for the purpose of raising queens from the eggs of a choice queen. See Queen Rearing in the body of this work.
Granulated Honey.—Honey that has formed into grains, in passing from a viscous to a candied state.
Grape Sugar.—A saccharine substance less sweet and less soluble than cane sugar, made principally from Indian corn; is called Grape Sugar because it is identical with the sugar found in grapes. It is often confounded with glucose, with which it is nearly identical, but glucose contains more dextrine than grape sugar, which renders it a permanent liquid, grape sugar being a permanent solid. Both substances are well known in commerce, and while glucose may, by chemical means, be converted into grape sugar, grape sugar can not, by any means known* at present, be converted into glucose. The sweet principle of both substances is known under the general term of grape sugar, to distinguish it from cane sugar, and as the manufacture of these articles, as an important industry, is of rather recent date, our dictionaries and cyclopædias, so far as I can learn, have failed to make any distinction between the two.
Green Honey.—See Unripe Honey.
Guide Comb.—Pieces of wood used as guides for building combs in brood frames or surplus boxes.
Hatching Brood.—Brood just emerging from the cells.
Hive.—A box or receptacle for the habitation of a colony of bees. See Hive-making.
Holy-Land Bees.—A race of bees from the Holy Land. They are very prolific, and are good honey-gatherers. As they are so very vindictive, and are no better honey-gatherers than the Italians, they have not come into very general favor.
Honey.—The nectar gathered by bees from flowers, and brought to a viscous state, by evaporation inside the hive, after being deposited in the cells.
Honey-Bag, or Honey-Sac.—An enlargement of the gullet, or first stomach, in which the bee carries the nectar gathered from flowers.
Honey-Bee.—An insect of the species *Apis Mellifica.*
Honey-Board.—An arrangement for separating the brood-chamber from the surplus-apartment. It may be one plain board, or a series of slats, making a honey-board large enough to cover the whole hive or brood-nest. Its object is to prevent the bees from gumming together the upper and lower stories with brace-combs. It should have a bee-space above and a bee-space below. See Bee-Space; see also Honey-Boards, under the head of Comb Honey, in the body of the work.
Honey-Box.—A receptacle for surplus honey, closed on all sides, but with entrance holes for bees. mostly discarded now for the section boxes.
Honey-Comb.—A sheet of hexagonal cells, the same on both sides, having a middle wall, or partition. When new, weighs ¼ lb. per sq. ft., requiring for its production from 1 to 5 lbs. of honey. Brood-combs are ⅞ to 1 in. thick; but, owing to the shape of the bottoms, each cell has a depth a little greater than half the thickness of the comb. Combs of this thickness will hold 3 lbs. of honey per sq. ft.; but the cells may be lengthened to the capacity of 10 lbs. per sq. ft. Worker-comb contains 28 cells per sq. in., on each side; drone-comb, 16 cells per sq. in., on each side: cells of both are of the same depth. Sides and bottoms of cells are, when new, 1-180 in. thick. The bottom of each cell is formed of 3 rhombs, so united as to make the center of each cell the lowest part, which point is the center of three cells on the opposite side. The bottom of each cell thus forms a fourth part of a rhombic dodecahedron, and a third part of the bottom of each of the three opposite cells. Honey-comb is made by the honey-bee, from scales of wax. See Wax.
Honey-Dew.—A sweet, saccharine substance found on the leaves of trees and other plants in small drops, like dew. Two substances have been called by this name—one secreted from the plants, and the other deposited by a small insect called *aphis*, or vine-fetter.—*Webster.*
Honey-Extractor.—A very ingenious contrivance by which centrifugal force is made to throw the honey from frames or pieces of uncapped comb.
Honey-Gate.—A cast-iron fixture, for drawing off honey or other liquids from extractors, barrels, etc.
Honey-House.—A building used for storing honey, combs, hives, and apiarian implements; also for extracting honey and doing other work pertaining to the apiary.
Honey-Knife.—A two-edged steel blade, with inclined handle, used for uncapping honey before extracting.
House-Apiary.—A double-walled building, usually of octagonal or rectangular form, in which bees are kept both summer and winter in separate hives as out of doors. They are but little used now.
Hybrid.—A cross between two species. In bee culture, generally applied to a cross between blacks and Italians.
Hymettus.—A country of Greece, famed for the superior quality of its honey, which is of light golden color, and gathered from mountain thyme.
Italian or Ligurian Bee.—A native of Italy, characterized by three bands of yellow across the upper part of the abdomen of the worker-bee.
Italianizing.—Changing from any other species of *apis* to the Italian.
Introducing.—Method of presenting a strange queen to a colony of bees, so that they will accept her.
Introducing-Cage.—A cage constructed for the purpose of introducing queens.
Inverting.—See Reversing
Lamp Nursery.—A device used in rearing queens; a double-walled tin hive, with space between filled with water kept warm by means of a lamp.
Langstroth Hive.—See Hives.
Larva (pl. Larvæ).—The bee in the grub state, from the time of the hatching of the egg until the capping of the cell; in other words, unsealed brood.
L. Frame.—Langstroth frame. See Hives.
L. Hive.—Langstroth hive. See Hives.
Ligurian Bees.—The name used by the English for designating the Italians. See Italian Bees.
Lining Bees.—Noting the direction of their flight.
Loose Frames.—See Fixed Frames.
Mandibles.—Jaws of the bee, which work sidewise instead of up and down, as in higher animals.
Manipulation.—The handling of bees.
Melextractor.—Honey-extractor.
Metal Corners.—Tin fixtures for securing the corners of frames, and for forming, on the upper bar, an edged support, which can not be made fast by propolis, and under which no moth worm can secrete itself.
Movable Frame.—See Hives.
Natural Swarm.—A swarm which issues spontaneously from the parent stock.
Nectaries.—The lower part of the petals of flowers where nectar is secreted.
Neuter.—See Worker-bee.
Non-Swarming Hive.—One so large, or so constructed, as to control the desire to swarm; an end never yet satisfactorily obtained.
Nucleus (pl. Nuclei or Nucleuses).—A miniature colony of bees, generally used for rearing queens or new colonies.
Nurse-Bees.—Bees that care for brood: generally, those less than two weeks old.

Nursery.—A place in which queens are reared. See Lamp Nursery.
Nymph.—See Chrysalis.
Observatory Hive.—A hive constructed partially of glass, to allow examination of work inside without disturbing bees.
Overstocking.—Having more bees in one locality than there is pasturage to support.
Paraffine.—A white, translucent, crystalline substance, tasteless and inodorous, obtained from the distillation of mineral and vegetable tar. It resembles spermaceti. It derives its name from its remarkable resistance to chemical action.—*Webster.* It is sometimes used as a substitute for beeswax, for coating barrels and other utensils for containing honey.
Parasite. A species of louse that lives on the bodies of bees.
Parent Stock.—A stock from which a swarm issues.
Parthenogenesis (or Virgin Breeding.)—The law that life is imparted by the mother independently, and that every egg, as originally developed in the ovaries, is of the male sex, but whenever fertilized it becomes transformed into a female.
Perforated Zinc.—Sheets of metal, perforated with oblong holes, just large enough to admit a bee, but not a queen or drone.
Pollen.—Fecundating dust of the antheral part of the stamen of flowers, gathered by bees, and when mixed with honey, used for food of young bees. After being mixed with honey, and stored in cells, is sometimes called bee-bread.
Pollen-Basket.—A slight cavity on the outside, just above the second joint, of each of the two hind legs, in which the pollen is carried.
Propolis.—A resinous substance gathered, probably, from the buds of certain trees, by bees, and used in covering rough places, and cementing and filling cracks about the hive.
Pupa.—See Chrysalis.
Q. Frame.—See Fixed Frames.
Queen.—The only fully developed female in the colony; the mother of all the rest.
Queen-Cage.—An inclosure of wire cloth, or of wire cloth and wood, in which to confine a queen for introduction or shipping.
Queen-Cells.—Elongated cells, in which queens are reared.
Queening.—Introducing a queen to a colony.
Queenless.—Having no queen.
Queen-Rearing.—Raising queens.
Queen-Register.—A printed card tacked on a hive, having an index which the apiarist moves from time to time, to indicate the condition of the colony or queen.
Queen's Voice.—A note frequently uttered by a queen, probably produced by her wings, often called piping.
Quinby Frame.—See Fixed Frames, in the body of the work.
Quinby Hive.—See Fixed Frames, in the body of the work.
Quilt.—A cover for brood-frames made by putting wool or cotton between two pieces of cloth, and sewing them together.
Rabbet.—Applied to a narrow strip of folded tin, to be used in any hive where frames are suspended by the top-bar, either with or without metal corners, to aid in making frames more movable.
Rendering Wax.—Separating the wax from all foreign substances by melting. Usually applied to the operation of converting combs into wax.
Reversing.—The turning over, or inverting combs, in order to bring about certain results. For full particulars, see Reversing, in the body of the work.
Rhomb.—An equilateral parallelogram, having two acute and two obtuse angles; one of the 12 equal sides of a rhombic dodecahedron; one of the lozenge-shaped parts of the bottom of a cell.
Rhombic Dodecahedron.—A solid having 12 rhomb-shaped faces.
Ripe Honey.—That which has by evaporation become sufficiently thick to be sealed in the cell.
Robbing.—The act, on the part of the bees, of pilfering stores from another hive, instead of obtaining them in the ordinary way from the fields. It occurs usually when no honey is to be obtained from the fields.
Royal Cell.—See Queen Cells.
Royal Jelly.—Food of queen-larvæ.
Sealed Brood.—See Capped Brood.
Sealed Honey.—See Capped Honey.
Section Box, or Section.—A small box for surplus honey, open on two sides.
Separator.—A strip or piece of tin or wood, placed between section boxes, to insure straight combs.
Sheet.—A single covering of cloth, for brood-frames.
Skep.—A term sometimes applied to any sort of bee-hive. The term is used quite largely in England.
Solar Wax-extractor.—A device for melting wax by sun-heat.
Spent Queen.—One that from old age becomes incompetent to lay any eggs, or but few which produce drones only.
Spermatozoon (pl. Spermatozoa).—One of the animalculæ contained in the generative fluid of drones.
Spring Count.—Number of colonies that survive the winter, and hence the number started in the season.
Spring Dwindling.—Slow decrease in size of stocks, in early spring.
Starter.—Comb or fdn. fastened in the top of surplus boxes, to induce work therein.
Sting.—A weapon of defense, contained in the posterior part of the abdomen of worker-bees and queens, composed of 3 parts, two of which are barbed.
Stock.—See Colony.
Storifying.—A term used in England for "tiering up" in this country.
Super.—Any receptacle for surplus comb honey, applied, by our friends across the water, to any kind of upper story.
Supersede.—To replace or exchange queens in a hive. Bees sometimes kill their own queen and raise another, and we commonly say say they "supersede" her.
Swarm.—A large number of bees leaving the parent stock at one time, for the purpose of taking up new lodgings, accompanied by one queen in the first swarm, and in after-swarms (see Colony) by one or more.
Swarming Season.—The time of year in which bees are most inclined to swarm.
Syrians.—See Holy-Land Bees.
Taking up Bees.—Killing bees in fall, to get the honey. A practice now going rapidly out of use.
Tested Queen.—One whose progeny has been examined and found pure.
Tiering up.—Piling hives or supers one above the other. See Comb Honey, in the body of the work.
Transferring.—Changing bees and combs from one hive to another; changing comb from one frame to another. Usually applied to the operation of changing bees and combs from box hives to hives with movable frames.
Transposition Process.—See Grafted Cell.
Unqueening.—Removing queen from a colony.
Unripe, or Green Honey.—Honey which has undergone but little change by evaporation, and contained in unsealed cells.
Unsealed Larvæ.—Young bees in the maggot form not capped over.
Virgin Queen.—A queen which has not been fertilized, by mating with a drone.
Wax.—A natural, unctuous secretion of honey-bees, formed in delicate scales, in the eight wax-pockets, on the under side of the abdomen. It is formed both in activity and in repose, but in much larger quantities while the bees are quietly clustered inside the hive. The production of each pound requires about 20 lbs. of honey. It is used by the bees for comb-building.
Wax-Extractor.—An apparatus by means of which wax is rendered by application of heat.
Wax-Pockets.—The 8 depositories under the rings on the under side of the abdomen of a worker bee, in which wax scales are secreted.

WAX-POCKETS.

Wax-Press.—A device for rendering melted wax by pressure.
Wedding-Flight.—The flight of a virgin queen, for the purpose of meeting a drone.
Wild Bees.—A term applied to honey-bees that live in the forest, in hollow trees, or in cavities of rocks, away from the abodes of men.
Wind-Breaks.—Tight fences or close hedges, to keep winds from the apiary.
Worker Bee.—Erroneously called neuter; an undeveloped female, possessing the germ of nearly every organ of the queen, which may at any time become sufficiently developed to allow her to lay eggs, but only such eggs as produce drones. They do all the work in the hive except laying eggs.
Worker-Egg.—An egg which is impregnated, and is laid only by a fertile queen: will produce either worker or queen.

DOOLITTLE'S REVIEW AND COMMENTS ON THE A B C BOOK.

In 1880 I offered friend Doolittle $100.00 for a careful going-over of the A B C book, that he might point out its faults, and add such suggestions as his large experience might dictate. He has done this ; and his remarks are of so much value that we have added them here. Where obvious errors were pointed out, of course nothing remained but to correct them, and so these points need not be given here. In the present edition (1891) we employed him to go over it all *again* and bring his suggestions up to present date. In some cases I have answered his objections, but generally he has either given his indorsement or added some hint or fact not in the body of the book. To these of course I make no answer. The figures at the left correspond to the small superior figures interspersed here and there in the body of the work. The figure at the right gives the page from which the comment is taken, and to facilitate reference to point at issue.

1—See Introduction. Right here we see the great advance our industry has made. Not a single paper could afford to pay any thing for an article on bees as early as 1869 to 1873, unless it might be by giving a copy of the paper free to the writer, so, as you say, a correspondent had no "compensation of any account" as pay for articles written, or the necessary correspondence which always comes to the one writing articles. Now, however, nearly all the live papers pay as much for articles on bees as upon any other agricultural subject, so that the writer of articles can afford to answer all correspondents free, excepting the stamps inclosed.

3—page 1. Bees that work hard all day, in my opinion, do not "parade" about the entrance at night. This is left for the guards to do. These guards perform no duty except to look for intruders, while they are set apart for this work. These guards are of the age of from 20 to 30 days, according to the belief of one who has scrutinized closely.

6—page 2. Scarcely a queen need be lost, as a few bees will always gather around the queen; and by walking over the yard, and looking on the ground, this ball of bees is easily seen, and the queen picked up. It is not so easy, however, always to tell where they came from; but this can be done by keeping them till near night and taking the queen from the bees, when they will return home to their own hives.

7—page 4. I can not agree here. With the after-swarms goes all prospect of surplus honey; and, if prevented, the old stock is by far the better. Wait 7½ days after the first swarm leaves, and, as a rule, the first young queen is hatched then. Cut all cells, and after-swarms are done away with. Where bees for sale are desired, they can be had at much less expense by making colonies by the nucleus system than by fussing with these after-swarms.

Possibly you are right as to the matter of after-swarming; but many extensive bee-keepers, the Dadants among the number, insist that the cutting-out of all the cells does not allay subsequent swarming.

8—page 4. I find that a plurality of queens is just as common in second swarms as in third; and I have had as many as half a dozen in a first swarm, issuing from the loss of the old queen ten or more days previously. During the height of swarming, the cells are not properly guarded, and thus the young queens run out.

9—page 4. I never knew of an after-swarm going off without clustering, and never heard of one doing so. After-swarms are forced out by jealous queens, the queen leading the way; so they do not select a home before leaving the old hive, as does the prime swarm sometimes, for the bees want no other home at this time than the old hive. After they are out on a limb of a tree, then they send out scouts the same as is done by the prime swarm.

14—page 5. They will live 45 days, from three experiments I have tried. Again, under the most favorable circumstances black or very poor hybrid bees will live from the first of September till the fourth of the next July. August 9, 1888, I introduced an Italian queen to a colony of poorly marked hybrid bees, and saw the first yellow bee hatched Sept. 1, although there were few yellow bees hatched that fall. As the bees from this Italian queen were very yellow, I took pride in showing them to many who visited me the next year, so I kept more than usual track of this colony. July 4, 1889, there were at least 1000 hybrid bees in this colony; and as I had no hybrid bees in the yard except those, they must have been the same bees which were hatched the August before.

15—page 5. Twice I have had drones live over the winter, and that in hives which had good prolific queens. The season previous had been so prolific in honey that the bees in a few hives seemed to have no desire to kill off the drones in the fall as is usually done. The hum of these drones on warm days during February and March was very pleasant to hear, to say the least. When warm weather came for good these old drones soon disappeared. From this, and other facts which I will not take space to relate here, I have an idea that drones will live about as long as the workers under similar circumstances, unless their life is prematurely taken by the workers.

17—page 10. The quality is excellent, as you state, but the color of alsike honey in this locality is decidedly poor, it being of a reddish pink shade. Where clear, or when it is mixed to any degree with our first basswood honey, as it often is, such honey has to go as second quality on account of its color. I am speaking of comb honey.

18—page 10. Alsike invariably dies the second year in this locality; and as it does not yield over one-half the weight of hay to the acre that the red clover does, our farmers have become disgusted with it, so that there is not nearly as much sown now as formerly.

19—page 12. Have you not made a mistake here somewhere? During a heavy yield of honey, our bees seem to be glad of a rest, and it takes at least 24 hours before our bees think of robbing, after a full flow of honey. We have taken off honey after a shower, as you speak of, when each bee was so full of honey that, if squeezed a little, she would throw the honey out on the tongue; and, if jammed a little, the honey-sac (filled with honey) would burst through the sides of the abdomen. After 24 hours has elapsed, or the season draws to a close, we agree with all you say.

I hardly think I have made a mistake in the matter, friend D.; but, very likely, more time had elapsed after the rain, than what I have given. I have noticed all you say, *immediately* after a very heavy yield; but so many others have spoken of having trouble in trying to extract, after a storm, that I can not but think my caution a wise one.

20—p. 13. I indorse all you say about being careful about allowing bees to get a taste of honey in times of scarcity, and know that such "taste" often makes bees cross or angry; but bees are often angered by some unavoidable accident, when they will buzz about one's face for hours, as you here describe. No matter what has caused bees to follow any one about in this way, they should at once be killed; for, according to my experience, if they are allowed to live they will keep this up for weeks, or by spells as long as they live, which makes them of little or no value as honey-gatherers. Such bees are dangerous to have around when friends come into the apiary, and for this reason I always kill them, and so have no trouble afterward till some mishap happens again. To be always prepared for an emergency of this kind I carry a little wooden paddle about with me in my tool-box and seat, the center of which is composed of wire cloth. This lets the air pass through the paddle in striking at the bee, so it is a sure kill every time; while if the paddle were made of whole wood, the air would often blow the bee to one side, so that several efforts might be required before hitting it.

21—p. 14. What you here say is true of most ants; but there is a kind which generally live in trees, burrowing all through that part of the wood which is partially decayed, that get into our chaff hives here, and, after a little, burrow through the sides of the hive next the bees, when a general fight ensues. The bees can not, or, at least, do not, sting these ants; and as they are so large and strong, the bees can not carry them away; and if they could they could not drop them when they would, for the ant fastens hold of the bee with its jaws with such a firm hold that the bee can not free itself from the ant. When disturbed so as to let the colony of ants and bees together, each ant seizes a bee and holds it fast, often holding the bee thus till it dies. In one case I had a powerful colony of bees nearly ruined, while many colonies have been very badly annoyed by them. As they live in the chaff and woodwork of the hive, I find it very difficult to get rid of them.

23—p. 19. Only look out that we do not get so many "irons in the fire" that we neglect both the bees and the grapevines, and perhaps much of our other business, so that we become a "jack of all trades and master of none."

24—p. 19. I now use chaff hives altogether for full colonies, and find that, after knowing how, it is no more trouble to work with them than it is with single-walled hives; while the prosperity of the bees, both in summer and winter, is insured to a much greater degree than possible with single-walled hives.

25—p. 29. After carefully testing all of the plans given for the artificial fertilization of queens so far made public, and not meeting with a *single* success, I am sure that there is no such thing as a *practical plan*, and I very much doubt there ever being such a thing as a single queen that became fertile, only as she went out to meet the drone in the usual way. In other words, I think the whole thing something made up of mistakes, misconceptions, and hopeful ideas.

26—p. 29. I can not agree here. I have had three daughters of imported queens from as many breeders, and none of them compared with the stock I had taken pains to breed for honey. With the majority of apiarists, probably your remarks are correct; but we have a few breeders whose queens are far ahead of a promiscuous importation from Italy; at least, such is my opinion. Five hundred dollars would not hire me to breed all my queens from an imported mother, and let my present stock go down. If better honey-gatherers can be obtained by going elsewhere rather than Italy, by all means let us have them.

28—p. 30. To this I say amen, after having tried the matter only at a loss in every instance.

29—p. 31. The first-hatched queen will destroy all remaining queen-cells, providing it is not in the height of a flow of honey. If it is, our experience is, they will swarm instead. I think, with Dr. Miller, that many *young* bees are important; and the greatest objection which I have to your plan is, that on most occasions you have only old or field bees for rearing queens.

30—p. 35. While honey contains much water, there is something very peculiar about none of the moisture which is in the honey ever soaking into the wood. In other words, a barrel which is filled with honey will apparently become just as dry as the same barrel would if no honey were in it. After thoroughly drying, tightening the hoops, and filling some barrels once with a nice thick grade of basswood honey, they were allowed to stay out in the sun during a very hot dry time during the fore part of September, when the staves of the barrels shrank so that the honey oozed out at nearly every joint in the barrel; and I have known the same thing to happen where the barrels were waxed. Barrels when filled with honey should be put into the shade, and, if possible, in some place where the air is somewhat moist.

31—p. 35. During a period of 22 years I have never known basswood to fail to yield honey, the very shortest season yielding three days, and the longest 29. I place basswood at the head of all honey-producing trees or plants as to yield. From it I once obtained 66 lbs. in 3 days, *from one hive*. Taking the world over, white clover may, as you say, yield more honey than basswood; but no area of clover can possibly yield the same amount of honey that the same area of basswood will.

32—p. 36. This is a picture of which you may well be proud; for a better picture to convey to the mind just what basswood is, was never executed.

36—p. 43. You have not mentioned the *best* way to hunt bees; namely, that of going through the woods on the first warm days of spring, while there is still snow on the ground, and finding the "bee-trees" by listening for the humming of the bees on their cleansing flight, and by seeing dead bees on the snow, brought out in "house-cleaning." I once found two in an hour in that way, and at another time, three in two hours and a half.

37—p. 44. Not till the millennium dawns; for there always will be careless bee-keepers, and trees in the woods where moths enough will be bred to remind the most thorough apiarist that they still exist. I don't believe that apiary exists in the world, wherein a pi e of combs can be thrown together in a pile during the summer season and not have them soon become a moth-nursery.

39—p. 46. You may be right about this, but I have always understood that our common (or black) bees are natives of the Old World. I can not say where I got this impression, but it was something which I read some twenty or more years ago, when I first began to keep bees. When they are called by their proper name they are always called "German bees." Can you give any history regarding them to prove that they were in this country before any white man came here?

40—p. 46. With me the Carniolans are breeders out of season, like the Syrians; hence they are poor honey-gatherers. This, together with the imperfections which you have named, has caused me to get rid of them entirely.

42—p. 48. You do not mention water as being mixed with the honey and pollen for food. If water is not mixed with this food, why is it so eagerly sought in spring and summer, and not at all in warm days in October and November? Now, I claim that many things point to water being one element in this food; and one of these "pointers" may be found on page 5 of this A B C book, near the top of the second column, where you tell of the *brood* suffering for pollen or *water*.

44—p. 50. Thirteen years have now passed since my bees have gotten enough honey from buckwheat to give a single pound of such honey throughout the whole of any single hive, so that I have ceased to expect any thing more from it than some pollen and a very little thin nectar for late brood and queen rearing. During some of these years there has been more than 100 acres within easy reach of my bees.

46.—p. 58. Sealed honey seldom candies in the hive as you say; but I never, to my recollection, had sealed honey away from the bees over winter without its candying, unless kept in a temperature as high as 75 to 95°. When kept in such a temperature it will not candy or deteriorate for years.

49—p. 60. If I understand you correctly here, you and I do not agree at all. I never pulled the blossoms from a head of red clover yet, but that there was honey is them. But I have frequently found the corolla so long the bee could not touch the honey. I think there is nothing in the world that secretes as much honey, year after year, as red clover; still, it is of little use except to the bumble-bee. All that is lacking is a bee with a tongue long enough to gather or reach the honey. While length of tongue is lacking, the red clover blooms and secretes honey mostly in vain, so far as we and the honey-bee are concerned. Why I say "mostly," is because I believe fully 1000 pounds are secreted to where one is gathered by the honey-bee.

50—p. 61. While the name "mammoth" would denote that this kind of clover should have a larger flower than the other red clover, yet I find that the corolla is really shorter than that of the small kind, hence the bees work on it to much better advantage. Nearly all the red-clover honey I have ever obtained came from the mammoth.

51—p. 69. The good honey-yield is the cause, not the cool weather. This good honey-yield causes the bees to secrete wax in such quantities that they do not even touch the foundation at all—simply add their wax on to the side walls of the foundation, so that, after scraping off the honey and the wax the bees added, we have the sheet of foundation intact. This is a thing that happens here to a large extent during the height of our basswood bloom, and for this reason I now use in sections only the flat-bottomed foundation. This the bees have to manipulate, no matter how much wax they are secreting; hence we never have any "fishbone" where such foundation is used.

52—p. 71. I see you do not mention foundation molds. After having used them for several years I think them an acquisition. They do away with the larger part of the paraphernalia used with the other machines; enable any one to use up the last pound of wax as well as the first one of 50 pounds; make a foundation that is more readily accepted by the bees than that made on rollers, and the molds can be operated with a degree of speed that will enable any ordinary individual to make from \$5 to \$10 a day in working them at his own home. For all persons having one hundred colonies or less, I think them just the thing to use in working up the wax made in such an apiary.

Friend D., we have, at least we think we have, a very good reason for omitting to mention foundation-molds. We have, in years past, spent something like \$1000 in such experiments. In fact, we advertised and sold molds made of plaster of Paris, and later of soft rubber. While these proved very satisfactory in the hadns of an expert like yourself, nine out of ten of our customers made such a failure of it we preferred to take the apparatus back again.

57—p. 76. I say, put the empty super on top every time. Just as much honey can be obtained in this way, and you are not likely to get caught with a lot of unfinished sections at the end of the season. After a party has tiered up three or four cases high, and found nothing but partly filled sections in any of them at the end of the season, as I have known in several cases, he will be likely to put the empty cases on top for ever afterward.

58—p. 76. I have used such drone brood many, many times, and I have yet to see the first section that was any poorer for it, except the one which had the brood in it.

60—p. 82. This applies to all sections as well, so I do not see that it is any more of an objection to unfinished sections than to those finished.

Yes; but finished sections are marketable, and hence can be got out of the way.

61—p. 84. There is no question in my mind but that this "metallic coldness" and bees not "walking on tin separators" exists more in imagination than in actual fact. If it is a fact, it is something which my closest observation has failed to discover.

63—p. 90. I do not have any pollen in one section out of 1000, when practicing contraction.

65—p. 92. This blossoms just with fruit, with us, and so is of little account, except the little they get before and after, at beginning and ending. Dandelion honey, after it is a year or two old, is just splendid.

67—p. 92. Can't you manage to tell us why bees did not spring-dwindle prior to 1870? When I first commenced to keep bees, there were 100 swarms around me, kept by four or five parties that had kept bees for 30 and 40 years; and, although they kept on using box hives, still not one of them has a bee to-day. Tell us what did it. I confess I can't see through it all.

To come right down to the point, I can't either, friend D., even after all the learned and exhaustive articles we have had on the subject. Once they lived almost without care, and now they don't.

68—p. 96. Fults, of Muscatine, Ia., says, in *A. B. J.* for January, 1880, that drones live only 24 days, while I claim they live to about the same age as a worker, if the bees allow them to live that long. See 15, or Doolittle's comments on age of drones.

69—p. 98. Are you sure of this? So far as my experience goes, drones from fertile workers, if reared in drone-cells, are as large as any drones. The size of the cell has more to do with the size of the drone than the parentage.

70—p. 98. If you had said "practically pure," I would not have said a word; but when you say "absolutely pure," I can not withhold saying, "I don't believe it." For my views on this subject, see my book on queen-rearing, beginning page 107.

73—p. 104. My experience says that the trouble was not in the patches of honey, but in the pollen that was under the honey. Mice are very fond of pollen that is fresh from being preserved with honey.

75—p. 105. I agree with you here exactly.

76—p. 107. I am just one of those persons who have proven to their entire satisfaction, that there is no difference between honey extracted before it is sealed and ripened in an open cask or can in a warm room, and that sealed by the bees, and ripened in the hive.

77—p. 108. I think your honey, when first gathered, must be very poor stuff, or else you are carrying this thing too far. We have tiered up hives, as you tell, and left till October, then used in the comb, and extracted it by warming the combs so we could, and for the life of me I could see no difference between this and some I warmed that was taken before it was sealed. Both were so thick you could turn a saucer over, as you tell, and not have it run out, and so clear you could read through it six inches deep. Just tell your readers to extract when they will, but ripen in open cans in a warm room.

78—p. 110. Candied honey in Dadant's pails is selling well in all the markets we have tried, and it is by far the nicest way to put it up. I have sold considerable honey in wooden boxes. Make boxes to hold different amounts to suit customers, and paraffine the inside of the boxes as you do barrels. When the honey has advanced so far in candying that it will scarcely run, fill the boxes; and when fully hardened, nail on the cover and ship to any part of the world without danger of leakage or of having the boxes broken.

79—p. 111. Don't say tin cans are "next best," but say, *the* way to keep honey is in tin cans holding 300 lbs., in a warm dry room, with a cover made of your duck cloth. If you want to sell it in that shape, fill the Dadant pails just before it ceases to run, and set them away. I store all extracted honey so.

80—p. 111. I say a *warm* dry room—one whose temperature never goes lower than 75°, the mean temperature of which is 90. If honey is kept in so high a temperature it will grow better and better as the years go by, no matter whether comb or extracted, green or ripe.

81—p. 122. This with me proves to be untrue nine times out of ten. If no queen-excluder is used, the queen and all the brood will often move up stairs, so that there will not be a single pound of honey below unless the season is an extra good one, or you do no extracting till the end of the season; and if the queen-excluder is used, the lower story will be filled with brood if the honey is kept extracted from the combs above. This is with the L. frame as well as the Gallup, in this locality; for I now have an out-apiary using the L. frame. To overcome this I set away enough frames of nice sealed honey during the height of the season to winter the bees on, and set these in the hives where needed in the fall.

82—p. 122. Where both can be had, my preference is a feed made up of two thirds sugar syrup and one-third honey. Bring the sugar syrup to a boil, set from the stove, stir in the honey, and it is ready for the bees. This entirely prevents the feed from either crystallizing or candying, and makes it enjoyable to the bees.

83—p. 123. I feel equally sure, that from one-tenth to one-third of the number of pounds of honey should be added to keep the syrup from crystallizing, and give the whole a relish to the bees. The inside of the feeders covered with sugar crystals, bees out trying to fly with their wings covered with the same, to such an extent that they could not rise more than a foot in the air, as well as crystals in the syrup after it was stored in the cells, taught me better than to attempt to follow your directions the second time. Whether the atmosphere is different here from yours, or why the difference, is too high for me. You will see by Dr. Miller's comments, that he also is troubled with crystallization. I rejoice that so simple a thing as honey put into the syrup while hot remedies the matter so that no one need have any fears of the syrup ever crystallizing.

84—p. 123. A sugar is damp or moist, while there is practically no moisture in the granulated sugar. Dry the A sugar so there is no moisture in it, and it will shrink in weight more than enough to overcome the difference in price, so it is not really as cheap as the granulated. Otherwise, I consider it equal in every respect for feeding bees with the granulated.

85—p. 124. An ordinary frame, with thin stuff nailed on either side, so as to leave room for the bees to pass in at the top, hung in the hive the same as any frame, makes the best feeder of any thing I know of, either for stimulative feeding or for feeding winter stores.

86—p. 127. Haven't you changed your mind on this feeding back? I have again tried it this season, only at a loss, as I have to feed 2 lbs. to get one in the boxes.

I agree with you that such is the case exactly until the brood apartment is crammed; but after that, there are not more losses than I have mentioned.

88—p. 130. If this is so, how came your thin honey from basswood you told us about a little while before on these pages? Why did they not thicken this in the same way? I still believe all evaporating of nectar is done in the hive, as I once wrote. I believe that this spray, seen to fall from bees while on the wing in summer time, is simply their excrement and nothing more.

I should explain it thus: The basswood yielded in such quantities that they carried it right to the hives. The Simpson plant furnished only a limited amount comparatively.

90—p. 133. Yes, and many times the cappings will have the sunken appearance with minute holes, and still the brood be all right. This I know is so, for I have found hundreds of such cells in my own apiary and in other apiaries where I know the brood was all right. The only sure test is in opening the cells, as you say. Then if the pupa is found to be white, or whitish, with the eyes formed or colored, we may know the colony is all right, no matter how or what is the appearance of the cells.

93—p. 140. I argue, that, if we had the same number of bees in a hive in apple-bloom that we do in basswood, and if the weather were equally good, the yield would be as great. But the trouble is, we do not usually have so many bees; and, still worse, the usual weather is such that the bees rarely have an opportunity to work on the bloom more than enough to encourage brood-rearing. Three years out of twenty-one seasons I have had honey stored during apple-bloom to such an extent that the hives were filled with this honey (one season the bees storing as much as 8 lbs. a day); but in the other 18 seasons, scarcely a single pound to the colony has been the result.

94—p. 141. It also shows how great the shrinkage the nectar undergoes during the process of evaporation. Nectar from fruit-bloom is usually at least five-sixths water.

107—p. 172. So far as I have been able to ascertain, *all* the cells which the cluster of bees surround are never filled with bees, except in cases of starvation. At all other times it is only the immediate cells next the outside of the cluster which are filled. This is done so as to form a living wall or crust around the outside, or so as to retain all the heat generated by the active, or comparatively active, bees inside. After Christmas most hives have brood inside the cluster to a greater or lesser extent, and surely bees would not pack themselves away in cells containing brood.

108—p. 175. Now, really, friend Root, do you think bees build comb any differently than they did when the great Creator pronounced all his works good? That there is a difference in the qualities of the bees, I know; and so I believe there was then. If God knows the beginning from the end, he knows just what is wanted, and so makes it good. We have no reason to believe that there has been much improvement made, as a whole, since the creation, if any thing; for instance, man has perhaps a better intellect to-day than he had 3000 years ago, but he does not live a tenth part as long. So with our choice breeds of our cattle, sheep, etc.; the more choice they are, the more petting it takes to keep them up, while the lean, uncouth "scalawag" will live and thrive anywhere.

109—p. 175. We tried to so improve the bee as to make them take cells 4½ to the inch, but we had to give it up, and believe God knew best when he taught them that five is right.

112—p. 184. I have been looking for the past sixteen years for a one or two banded bee, and I have yet to see one. I do not see how this term ever came into use, for, so far as my observation goes, and it has been close during these sixteen years, a bee which has any yellow on any of the horny segments of the abdomen, has yellow on three. Of course, there is the most yellow on the second segment; but I wish to repeat, if there is any yellow of any account on this segment there is on all three of the first segments. Just fill one of your one or two banded bees with honey, friend Root, and place her on the window, and see if I am not right.

113—p. 184. The first segment of the abdomen is not the broadest segment, nor does it show the most distinctly. The segment, or band, which is the most broad, and shows the plainest, is the second.

114—p. 184. Just because anybody and everybody can raise plenty of hybrids themselves, if they have an Italian to start with; but if they have a queen producing hybrid workers, they soon have nothing but blacks.

116—p 184. I have had pure Italians that were ordinarily quiet and peaceable get so roused up as to sting worse than any hybrid ever thought of stinging.

117—p. 185. I would say, draw one of the outside brood-combs, for the queen is oftener found on the outside brood-combs during the day than she is on the central one.

128—p. 193.—Can't "swallow" that yet; and I candidly believe further importation is useless for the next twenty years.

129—p. 193. I have had Italian bees that did not show a particle of black on A, B, C, and only as much black on L as there usually is on B, while M showed nearly as much yellow on the horny scale as most Italians show on C. According to your theory these should have been poor workers; but, strange to say, they were among the very best for honey-gathering.

130—p. 193. My experience says *no*, unless it also disappears at B. In other words, if there is a yellow band at B, there will always be more or less yellow on C, if the bee is filled with honey and placed on a window. In the fall of the year the segments telescope so that the yellow on C is usually hid on poor specimens, hence the term "one and two banded bees."

131—p 194. Dr. Miller's comment here is well put in. A Syrian or Holy-Land queen can no more fly at maturity than any other, and no queen can fly at maturity. The Syrians are more liable to hold their queens in their cells after maturity than are those of the other races, and that is the reason we have so many Syrian queens flying up on hatching from the cells.

132—p. 194. If queens are raised as given in "Scientific Queen-rearing," all colonies go on with their regular work, whether rearing queens or not. This, I claim, is of much value to the queen-raiser as well as to the honey-producer.

139—p. 198. There are thousands of these hatchers now in use; and the Good candy makes just the right food to provision them with, when the queens can remain a long time.

140—p. 140. As I said at the Chicago convention, so I say now; if I were to cultivate any plant for honey, it would be motherwort; for our bees work on it from morning till night for weeks. A plant of motherwort is covered with bees from morning to night in this locality while in bloom, and that, too, every year; yet notwithstanding this, I, with you, do not believe that it will pay to cultivate any plant for honey alone, so I have not tested it by the acre.

141—p. 200. You know we don't agree here, as I claim they go from 3 to 6 miles from choice. My bees went 4 to 5 miles to work on teasel the past year, without any teasels within 3½ miles on the first part of the route. This I know, as a bee working on teasel is always partly covered with a whitish dust, as they are with yellow when working on pumpkin and squash.

Thanks; very likely I have put the distance too small.*

142—p. 200. This is something I do not understand. I frequently move colonies about in late fall, and have no trouble. The bees seem disposed to mark their location over again if they chance to have a fly in December or the last half of November, so I take advantage of this in shifting my bees where I wish them, and especially in doubling up nuclei. A few bees always hover around the old place for a little time on the first pleasant day; but from the fanning bees at the entrance of the moved hive, and the disappearance of the bees about the place where they formerly stood, together with no diminishing of their numbers, I am led to think that they found their way back all right.

144—p. 201. I have shipped many colonies of bees during the past five years; and although none of the combs have been wired, I have yet to hear of the first injured comb. As my combs are deeper than those in L. frames they would be more likely to be damaged than would those in the L. frame.

Perhaps you do not ship bees to the extent that we do. Nuclei and colonies *can* be shipped many times on unwired combs; but our extensive experience has shown, beyond any question or doubt, that it is decidedly risky for us. We seldom get combs through unwired without their being broken down, and when they are wired they always go through in good shape.

145—p. 204. We once had a colony become so reduced that, by actual count, there were 81 bees and the queen, and so they held on till warm weather, when they built up without help, and actually gave a surplus of five pounds on buckwheat, in sections, and were in splendid condition for winter. The next year this colony did the best in comb honey of any colony in the yard. I wish to do away with the idea which prevails, that a queen from a colony which has "spring dwindled" is good for nothing.

146—p. 204. I don't see how you can call the Gallup frame deep, when it is only two inches deeper than the L. frame. If you had said that of the old American and Kidder, that were 14 inches, I could have agreed. The Gallup frame is the best-proportioned frame of any, all things considered. So think I. It must be always borne in mind, that the bees themselves make the hive proper, at all times, till they become strong enough in numbers to reach the sides of the hive. This might argue for a box six inches square, as was formerly used, but such a box is too small for even a nucleus.

147.—p. 204. No more than the ends do, for it is exactly square. A good swarm of bees in the Gallup frame will touch the bottom and top of the hive, and also each end where only 9 frames are used, but not the sides; while with the L. frame they touch the bottom and top only.

Why, friend D., it seems to me our bees don't act just as yours do, but perhaps we are both a little prejudiced.

*An article in April No. of GLEANINGS for 1882, shows conclusively that Italian bees will fly from an island, under favorable circumstances, as much as even SEVEN miles. We have since had corroborating testimony of such long flights.

150.—p. 216. If I am correct, basswood yields no pollen at all. Elm, beech, and poplar trees, as well as sorrel, buttercup, etc., among plants, yield large quantities of pollen, but no honey.

151—p. 216. To Dr. Miller's 358 I would add: That depends. With me, when the dandelion, hard maple, wild grape, and sorrel, are in blossom, at least half the bees going into the hives have loads of pollen, while in the basswood-honey harvest, not one bee in 200 has any pollen in its pollen-baskets.

152—p. 217. After using nearly all kinds of meal, I very much prefer corn ground very fine. There are enough hulls in this to make it just as the bees like it best, and what the bees leave can be fed to the chickens or stock.

153—p. 220. I believe this to be all "bosh." The field-mouse is not an enemy to the bumble-bee, but, on the contrary is its friend; i. e., seven-eighths of the queen bumble-bees crawl into the deserted nests of the mouse, in the meadow, in the barn, under stumps, stones, etc., and there lay the foundation of the future colony of bumble-bees. After being once established, a mouse has no show in a hand-to-hand fight with a queen bumble-bee, much less with a colony of these bees; for each one can sting at least twenty times, as the back of a certain boy I once knew could testify to.

154—p. 220. Did you ever see a bee on a tame-grape blossom? Although they get pollen freely from the wild, or frost grape, yet I never saw one on a tame variety.

I have many bearing vines of different varieties of grapes, and two very large vines of the Delaware variety; yet in all of the fourteen years that they have been bearing right in the bee-yard I have never seen a honey-bee at work on the blossoms. Other insects work on them.

Yes, sir! *our* bees work on our Concords nearly every season.

160—p. 227. Impossible according to my way of thinking. A larva, fed three days as a worker, has the female organs dwarfed to a certain extent; and just in porportion as they are dwarfed, in that proportion are they inferior to a perfect or good queen.

161—p. 227. No. It is the cocoon which the queen spins that is "tough an leathery." The material of which the cell is made is little if any more tough than that of the ordinary worker-cell. But here is a strange thing which I do not know that I have ever seen mentioned: The worker larva, when she spins her cocoon, attaches it to the bottom and sides of the cell, so that, at the point where she bites off the covering to the cell, there is little if any of the cocoon; while the queen-larva spins her cocoon right the opposite, having the thickest part of the cocoon right where she must bite her way out, the bottom of the cell having no cocoon in it whatever. Now, whether this is brought about for the purpose of making it hard work for a rival queen to bite through the cell when she wishes to destroy the inmate, or whether it is done so that the queen larva can still partake of the royal jelly while she is spinning her cocoon, I do not know; but I do know that the facts regarding the position of the cocoons in the different cells are as above stated.

162—p. 229. The first hatched queen is enthroned as "ruler" of the colony, so she is in no way molested by the next queen allowed to hatch, hunting her up as you here infer. It is a rare thing that the second queen is allowed to hatch, unless the bees intend to swarm again, in which case the second hatches after the first has gone out with the swarm. Once in a great while a whole lot of queens are allowed to come out of their cells and walk about the combs; but in all such cases, so far as I have observed, the first queen pays no attention to these, but they are dragged or driven out of the hive by the workers, and the first one becomes the mother of the colony.

163—p. 229. As far as my experience goes on this point, the workers do this destroying of the cells. I know queens do tear open cells but believe the workers do most of it when the idea of swarming is not entertained.

164—p. 230. In all cases of after-swarming there is no chance for a fight, as all but the first-hatched queen are kept in their cells.

165—p. 230. After the closest watching on my part for the past eighteen years, I am sure that there is never any piping till after one queen has hatched, and this hatched queen does all the piping, she being answered by those that are mature, and held by the bees their in cells by the hoarser note which Dr. Miller calls "quahking." Also more than one queen is never allowed her liberty before the second swarm issues. When the swarm is issuing, the cells are left unguarded, and several of the mature queens may push out of their cells, and run out with the last-issuing bees of the swarm. Where a lot of queens are allowed their liberty at one time, the colony thus allowing them their liberty does not calculate to swarm; hence no piping is heard.

169—p. 235. Queens having their wings clipped equally on both sides, unless cut very short, are frequently able to fly after ridding themselves of eggs, and becoming small like virgin queens. For this reason it is preferable to clip only one side.

170—p. 236. This is too much work. With the left hand, using the thumb and forefinger, catch the queen by the wings; lay the sharp small blade of a jack-knife, held in the right hand, on the wings, when both hands are to be lowered close to the tops of the frames, the knife drawn a little, when the queen falls, clipped, on the bees below, and you have not even touched her to convey any foreign scent to her person, as the wings you have touched are left in your hand.

172—p. 240. If you have ever seen a little larva, 36 hours old or less, that did not have more or less of this milky food surrounding it, you have seen something which I never did, except in cases where the colony was bordering on starvation. When a colony is thus starving they will not rear good queens any way. Well, if there is always milky food shining in the cells about the larvæ which are under 36 hours old, so that the larvæ have all they can eat, this is just as good as if they had ten times as much in the cell, and they are certainly progressing toward "queenhood" just as fast in one case as they are in the other. Where the trouble comes, is in an insufficient supply of food during the last four and a half days of larval life, this being the time when the female organs of the worker are dwarfed, thus causing it to hatch out a worker instead of a queen. I am very positive that, if plenty of royal jelly is given to a larva from the time it is 36 hours old, till it is sealed up, it will make as good a queen as will the larva which swims in royal jelly all its larval life.

173—p. 240. Add my indorsement to Dr. Miller's, 368. Field bees do not make good nurses.

177—p. 241. If you use the queen-cell protectors, spoken of elsewhere, the bees can not tear the cell down unless it is mutilated near the point. I have often used cells in these protectors, having one side all open, yet they hatched out as perfect queens as they would had the cell not been mutilated. For this one purpose alone I should want some protectors in my yard, as many valuable queens in mutilated cells can be saved by their use.

179—p 244.—I think this unnecessary where full-sized frames are used; besides, after a year or two we should have none but mutilated combs in our nuclei were we to follow out this plan of inserting a piece of comb containing larvæ, every little while.

180—p. 244. If you suspect a cell is not going to hatch, cut it open carefully at the side and look in. If the queen is of the right form and color, press the cut together; insert the cell in a queen-cell protector, and the queen will hatch just as well as if curious eyes had not peered in at her. This I do hundreds of times each year.

181—p. 244. Yes, and have cells of all sizes all along the lines where the pieces are cut out and inserted, in which many drones will be reared when these combs are used in full colonies.

182—p. 252. I cover the hive all up with a large sheet, and then there is no chance of smothering; and, also, the robbers are not confined to the hive.

183—p. 253. Yes; and while so confined I would carry the hive to the cellar. I frequently do this, leaving it in the cellar till pollen becomes plentiful, or something comes about that causes the robbers to be interested in something else.

186—p. 255. I had plenty of snakes live under my hives one season, and the idea that bees dislike snakes is all bosh. I have seen snakes glide in and out of the entrance of different hives, but the bees paid no attention to them.

Yes; but snakes pay attention to the bees. They once for us depleted a full colony, besides making inroads into quite a number of others. The bees may not dislike snakes, but the snakes certainly do like the bees.

187—p. 256. You do not say a word about the bees crawling all over one when working by lamp or lantern light. This I find to be a perfect nuisance with me.

If you work *right*, they won't crawl all over you. Don't get too close to the lamp or lantern.

188—p. 258. The only sure way to tell about robbers is to kill a bee which you suspect to be a robber. If you find its sac full of honey you may know that such a bee was a robber, for bees always carry honey *into* a hive, never *from* it, except in cases of robbing or swarming. Young bees taking a playspell often look as plump as robbers, but when one is killed it is found full of excrementa, not honey.

189—p. 262. Smoke will drive yellow-jackets and bumble bees much quicker than it will bees, so they will leave their nests entirely—the yellow-jackets rarely returning, but the bumble-bees will return.

191—p 271. This is the way I always remove them; and if you learn by instinct, as it were, to strike your hand against your clothing at the moment you feel the strike to sting, you will, in nearly all cases, remove the whole sting, and suffer scarcely any pain. I always wear a veil, as I don't want them in my face if they did not sting at all.

A bee must always "lay hold," as it were, with its feet before it can sting; and after practicing striking my hands down on my clothing to rub stings out, for years, it has become, as it were, second nature to me, so that, as soon as I feel this "laying hold," my hand, or the part the bee is on, comes to the clothing without thought, so that not one bee in five which intends to sting me succeeds in doing so. When I go out into the bee-yard without a veil, the same instinct, or second nature, brings my sleeve up to my face when a bee alights on me there to sting, so that I can safely say I do not get stung once now to where I used to ten times fifteen years ago. I also know in an instant whether a bee which alights on me intends to sting or not; and when it does not, no inclination comes over me to rub it off.

193—p 273. This is the worst trial I have, and I sometimes feel like telling such persons that it seems as if they should "know something;" but instead, I request them to come back where I am, only to repeat it when I open the next hive, and so on. Isn't it strange that some folks can not learn any thing?

194—p. 273. This is more common with the blacks and hybrids, very little of this angry buzzing being done by the Italians. The Cyprians are the most vindictive of any bees I ever handled; but, strange to say, they would allow you to stand for hours at a time right in front of the entrance, turning out for you or putting up with almost any inconvenience as long as their home was not molested, without any of this angry buzzing or giving a single sting; but let some little mishap occur while opening the hive, and a quart of angry bees would be on you in a moment.

195—p. 274. I never had any bees but the Cyprians that would follow me through a door; but these fellows would do so, and sting equally bad in a room as anywhere else. It was after a fight with 50 to 75 of these fellows in my shop (fighting till I had killed every one of them, because they insisted on coming into the shop and stinging), that I decided that they must go, for the Cyprian bees are the best honey-gatherers of any of the races.

196—p. 274. I carry a "paddle," made of wood and wire cloth, in my work-box; and if any bee insists on following me two rods from its hive, I always kill it with this paddle, and thus my apiary is always kept free from angry bees. The wire cloth is inserted in the center of the wood, so as to allow the air to go through the paddle, thus making sure of hitting the bee every time, instead of blowing it one side, as is often the case where only solid wood is used.

197—p. 274. The busy man has no time for this. Take off the cover of the hive, raise one corner of the quilt, and, as you "peel" it off, give two or three gentle puffs of smoke under the quilt and over the tops of the frames. You can now go about your work with this colony of bees with rapidity; while, if you try to get along without any smoke, you must work slowly; and, ten chances to one, after all your care the colony will get aroused, ten times the smoke now having to be used that would have been used on the start if worked as I suggest, and many cross bees be following you around, if not killed. Don't let us get too sentimental over any practical work in and about the apiary.

201—p. 277. I always blow a little smoke under the quilt as I raise it, and after that use no more unless they show signs of stinging. In this way no time is wasted to have them off from the tops of the frames out of the way. Any colony can be subdued by blowing in a little smoke at the entrance, and closing it, and then rapping on the hive a few times. In two or three minutes you can do anything with them.

202—p. 279. Why not say bees swarm because it is God's plan to keep them from becoming extinct, as much as it is his plan for the birds to return to us each spring, mate, and raise their young? With an apartment that is suited to the bees for all seasons of the year, that is not enlarged or contracted by man, the bees invariably swarm if the season is propitious, and all the combined ideas of man have not as yet been sufficient to produce a non-swarming hive when worked for comb honey, that was reliable.

204—p. 280. Bees have been known to swarm many times when wintered over in a large hive that they had filled only half full the year before, without building a bit of comb before swarming; thus proving that lack of room does not cause swarming. Why not admit the *real cause* of swarming, which is all embraced in the one sentence of the Creator of all things, where he said, "Go forth, multiply, and replenish the earth"?

205—p. 281. How about the comb they would build? At present prices of wax, this would be worth more than "a fly."

206—p. 282. I never could see a bit of difference as to the work of a colony, and I have watched closely to see, when I knew a colony had a sealed queen-cell.

207—p. 282. I do not believe that the first swarm *of the season*, in any apiary, whether containing one colony or one thousand, ever issued until the first queen-cell was capped over. If I am correct in this, and no one has shown that it was otherwise, then there is no need of watching for swarms till queen-cells, nearly ready to seal, are found. After several swarms have issued in an apiary, then it is that swarms may issue without any preparations in the way of queen-cells.

209—p. 287. I think all of this very much more work than to keep all queens' wings clipped, and hive the swarms on the returning plan. Where an apiary is worked with clipped queens, and all after-swarming is prevented, as it *should always be*, tall trees, absconding swarms, or several swarms out at once, give no anxiety to the apiarist.

2 9—p. 288. Here is where your swarming-device comes in well. As the swarm is issuing, open the swarmer, hold it in front of the hive till a pint or quart of bees have run and flown in; close and attach the caged queen to the swarmer, and set it up anywhere in the yard for bees to cluster on. When clustered, hive wherever you wish, letting the queen run in with the bees, when about half have gone in.

210—p. 288. No mistake so far as my experience goes.

211—p. 289. The hive which begins to "draw" the bees first will usually get the larger share of these bees. To obviate this I use two plans, the first of which is to put a sheet over the one that the bees go to first, as soon as it has nearly or quite its proportion of bees, which causes the rest of the bees to go to the other location. If more than two are out, a sheet is put over the second hive when bees enough have entered, and so on till I have them where I wish. The other plan is to place a caged queen with the large cluster to hold it till all get settled, and I have the hives all prepared, when I dip a certain number of measures full of bees to each hive, letting each swarm have one of the caged queens, and all are where and just as I wish them.

212—p. 289. I never knew but one first swarm to issue the second time on the same day—a returned swarm, I mean.

216—p. 290. I don't agree; your extracting reduces them, for the time being, to a state of poverty, the same as a dearth of forage; hence, all idea of swarming is given up the same as it is when the flowers yield no honey, on the principle that God has given them knowledge enough to know that they can't prosper outside of the old hive without a yield of honey. The above holds good where small hives are used. Large hives filled with comb or comb foundation tend to keep from swarming, whether the extractor is used or not.

218—p. 295. I have never known it to fail but one year during the past twenty-one years, the time I have kept bees. Teasel will, in all probability, soon be a thing of the past, as the price is now down to 25 cts. per thousand, on account of new machinery being introduced to take its place.

222—p. 297. Put a box or cap to a hive, over the open mouth of the old hive; and, during the tearing to pieces of the old hive, etc., the bees will all, or nearly all, run up into this and be out of the way. When through, they can be hived into the new hive.

225—p. 298. The drumming is done by getting off the side of the old hive, and getting the nails out of the cross-sticks so no time is wasted.

226—p. 298. Don't lay the hive on its side at all, but stand it with its mouth up. In this way you can cut the nails just as well, be in no danger of injuring the combs, and, by putting a box partly or wholly over the mouth of the hive while doing this work, the bees will all run up into the box out of the way.

227—p. 3 1. Alternate the frames, and thus mix the bees thoroughly, and they will never fight at any time of the year.

But they do *sometimes*, friend D., *with us*, nevertheless. I wish you would try uniting Cyprians in that way.

228—p. 3 1. The honey will be removed much sooner if placed under the bees.

229—p. 301. I never lost one in my life.

230—p. 302. I don't agree. August is the time to unite bees. The first part of September would do, where fall flowers are abundant. It is far easier to unite bees in the brood form in August than in the bee form in October, for the brood the last of August are the bees of October.

231—p. 3 2. The better way is to shake the swarm, that has been hived from two days to a week, out of its hive, in front of the same; and while they are running in again, shake the swarm down with them. In this way I never knew any fighting, but I have had nearly all of the swarm killed, in spite of all I could do, by allowing the new swarm to run in with the one hived a few days before, when those established in the hive were not disturbed before attempting to run in the new swarm.

232—p. 3 3. I wear it all the while when I make a general business of working with the bees.

233—p. 307. You are just "shouting" here, and this is one great secret of success in getting box honey. To keep the surplus apartment as warm and nice as it should be, a cap or hood to each hive is almost a necessity.

234—p. 309. Vinegar is also used in cleansing wax. By its use the impurities can be made to separate from the wax nearly as fast again as where no vinegar is used in the water the wax is melted in.

236—p. 310. I am glad you say "I think." I think that what you saw was nothing but excrement in a very thin form. But why did you not prove your "think" by killing one of those heavily laden bees as they went out, and dissect it, so as to tell us just what she was laden with? By doing this, and then dissecting one of those less corpulent that went into the hive, you could have proved to us positively whether your "think" was right. I once thought that my bees were getting honey quite rapidly; and wondering what it came from I dissected one of these loaded fellows, and found that the contents of the honey-sac was brackish water.

You may call it excrement in a very thin form, friend D., if you choose; but to show you that I am probably right, I will mention one thing I did not think proper to put in print till you called it out. When I made the experiment, I wanted to be sure it was only water, and not sweetened water, that they were expelling, so I borrowed of Mrs. Root several clean dinner-plates and placed under where they were playing in the sunshine. Well, this substance that dropped on the plates looked exactly like clear water, and when I touched it with my finger and tasted it there was no sweet about it at all.

238—p. 317. Like you, I know it is very easy getting things daubed with wax where it is rendered in the old way; but with the sun wax-extractor, no one can get wax daubed about, as, with this, wax is never handled in its melted form. Here is a point for the sun wax-extractor which you did not score.

239—p. 320. Bean meal is often used to adulterate wax, so I am told.

240—p. 320. The reason why you did not see that "spoonful" of honey was because you did not look in the right place. If you had taken a bud a little more advanced than the one in the left of the cut, one just ready to blossom, and torn it open, you would have found the honey. In this locality the wasps and hornets bite into these buds near the middle, so as to get at the honey before the blossom opens; and after they sip what they wish, the bees take the rest. I have often seen as much as a teaspoonful of thin nectar in a single whitewood bud.

241—p. 323. So far as my experience goes, there can be but little if any gain in bees made, in this locality, by thus feeding in September. The bees will not breed as in June, and the exertion in carrying this feed and keeping up the temperature for brood-rearing wears out the bees of the hive about as fast as the young ones are reared. From past experience I prefer to go into winter quarters with mostly old bees rather than try to rear young ones at this time of year. We have very little brood in the hives after the 25th of August.

243—p. 326. After trying the spreading plan on part of my apiary for several years, I see nothing in its favor; so I now leave the frames during the winter just the same as in summer.

244—p. 327. I consider fine dry basswood sawdust just a little better than any thing else for cushions, having the cushions about three inches thick.

245—p. 328. The Good candy is best for winter feeding, and it is a great convenience to have a piece of wire cloth over the frames to keep the bees out of the way while you are putting the candy on and looking after things.

246—p. 328. If that warm day comes. We frequently have from 120 to 160 days here in which the bees can not fly: and in such cases they are better off in the cellar.

247—p. 329. If the temperature is right. A damp cellar needs a higher temperature than a dry one, to winter bees successfully.

248—p. 329. If the cellar is a proper one, an open winter should make no difference with it, hence I do not see any logic in this sentence. If the bees are short of stores in the spring, it is easy feeding them after they are out of the cellar.

249—p. 329. I use my sawdust cushions on the hives which are put into the cellar, just the same as I do on those outdoors, and like them much. Perhaps I should say that the hives which are put into the cellar are chaff hives also.

250—p. 330. Don't wait for snow. Put them in some quiet day with the mercury at 38 to 44 degrees, and you will never wait for snow again.

251—p. 330. I remonstrate. Pry these hives up a week in advance, slipping a shingle nail between, then lift the bees quietly when setting into the cellar.

2 2—p. 332. I should consider bees better off on their summer stand than in a cellar that would vary 10 degrees in temperature. Such a variation tends to make the bees uneasy, causes them to go to breeding, and often results in diarrhea and spring dwindling. My bee-cellar has not varied four degrees between the hottest and coldest temperature, while the bees were in it, during the past fifteen years, it usually standing at from 42 to 43 degrees.

254—p. 333. In re-covering my cellar with flagstone I did not make any provision for ventilation, so the ventilator shown at 6 is not on the cellar now. I see no difference in the behavior of the bees, now the ventilator is off.

258—p. 334. As you advise waiting till pollen is plentiful (which advice is good), your advice as to the time of day in putting out is bad, as it is so warm at this season of the year that robbing will likely result from those set out previously, or from those wintered on summer stands. Commence to set them out about four o'clock, not setting any out later than when the sun is an hour high, on a warm day, and they will have a nice fly, and protect themselves the next morning.

259—p. 334. All of my experience says weak swarms from the cellar are no more liable to swarm out than are those of the same strength wintered on their summer stands.

260—p. 334. I put half an inch of dry basswood sawdust on the floor of my cellar every month during the winter, which answers instead of sweeping the dead bees up, and keeps all dry and sweet.

261—p. 334. I never used a stove except one year, and then I lost nearly all of the bees.

262—p. 337. The uniting of spring-dwindling colonies does no good. If they will pull through united, they will do so singly. I have put as high as eight such colonies together, and at the end of two weeks they were no stronger than colonies not united, which were no better than either of the united ones were two weeks previously.

263—p. 337. I believe these bees die of old age, caused by a used-up vitality from holding the excrement so long. If you will consider, you will see that all evidences point that way.

264—p. 338. This sounds better than what you say elsewhere. I believe it well pays to save all pieces of worker comb 6 inches square. This you *save*, while foundation costs money.

Friend Root:—Although I have been pressed for time and hardly knew how to do it, I have thoroughly read the preceding pages, and criticised what I considered wrong. I may not have clothed my language with as smooth a dress as some would have done; but, believe me, I have not intended to be harsh, and if you find any thing that so sounds, please forgive. I did not intend any thing but kindness.

G. M. DOOLITTLE.

Borodino, N. Y.

MILLER'S REVIEW AND COMMENTS ON THE A B C BOOK.

Recognizing the value of the comments of Mr. Doolittle in previous editions of this work. I have thought best to solicit the aid, in a similar way, of a no less practical and prominent bee-keeper. Dr. C. C. Miller, of Marengo, Ill. Accordingly, in 1888 he reviewed most carefully this entire work, and I here append the comments which he has made. Although we differ on some few points it will be interesting to the reader to notice how nearly we agree in our experiences on all the fundamental principles of the pursuit. It is to be observed that Mr. Doolittle's comments are numbered from 1 to 303, and that Dr. Miller's begin with 305 and include all successive numberings. As before, the figure at the right indicates the page from which comment is made.

305—p. 4. The third objection is that it is almost impossible to be *sure* that no queen-cell has escaped observation, and you might nearly as well leave all as to leave one.

307—p. 8. I think it very desirable that not a single bee shall be hindered in its work, but I do think the amount of hindrance is often overrated. The experiment here given is striking, and apparently conclusive, but there may have been other reasons for the great difference. In no case could the loss in storing be greater than would occur from taking away as many bees as the greatest number hindered at any one time. Here was one-fifth of the total storing apparently lost. Have you the slightest idea that one-fifth of the field force were lying in front of the entrance?

For the time being, I think that perhaps one-fifth of the field force were in front of the entrance; but the loss in the aggregate would be only the amount of time these bees were hindered in getting their breath, and taking wing again. You will often see weeds or grass in front of the hive bumped by the bees until the leaves are torn to shreds. The wings of our little workers are also torn to shreds by this kind of bumping; and I do think it quite important that the owner of the hives should by some means keep weeds and grass out of the path of the worker-bees.

308—p. 10. Alsike well deserves a place in the flower-garden. A bouquet of alsike is very beautiful and *delightfully fragrant*. Like some others, however, I have failed to make it a profitable crop.

309—p. 10. Unlike red clover, the stalks of hay from alsike clover are all eaten clean.

311—p. 17. I can transplant successfully at any season of the year almost any thing but a poppy, but you couldn't get me to transplant grapevines in full leaf. Spring or fall, always.

312—p. 18. Only don't forget to "firm" the ground well after planting, by tramping.

313—p. 24. Unless my figures are all wrong it will cost considerably more to paint the building than the 36 hives, so I can't see the advantage.

314—p. 24. Yes, but you must carry it to some other place to brimstone it, as nearly all agree is necessary.

Friend Miller, I can not agree with you in this. My impression is, that just now nearly all the honey producers agree that brimstoning is *unnecessary*.

315—p. 24. Yes, but as a general thing bees should not be touched during rainy and wet weather. The most of the work is done in bright, hot weather, and isn't it pretty hot work in the house-apiary sometimes with the doors closed, compared with the shade of an old apple-tree?

But suppose a light shower comes up when you are busy at work out among the hives. You can go into the house-apiary and work quite comfortably until the shower is over. When we have a whole rainy day, I agree with you that it is better not to handle bees, if it can be avoided.

317—p. 26. Perrine's floating apiary was abandoned as a failure.

318—p. 31. I think it important to shake off some *young* bees into the hive where the queen is to be raised.

353—p. 53. I prefer one which sent off a swarm at the last swarming season.

330—p. 77. This allows too few supers in the tent. I have practiced putting one super flat on the ground, another upon this crosswise, then another crosswise, and so on as high as they could be piled, and as many piles as would go in the tent. The bees will not go out quite so soon as if the supers stood on end separately, but you get through with a big lot at once.

332—p. 98. I doubt it. I once had a good colony in a hive almost entirely filled with drone comb. They swarmed out after occupying it, if I remember rightly, only a few days, and I know of no reason for their leaving, except their having so much drone comb. After changing their comb for worker, they remained contented.

333—p. 101. Is not "diarrhea" a better name than "dysentery"?

334—p. 102. Is not a good cellar in proper condition just as ready a means at the command of some?

A good cellar is probably just as well where cellar wintering is found to be advisable.

335—p. 103. I am not sure about it, but I have had cases that looked much as if they were cured, simply by being warmed up in the cellar; that is, running the temperature of the cellar up as high as 50°.

336—p. 104. Mice are not so apt to riddle surplus combs in which no brood has been raised, as old black brood-combs. These they will chew up fine, perhaps on account of the cocoons, (may they not contain a trifle of sweetness?) and I think in such combs I would rather have occasional batches of honey, or honey accessible near by, in hopes that they might gnaw the combs less. One year mice were plentiful in my honey-room, where were thousands of sections, and scarcely a section was touched, because extracted honey was allowed in daubs on the floor. Extremely untidy, but it saved dollars.

337—p. 106. I do not know that there is any more chance of clogging in single-walled hives, providing they are wintered in the cellar.

338—p. 106. The entrances to my hives were ⅜ inch, full width of the hive. I found it so difficult to clean out the dead bees, in the cellar, that I took a 2-inch chisel and enlarged all the entrances to ½ inch. I think I like this better for all times of the year. In early spring a pine stick closes up the entrance so only a few bees can pass. If at any time this seems to crowd them the entrance is enlarged; and when hot weather comes, the whole entrance is left open.

339—p. 106. I think there is danger that the entrance would be worse clogged if stopped with wire cloth. Besides, in the cellar the dead bees may need cleaning out several times in the course of the winter, and the wire cloth would be in the way.

340—p. 107. Neither have I, if it is to be bottled up as soon as extracted, and I know that honey improves in the keeping of the bees; but I also know that unsealed honey can be improved after being extracted, and, if rightly managed, may it not equal that ripened by the bees?

341—p. 110. For years, when I wanted any extra nice honey I have been in the habit of draining it off and melting the grain, and never failed with clover honey; but linden (I don't often have linden) I can't drain. It runs, grain and all, like half-melted lard. Is all linden the same?

I do not think all linden can be the same, for with us it gives the very nicest, whitest, and dryest lumps of candied honey. In fact, we have had barrels of it drained off so it could be handled much like sugar.

342—p. 123. I dislike to make any issue on this ground; but after having had syrup with no acid which had been boiled granulate in the feeder, I hardly dare to omit the tartaric acid, although I am a little afraid the acid may not be *quite* so good for the bees. Notwithstanding the very serious results that would follow from burning the sugar, it has been with me such slow work dissolving *granulated* sugar without having it over the fire, that I always boil it. At first I always stirred constantly from the time the sugar was poured in till the syrup was taken off; but after seeing that candy-makers never stir at all, although they boil down syrup much thicker than we do, I allowed it to cook without stirring, except to stir when the sugar is first poured into the boiling water, so as to be sure nothing like dry sugar can settle and burn on the bottom.

345—p. 178. Is this well authenticated? You will find manna sold in the drug-stores, and I am rather fond of it. I think it is sometimes used as food, and is the dried juice of the *Fraxinus ornus*, or flowering ash of Southern Europe; but I think it never falls from the air.

346—p. 179. If I am not mistaken, we have had reports of fields of wheat stubble covered with a kind of nectar, and I think it is quite common for corn-plants to secrete nectar.

349—p. 188. For years I have followed this plan: When a colony shows its sense of queenlessness by starting queen-cells, no matter if the queen-cells are well advanced, I simply lift a frame out of the brood-nest and place the queen right among the bees on the brood, with no precaution or preparation whatever. So seldom is there any loss that I much prefer this plan to caging, although the plan might not work so well when honey is not coming in. Latterly I generally follow a still safer plan, original with me, but discovered by others as well. It is, to merely lift out from a nucleus the frame containing the queen, and put it, bees and all, into the queenless hive. Probably the cages are best for Mr. Root, because he receives his queens from abroad in cages.

I have tried both plans you mention for introducing queens; but once in a great while they are both liable to fail. The failures are so few, however, that I would let any queen loose as you did, that does not cost over a dollar.

350—p. 194. Will not any queen do so if held in the cell some time by the bees? Will a Cyprian do so as soon as she is old enough to gnaw out of her cell?

351—p. 194. Some insist that, the more queens reared, the poorer they will be, and that not more than twelve queens to the colony should be raised. How is this?

I do not agree, friend M.; that is, where you have a good strong colony in the height of the season. Such a colony, I think, could rear 100 queens, and have them just as good as if they reared only half a dozen. Even with natural swarming, I have seen as many as from fifteen to twenty queens come out with an after-swarm; and for experiment this after-swarm was divided up into nuclei so as to save nearly all the queens, and they all proved to be excellent.

152—p. 200. The first year I kept bees they were pure blacks, and I moved a colony perhaps 25 feet, and they readily found their hive, and I think there would have been no trouble in moving them 100 ft. Last summer I moved a colony of Italians 6 ft., and they never found their hive; but if these latter had been pure blacks they would have found their hive, I think, no better; and if my one colony had been Italians the first year, they could have been moved with safety 25 ft. The difference is not in the blood, but in the number and position of other colonies. If there are no other bees about, a single colony can be moved quite a distance, black or yellow.

Very likely you are right, friend M., although it is something I had never thought of before.

355—p. 205. I have wintered many colonies, two in a hive, with ⅜-inch division-board between, and I have *always* found the two colonies practically in one cluster.

356—p. 216. Frank Cheshire says a spur at the termination of the tibia of the middle leg, acting like a crowbar, pries the pollen-mass loose.

357—p. 216. I shouldn't wonder if it were much the same with you as with me. There is a great *show* of pollen carried in from maple and corn, and undoubtedly a great deal of it; but I suspect much more is stored from clover than from any other source, for the bees work so much longer time upon clover, although the pellets, as carried in, are not so conspicuous. Besides, the surplus pollen carried over winter is nearly all of the brown color of white-clover pollen.

358—p. 216. I may be mistaken about it, and the ground is covered with snow, so I can not refer the matter to the bees; but as memory brings the matter up before me, not more than one bee in three ever bring in pollen, and often not more than one in five or ten. Possibly they had small loads of pollen when I thought they had none.

359—p. 217. I have fed many bushels of grain to bees (generally ground corn and oats), and I would never think of feeding it on the ground. The best way I have tried is to take hive covers, 6 or 8 inches deep, put a stone under each near the middle; and as often as the bees work down the feed, turn the cover around so as to leave the feed at the upper end.

360—p. 222. Years ago, doing just as you direct, I couldn't get my bees to touch meal; but latterly I have no difficulty, without using any honey, simply setting out the meal. The explanation is, that, with a very few colonies, they got enough natural pollen and didn't want horse-feed; now there are so many that pollen is scarce, and they are glad to get any substitute.

362—p. 230. Instead of paying no attention in such instances, is it not the case that the queen tries to destroy the cells, but is hindered by the workers?

I do not think the queen even tried to destroy the extra cells in the case I have mentioned. Once it was an observatory hive, and the whole family watched to see the queen destroy the cell; but she was never seen to pay any attention to it whatever, although she often crawled right over it.

363—p. 230. There are two kinds of sounds made by queens; *piping* or *teeting*, and *quahking*. A queen quahks before coming out of the cell, never after emerging. She may, and perhaps always does, quahk before emerging, even if no other queen is in the hive. After emerging she pipes, and no queen ever pipes in the cell. She may, and perhaps always does, pipe while young, even if no other queen is in the hive. Rarely an old queen pipes, probably from alarm. In the majority of cases, piping and quahking are heard in a hive where a young queen is at liberty, and several others in their cells. Dzierzon says the piping and quahking is from sheer jealousy. The piping consists of a prolonged tone followed by several much shorter, and, if I remember rightly, each tone is shorter than the preceding one. The quahking consists of several tones of equal length, uttered in a lower pitch and in a more hurried manner than the piping. Only one queen is heard piping, and immediately after, or just before she ceases, one or several queens are heard quahking.

364—p. 230. I doubt if piping is produced by the wings. I have seen the wings trembling during piping, and so have I seen a horse's tail shaking during neighing, but the horse didn't neigh with his tail. Daubing a queen with honey might prevent her squealing by closing up the stigmatic orifices whence proceeds the voice. Frank Cheshire thinks, that from these orifices more than from the wings proceed the tones of the bee.

365—p. 235. When it comes to hunting up a hundred or more queens every spring to see whether they are clipped, I very much prefer to have both wings, on one side only, cut; then I can tell a clipped queen at a glance; whereas I have more than once caught a queen, supposing her unclipped, because only the large wing was cut.

366—p. 236. I haven't time to carry my queens into the house to be clipped, especially when five miles from home, and I can't clip them while free on the combs, so I just catch the queen and hold her by the shoulders with the thumb and finger of the left hand while I cut off all I conveniently can from the two wings on one side.

367—p. 236. Suppose you try your hand at this sort of "remembering," and astonish your blessed old mother by bringing to mind an incident that occurred in her early girlhood.

368—p. 240. If by this you mean to put in an empty hive a frame of brood with no bees, and set this hive in place of a removed colony, to catch the returning bees, I can not approve the plan. Field bees will not make the best nurses, and you will have no others till some hatch out. Better make sure there are enough nurses.

369—241. As it is somewhat difficult to have all larvæ just at this stage, I generally take mostly eggs.

370—p. 250. Perhaps more sounds are produced by the true vocal apparatus than by the wings, and perhaps more sounds are *noticed* while bees are on the wing; but if the ear be held hard against the wall of the hive, a great number and variety of sounds will be heard; in fact, a regular jabber, and the nervous novice will hear a queen piping sometimes when no queen is in the hive.

371—p. 259. I'm afraid the honey wouldn't pay for the work, even if the land cost nothing.

At the present writing I quite agree with you.

374—p. 277. Quite likely, muscular action may cease in five or ten minutes, but by no means the power to make a painful wound. One winter, toward spring, my wife was cleaning wide frames, and came to me with a dried bee-sting, saying it got into her finger from a wide frame, and that it hurt. To see how far her imagination went, I thrust the sting into my hand, and there was no question about it. I experienced the genuine, simon-pure bee-sting pain—not very severe, to be sure, but unmistakable. Her pain was probably greater than mine, and I see no way that the sting could have belonged to a living bee any time within six months.

This is indeed wonderful. I am very glad you have mentioned it, friend M., for something of the same kind has come up before, and I assured the parties they were mistaken; that the sting must have come quite recently from a live bee.

375—p. 279. One year I had about a quarter of an acre of Russian sunflower in a solid patch, which was nicely cultivated. It did not appear to be of any value to the bees; and although it will produce more quarts of seed, they are mostly shell with very little meat. I suspect the common variety is of more value.

376—p. 280. This proves nothing either way. The queen might stir the workers up to swarming pitch, without herself leaving the hive at all. She might even do this so that this temper would continue for some time, although the queen were taken from the hive. I only say *might*, for I don't *know* any thing positively about it. There is important ground here for the A B C class to work.

377—p. 280. I once had a swarm issue from a hive in which there was no queen at all. I had taken her from the hive perhaps an hour before, and I presume the bees had not discovered her absence. In this case the queen was certainly not the direct and immediate cause of the swarm, although she may have started the fever before leaving.

379—p. 288. If there is in the apiary a hive in which a swarm has been put, or has returned, a short time before, a swarm without a queen will sometimes enter such a hive instead of returning to its own.

380—p. 289. Too often, one hive may receive the greater share of the bees.

381—p. 289. I have less faith in this than I formerly had. When a colony gets to the point that it actually swarms, it takes considerable room to satisfy it; and the ofteuer it is balked in its attempts, the more determined it seems. I once had a colony swarm, and I returned the bees, giving them one or two frames of foundation. Next day they swarmed again, and I gave them another frame of foundation. Out they came the next day, and went back with another frame of foundation. When they came out again I put them back and decided to have my own way by leaving in the brood-chamber nothing but empty foundation. But their blood was up, and they came out, leaving the foundation untouched except one incipient queen-cell with an egg in it! I gave in. I hived them on a new location, and all was "lovely." Some sections of honey were on, and I think that, without these, they surely would not have swarmed the last time.

384—p. 293. If I understand it, your reasoning is that bees cluster because they don't hear the queen. Now, when a swarm issues without a queen, as when the queen is clipped, they generally do not cluster, but go back to the hive without clustering. If *not hearing* the queen in one case makes the bees cluster, why doesn't it in the other?

Friend M., I can not answer. You must not ask such hard questions.

389—p. 298. Lay the box hive on that side which will allow the combs to stand as nearly as possible straight up and down, and not flat; for if flatwise, the combs may break down.

391—p. 335. In actual practice I have not found that disturbing bees in winter by entering the cellar or jarring the hives, so long as the hives are not opened, makes any thing like the difference it seems to me it ought to make.

My experience has been exactly like yours. I have seen bees bumped and jarred and disturbed so much that I supposed they must be about used up. But such cases sometimes turn out as well as one could ask for.

392—p. 334. At present I keep fires nearly all winter long; but I am looking forward to the time when I shall have cellars good enough, and when I know enough, to leave my bees with no care the entire winter.

398—p. 335. I presume if I had used chaff hives as Mr. Root has, I should advise as he does, and I think likely if he had practiced cellar wintering till now, he would recommend that. My advice would be this: If nearly every one in your locality succeeds better with a certain kind of wintering, you will do well to try that kind; if the matter is somewhat unsettled, try both and see which is best for *you*.

399—p. 337. Like many others I have found that two or more "dwindlers" united last no longer than one separately, so I never unite unless I am pretty sure a queen will otherwise be lost. The queens of those colonies too weak to retain them, are put in cages under the quilt over the brood-frames of a strong colony. This colony may lose its own queen by the operation, but the caged queens will be kept in good shape till needed for new colonies.

BOOKS ON BEE CULTURE.

No book can well be a complete substitute for our bee-journals. One gets a better view of any science, by reading the experience of a great number of individuals. We are all liable to draw wrong conclusions, and to become set in our own way; but by collecting and comparing facts from different authors, we, in a measure, steer clear of these mistakes, or errors of judgment.

I know of nothing that has ever been written, equal to *Langstroth on the Honey-Bee*, for all general purposes. The book was pleasantly and beautifully written, and the number of mistakes in it was marvelously few in a work treating on any one subject so thoroughly. The first edition was issued in 1853. A later edition appeared in 1859, and another in 1865; but on account of ill health on the part of its author, L. L. Langstroth, it was not again revised and put before the public until 1889. At the suggestion of Prof. A. J. Cook, who is also the author of a bee-book, Mr. Langstroth placed this revision in the hands of Charles Dadant, of Hamilton, Ill., one of the largest and most extensive honey-producers in the world. By him it has been most thoroughly revised, the obsolete being struck out, and many of the beautiful passages from Mr. Langstroth that would never grow old were retained. and so nicely blended with the new matter that a casual observer would hardly think that it had been written by two eminent bee-keepers. It is plain, practical, and to the point, and it is destined to remain as one of the standard bee-publications. It is nicely bound in cloth, and contains something over 500 pages, the whole being beautifully illustrated. The pictures were executed by one of the finest wood engravers in the world —a German. In fact, Dadant & Son have put a wonderful amount of painstaking care and labor upon the book. Having produced many tons of honey every season for many years, Mr. Dadant is fully competent to place before us a work which every practical bee-keeper should have in his library. Although much enlarged, the price is still $2.00. The work is also published in French.

The book that comes next to Langstroth, and in fact the only one that can stand beside it at all, in many respects, is *Quinby's Mysteries of Bee-Keeping*. If one were intent on keeping bees solely for the money they would produce (and almost all of us take that view of the business to a greater or less degree) Quinby would be the man to follow, for he made his bees *pay*, and pay well, before movable-frame hives were ever known. He had, in fact, reduced bee-keeping to a paying business with a certain profit, with his plain, cheap box hives. After reading his old edition over, I feel as if it would be rare fun to keep bees in just such box hives now.

In the year 1879, the son-in-law of the late Moses Quinby, Mr. L. C. Root, formerly of Mohawk, Herkimer Co., N. Y., now of Stamford, Ct., re-wrote Mr. Quinby's *Mysteries of Bee-Keeping*, and in 1884 revised it. Mr. Root might very properly have styled himself the author of the book; but with that rare modesty which is characteristic of him throughout the work, he gave the book the name, *Quinby's New Bee-Keeping*. That you may know whether Mr. Root is competent to write a book on bees, I will say that he has made the production of comb honey his exclusive business ever since 1869. Besides that, he worked and studied with Mr. Quinby during the closing years of his life. As an evidence of Mr. Root's ability to manage bees successfully, I remark, further, that he secured, from 40 colonies, 4103 lbs. of basswood honey in only seven days. Price of *Quinby's New Bee-Keeping*, by mail, postpaid, $1.50.

In 1876 Prof. A. J. Cook gave us a manual of bee-keeping, at 30 cts., and in 1878 a much larger one. Since that time *The Manual of the Apiary* has been revised several times. It has had quite a large sale, the last edition being the 16th thousand, the 15th being largely rewritten. The author is Professor of Entomology in the Michigan State Agricultural College. He has, therefore, given us material aid in many matters not touched on by others — not only in entomology and the physiological structure of the honey-bee, but in the science of botany directly pertaining to apiculture. His work contains about 460 pages and 230 illustrations. It is very full, especially in the scientific department. It covers a very wide field, and is necessarily brief on some subjects, many of which are not treated in any other one work. The author is well versed in both the French and German works pertaining to the subject in hand, and has been careful in all cases to give due credit. He is a writer of high standing; his diction is classic, and his style pleasing. He is not only considered to be high authority on bees, but also on a great many kindred subjects as well. We feel sure that every bee-keeper will find this book a valuable addition to his library of bee-literature. Price by mail, postpaid, $1.00.

A Year Among the Bees is the title of a little unpretending work of 100 pages. It is written by Dr. C. C. Miller. To say that the style is terse, clear, and even humorous in some places, is but speaking justly in its praise. In the introduction, the author says: "I shall try to tell honestly just how I do; talk in a familiar manner, without being obliged to say *we* when I mean *I*. Indeed, I shall claim the privilege of putting in the pronoun of the first person as often as I please; and if the printer runs out of big I's toward the last of the book, he can put in little i's." The very simplicity of his manner of writing carries the reader along. He begins by telling about taking bees out of the cellar; and for every successive month in the year he tells what he does and how he does it. He lays considerable stress upon little things, just such as beginners and the more advanced bee-keepers are anxious to know. He explains how to make many a short cut, and he seems to be especially happy in discovering short ways for accomplishing certain results. Along through the pages of this work he speaks familiarly of his son Charlie, of his sister Emma, and of his good wife; and although the book is designed primarily to instruct, it has almost the interest of a romance. The price of this work is 75 cents.

The Production of Comb Honey was the title of a little work of 45 pages, by W. Z. Hutchinson, of Flint, Mich. This, though written primarily to show how to produce the article in the comb, covered in detail the matter of the use and abuse of comb foundation. In 1891, after this edition was exhausted, Mr. Hutchinson entirely rewrote and at the same time, enlarged it greatly, bringing it up to 88 double-column pages. The new book was christened "Advanced Bee Culture," and such it eminently is. While useful and practical to the beginner, it is invaluable to the *advanced* bee-keeper. Though it does not enter into the details ordinarily sought after by beginners, as is given in our own A B C and other larger works, it covers sufficiently the important subjects. In short, it contains a condensed summary of some of the excellent discussions that have appeared in the *Bee-keepers' Review*, of which Mr. Hutchinson is editor. The book is written in his happiest style, and is appropriately and neatly bound in tinted paper. Price 50 cents, prepaid.

G. M. Doolittle, of Borodino, N. Y., although a practical and prolific writer on bees for the bee-journals, covering a period of over 20 years, never wrote a book until 1889, when he succeeded in developing a practical system of queen-rearing, upon which he had been working for several years prior to that time. Although the system is not strictly original with himself, yet the credit belongs to him for *perfecting* a plan that has some pretty features about it. Among other good things he tells how to rear queens from artificial cells which, after being grafted, are completed and capped over by colonies *not* queenless; how to have the young queens when hatched from these cells fertilized likewise in non-queenless colonies. In short, he tells how to rear queens extensively, and yet not have a single colony queenless. For further particulars, see QUEEN-REARING, in the body of this book. All this, and more, is told in a neat cloth-bound book of 170 pages, entitled *Scientific Queen-rearing*. Price, $1 00, postpaid.

Success in Bee Culture is the title of a work written by James Heddon, Dowagiac, Mich. Mr. Heddon is a terse, able writer, and has originated not a few ideas in regard to hives and hive manipulation. His work of 50 pages embraces all his latest ideas. It contains a number of little hints which will be found valuable to the bee-keeper. In this work, also, will be found the subjects of contraction, inversion, honey-boards, and surplus-cases, with which Mr. Heddon has been more or less identified, fully treated. In the writing of the book, Mr. Heddon did not design so much to instruct the beginner in bee-keeping as to instruct the veteran bee-keeper with regard to some of the recent innovations which he has brought out. One of the special features of this book, and around which the whole matter centers, is his new hive, and how to use it. Mr. Heddon thinks, and so do some of his friends, that it will create a new era in the management of bees; but I believe that the majority of bee-keepers favor the old style of hives, not only because they are cheaper, but because they can not afford to change, even if the new hive is better. Price, postpaid, 50 cents.

Bees and Honey is the title of a work on bee culture, by Thomas G. Newman, editor of the *American Bee Journal*. It is written in Mr. Newman's usually vigorous style. Where one has little time to read, and does not care to peruse the more exhaustive treatises on the subject of bees, this work will give him all that is really essential. It treats both of the scientific and the practical, and no library on bees would be complete without it. Price, by mail, 75 cents.

Thirty Years Among the Bees is the title of an 80-page book on queen-rearing as practiced by Henry Alley, the veteran queen-breeder, ot Wenham, Mass. Mr. Alley has worked out an excellent system, and any one who rears queens should have a copy. It very nicely supplements Mr. Doolittle's book on the same subject. Price, in paper cover, 50 cents postpaid.

Every one who aspires to become a successful bee-keeper should take one or more of our bee-journals. As sample copies will be furnished by the editors, I need not attempt to discuss their respective merits here. A sample copy of GLEANINGS IN BEE CULTURE, which we always mail on application, will give you the address and price, not only of any of the journals, but of whatever you may need in the apiary.

Foreign Books.—As a general rule, climatic conditions and national peculiarities make foreign works on bee culture of little practical value to American bee-keepers. The Europeans, in practical apiculture, are not as far advanced as the Americans; but in scientific research they are considerably ahead of us. I will mention, however, two or three of the more prominent foreign works: Dzierzon's *Rational Bee-Keeping* (German), by Dr. Dzierzon, of Carlsmarkt, Germany; *The Bee-Keeper's Guide-Book*, by Thomas William Cowan, editor of the *British Bee Journal*; *The Honey-bee*, by the same author. This is purely a scientific work detailing the physiology of the honey-bee, as revealed by the microscope. Though not so full it is probably more accurate than any other purely scientific treatise on bees. *Bees and Bee-Keeping*, by Frank Cheshire, is issued in two volumes—the first scientific, and the other practical. The engravings in the former illustrate the physiological structure of the bee, and are probably finer than any ever before executed, either in America or in Europe.

The Bee's Knees – Charles D. Stewart – Atlantic Monthly
July-1925 – Page 1 = Bees vs Evolution Theory = Food for Thought

INDEX.

Absconding..........................1, 3
" Caused by Dissatisfaction with Hive.. 3
" Directions for Preventing in Spring... 3
" First Swarms, Prevention of........... 2
" From Want of Food.................... 2
" In Early Spring...................... 2
" Nucleus Swarms....................... 3
" To Prevent, of New Swarms............ 1
" Prefer to Enter other Hives.......... 2
" " " Several Unite.......... 2
Adulteration of Wax.......................320
After-Swarming............................ 3–5
" " Cautions about................... 4
" " Prevention of.................... 4
" " " " With Box Hives.. 4
" " Advantages of.................... 4
" " Amusing Features of.............. 4
" " May be Built Up.................. 4
" " Number of........................ 3
" " Size of.......................... 4
Age of Bees................................ 5
" " Affected by Brood-Rearing............ 5
" " Cut Short by Wearing out of Wings.... 5
" " How to Ascertain..................... 5
" " (See Bees)...........................47
Age of Queens at Wedding-flight.............232
Alfalfa..................................... 6
" Adaptability of to soils................ 6
" Forage for Cattle...................... 6, 7
" Roots, Length of....................... 7
" Honey from, Quality of.................6, 7
" Honey, Large Yield from................ 7
" Cultivation of......................... 7
" Preference of for Desert Wastes........ 7
" Hay of................................. 7
" Seed, Price of......................... 8
" Honey, Carloads from................... 7
Alighting-Boards...........................8–9
" " For House-Apiary............... 8
" " Importance of.................. 8
Alley's Drone-excluder and Queen trap........99, 291
Alsike Clover...............................9–12
" " Amount of Seed to the Acre..........10
" " Preparation of Ground for...........10
" " Profit from Seed of.................11
" " Rank of, as Honey-Plant.............10
" " for Farmers.........................11
" " Saving Seed of......................10
" " Sown with Other Crops...............10
" " Time of Blossoming..................10
" " Time of Sowing......................10
" " Value of, for Hay and Pasture....10, 11
" " Weight of Seed per Bushel...........10
Anger of Bees...............................12, 14
" " Can Generally be Avoided by Care.12
" " From Colonies Having a Habit of Robbing...........................12
" " How Excited.........................12
" " Indicated by High Key-Note..........13
" " Intense............................251
" " Occasioned by Feeding Sweets in the Open Air.......................12
Ants..14
" How Disposed of by One of my Colonies....14
" How to Get Rid of, Pleasantly and Easily.....15
" Keeping them from Barrels of Honey, Sugar, etc...............................14
" Kill Young Plants and Trees..............14
" Meeting of Males and Females..............97
" Not Troublesome to Strong Stocks..........14
Aphides....................................27, 28
" Excrement of............................27
Apiarist, Definition of......................15
Apiary......................................15, 27
" Floating...............................26
House, Objections to and Advantages of.24, 25
Apiary, Lawn or Chaff-Hive, Advantages of and Objections to...........................19
" Railroad...............................25
" Vineyard, Directions for Starting........16–17
" Wind-breaks for........................16
" Where to Locate........................15
" Which Style to Adopt...................25
" McIntyre's plan for.................... 19
" Miller's, C. C., plan for.............. 20
" Miller's, S. E., plan for.............. 21
" Shade-boards for....................... 21
Apple-tree Honey............................ 140
Artificial Comb, Attempts to Produce (See Comb Foundation).............................28
" Fertilization............................29
" Heat.....................................29, 167
" " Much Risk, Experiments...............29
" " Often Proves a Failure...............30
" Pasturage, Little Encouragement to such Investments........................30
" Pollen...................................214
" Artificial Ripening of Honey.............108
" Swarming..................................31
" " Caution............................33
" " Changing Position of Hives.........31
" " Fdn. in Place of Empty Combs.......31
" " Preventing Death of Queen..........31
" " Rearing Queens for.................31
" " Suggestions to New Hand............31
" " With Combs of Hatching Brood.................31, 33
Asters, Description of........................33
Automatic Swarming, Alley plan for............291
Bag for Catching Swarms.......................283
Balling Queens................................189
Barbs of Bee-sting............................278
Bareheaded Bees...............................48
Barnes Bros.; Criticisms, Suggestions, etc., on their work...............................170
" " Foot-Power Saws.................146
Barrels, Coating with Paraffine................35
" Cost of..................................34
" Having Returned..........................35
" Leaky....................................35
" Material for.............................34
" Profitable Size...........................34
" Removing Candied Honey from...............35
Basswood, or Linden............................35
" Compared with White Clover..............35

" Cultivation...37
" Description of Tree and Blossom...36
" of Great Value...37
" Our Plantation of 4000...4, 36
" Honey, Taste of...37
" " Yield of, from One Hive in a Single Day...37
Bears...37
" Proverbial Enemy of Bees...37
" Anecdotes of...37, 38
" Stealing Honey...38
Bear, Pet at the Mich. Agricultural College...38
Beating Pans, etc., for Swarms to Cluster...293
Bee-bread (See POLLEN)...38
Bee-brushes...116
Bee-disease, Nameless...94
Bee-dress (see INTRODUCING, also VEILS)...38
" " Coggshall's...304
" " for Ladies...305
" " Gloves, etc...306
" " of Mrs. Harrison...305
" " of Mrs. Axtell...305
" " Miss Wilson...305
" " Martin's...304
" " Veils...306
Bee-escapes...38, 78, 79
Bee-glue, or Propolis...223
Bee-hats...303-305
Bee-house...25, 328
Bee-hunting...38
Bee-Moth...43
" " How to Keep Combs Secure From...44, 338
" " How the Eggs are Deposited...45
" " In Lamp-nursery...44
" " In Section Boxes...223
" " Italians a Preventive of...46
" " Removing Worms from the Comb...46
" " Summing Up...46
" " Traps for, etc...43
Bee-keepers (See APIARIST)...15
Bee-keeping, A Hazardous Business...336
Bee-stings (See STINGS)...271
Bees...46
Bees, Advantages to Fruit-raising...218, 220
" Age of...5
" Albino...46
" Anger of...12
" Attachment to Home...1
" Attracted by Color of Flowers...221
" Breeding in Winter...217
" Bumble...220
" Buying and Selling...53
" By the Pound...54, 55
" Carniolans...46
" Choosing Location...292
" Cross...254, 255
" Cyprian...46, 193
" Difference in Color...46, 190, 193
" Diseases of...92
" Disposition to Rob...12
" Egyptian...46
" Enemies of...104
" First Flight of...48
" Five-banded...193
" Food of Hatching...48
" For Business...193
" Following Their Owner to the Grave...224
" Getting them out of Sections...77-79
" Growth of...47
" Hanging Out...76, 282
" Holy Land...193
" How they Build Comb...176
" How they Grow...46
" " " " From the Egg to the Time of Hatching...47
" How to Dispose of Annoying...13
" Hunting...38
" Instinct of, vs. Reason...221
" In Upper Rooms or Garrets...291
" Italian (See ITALIANS)...190
" Kept with Profit in Large Cities...14
" Lack of Compassion...229
" Leather colored...193
" Length of Flight (see Doolittle's 141st com't)..200
" Manner of Ventilating the Hives...307
" Mixing in Different Hives...134
" Moving...200
" Necessary to Fertilize Plants...220
" Need of Water...310
" Number in a Quart...203
" On Shares...49
" " " Disadvantages of...49
" On the Rampage...254
" Playspell of Young...258
" Size of Worker Cells...176
" " " Drone...176
" Study of the Habits of...46
" Telescopic Vision of...221
" Time of Hatching...47
" Uniting in Fall...302
" " in Spring...302
" " New Swarms...302
" What Age to Have (See AGE OF BEES)...48
" Wonderful Instinct in Building Comb...177
" To Get out of Sections...77
Bee-tent, Folding...77, 257
" to Stop Robbing...256
Bee-escapes, Miller's...77, 78
" Reese's...78, 79
" Pouder's...78
" Porter's...79
Bee-trees, Cutting...41
Bee-yards (see APIARIES)
Bee-house (See REPOSITORIES)...179
Beeswax (See WAX)...312
Bellows Smokers (See SMOKERS)...262
Benzine to Remove Wax from Utensils...317
Bingham & Hetherington Honey-knife...118
Bingham Smoker...262
Bingham, T. F., on Vinegar...308
Birds Eating Bees...196
Black Bees Inferior to Italians...43, 44, 53, 61, 194
" " Longevity of Compared with Italians. 5
" " Mixing with Italians...191
" " Two Varieties of...46
" " Will not Work on Red Clover...64
" " Work on Buckwheat Better than Italians...53
Bleaching Wax...320
"Blessed Bees," an Experience He Didn't Tell of.336
Blossoms, Do Bees Injure?...141
Blue Thistle, Value as a Honey-plant...49
" " A Nuisance...49
Borage...49
Borax for Ants...14
Borrowing, Bees...256
Bottom-Boards...152
Box Hives, Short Way of Transferring from...299
Breeding In and In...97
Brood, Differenee Betw'n Drone and Worker...96
" For New Swarms...31
" Need of Pollen for...216
" Uncovered...47
" (See BEES)...46
Brood-chamber, Contracting...90
Brushes for Getting Bees off Combs...116
Bucket, Comb...62
Buckwheat, Value of as a Grain Product...52
" Better for Blacks and Hybrids than for Italians...61
" Cultivation of...52, 53
" for Enriching Soil...50, 53
" Honey of, Taste and Value...50
" Japanese. Wonderful Grain Yields...52
" a Preventive of Robbing...50
" Soil for...50
" Value of as a Honey-producer...50
" Varieties of...51
Bumble-bees, Use of in Fertilizing Red-clover Blossoms...220
Buying Bees...53
" " Suggestions about...55
Buzz-saw, Hand-power...147
" Table...164
Cages, Candy for...54
" " for Sending Queens Across the Atlantic...186
" for Introducing...186
" for Shipping Bees...54
" Size of...187
California White Mountain Sage...261
Candied-Honey Confectionery...59
" " Extracted...110
" " Prevention of...59, 110
Candy for Bees and Queens (see CAGES FOR QUEENS).57
" Burnt...58
" Feeding...58
" Introducing Queens...186
" "Good"...57
" Honey that does Not, in Brood-frames..59, 111, 261, 267
" When to Feed...58
Candying of Honey Fed Back...83, 126
Carniolan...46
Cary's Letter Descriptive of Wax-press...314
Cases, Single vs. Double Tier...87
Catalpa, Honey from its Leaves...179
Catnip...59
Caution about Clipping Queens' Wings...236
" " Feeding back...127

J

" " Foul Brood...... 136
" " Foundation-making...... 67
" " Moving Bees......203
" " Robbing......258
" " Out-apiaries......212
" " Tiering up...... 76
" " Using Brown Sugar and Burnt Candy......123
Cellars for Wintering......328
" Advantages of Wintering in......329
" Carrying Bees into......330, 331
" Dead Bees in......334
" Preparing Stocks for......329
" Removing from, to Old Stands......331, 334
" Temperature of......334
" When to Put in......329
" Sub-earth Ventilators......334
Cells, Different Kinds of......175
" Doolittle's Protector......243
" Structure of......173
" Queen, Cutting......227
Chaff, A Remedy for Spring Dwindling...... 93
" " " " " " not Positive 337
Chaff Packing for Winter......325, 327
" What Kind to Use......327
Chaff-Cushion Division-Boards...... 95
Chaff-Hive Apiary...... 18
" " Entrances to......106
" " How to Make......153
Changing Position of Colonies to Stop Robbing...253
Chapman Honey-plant...... 59
Choosing Location, Bees......292
Cider Unsealed in Cells...... 60
" Mills, a Detriment...... 60
" " How to Keep Bees from access to .. 60
Circular Saws, Putting in Order...... 169
Clark's Foundation Fastener...... 71
Clamps (Winter Repositories)......332
Clark Smoker......263
Cleaning Wax from Utensils......317
Climbers for Bee-hunting...... 41
Clipped Queen, Swarm with......288
Clipping Queens' Wings......2, 3, 236
Clover, Alfalfa...... 6
" Alsike (see ALSIKE CLOVER)...... 9
" Peavine, or Mammoth...... 61
" Red...... 61
" " Bumble Bees Required to Fertilize Seed of......220
" Sweet, or Melilot; Its Value...... 61
" Trefoil, White and Yellow...... 61
" White...... 60
" " Dutch...... 60
" " the Best Honey-producer...... 60
" " Superiority of Honey from...... 60
Cluster in Gallup and Langstroth......205
Clustering, Duration of...... 1
Clustering, Outside the Hive, Indicative of Swarming......282
" " " " Never Allow......282
Comb-buckets...... 62
Comb In Bee-trees...... 41
" Starting in Fruit-bloom......141
" Straight, How to Secure...... 62
" Foundation...... 62
" " Fastening in Frames...... 70
" " Dipping board, to Make...... 64
" " " " to Use...... 64
" " Fasteners for...... 70
" " for Comb Honey...... 69
" " First Mention of...... 62
" " Frames for Trimming...... 68
" " Gripper for Holding...... 66
" " How to Roll out...... 65
" " its Great Value...... 62
" " Lye, its Use on Dipping-boards. 65
" " Lubricants for Making...... 65
" " its Use in Obtaining Straight Combs...... 62
" " Machines and their Invention... 62
" " " for Making Fdn Rolls. 63
" " Making in Large Quantities.... 67
" " Making Wax Sheets for...... 64
" " Peeling Sheets off Rolls...... 66
" " Rolling the Wax Sheets...... 65
" " Power Mill for Making...... 68
" " Sagging of...... 69
" " Starch Paste in Making...... 66
" " Soap for Making...... 66
" " 5 Kinds—Heavy, Light, Thin.... 65
" " Trimming...... 68
Comb Foundation Used in Rearing Workers and Drones...... 98
" " Use of Wires in...... 70
Comb Honey...... 72
" " Advantages of Single-tier Shipping-cases for...... 87
" " Advantages of Open-side Sections for...... 85
" " Bee-escapes for......77, 79
" " Best Shipping-cases for...... 88
" " Caution in Tiering up for...... 76
" " Combined Crate for...... 74
" " Doolittle's Surplus Arrangem't for. 73
" " Davis' Brush for Getting Bees off .. 77
" " Emptying T Super of...... 80
" " Falsehoods About......122
" " for Winter Feed...... 83
" " Feeding Back for...... 83
" " How to Pick up Sections of...... 82
" " How to Remove Filled Sections of, from Wide Frames or Crates...... 82
" " How to Get Bees out of Sections of. 77
" " How to Secure...... 75
" " Honey-rack for...... 74
" " Invention of Section Honey-box for. 72
" " Keeping...... 89
" " Manufactured (?)......122
" " Moore's Crate for...... 74
" " Muddy Feet of Bees on...... 77
" " Marketing...... 88
" " Making Comb Honey Sell...... 89
" " Narrower Sections for...... 85
" " Open-side Sections for...... 85
" " Partly Filled Sections of...... 82
" " Pasteboard Boxes for...... 88
" " Reward for Manufactured......122
" " Scraping Sections of...... 82
" " Sending to Commission Houses...... 86
" " Sturwold's Showcase for...... 89
" " Section-Holder...... 89
" " Sections Partly Filled with for Bait. 82
" " Size of Packages for...... 87
" " Tiering up for...... 76
" " T Super for...... 74
" " Two Kinds of Surplus Arrangements for Holding Sections of...... 73
" " Why Preferred to Extracted...... 72
" " When to take Sections of...... 77
" " Wood Separators for Comb Honey; some Reasons for...... 84
" " Wood or Tin Separators for...... 84
" " What Size of Section for...... 84
" " What to do with Unfinished Sections for...... 82
" " What to do when Bees Refuse to enter Sections of...... 76
" " Wide Frame for, why Preferred...... 73
" " Wide Frame (Single and Double)...... 73
Combined Shipping case and Honey-crate...... 74
Concord Grapevines, Culture of...... 17
Confectionery Made of Candied Honey...... 59
Contraction (see CONTRACTION)...... 90
" Advantages of...... 90
" By whom Advocated...... 90
" How Practiced...... 90
" Purpose of...... 90
" Queen-exclud'g Honey-board for. 90, 91
" When to...... 90
Corn......218
" Why it Contains no Honey......219
Corner Joint of Hive......149, 166
Covers for Chaff Hives......157
Crate, Combined...... 74
" Moore's...... 74
Crates for Holding Sections on the Hive...... 74
" for Shipping...... 87
Cross Bees......12, 13, 254, 255, 274
Cultivation of Honey-Producing Plants...... 30
Cure of Dysentery......103
" Foul Brood......134
Cushions, Chaff......326
Cut-off Saw-table......165
Cyprian Bees......193
Dadant's Uncapping can......117
Damp, How Hives Become......324
Dandelion as a Honey and Pollen Producer...... 92
Davis Bee-brush......116
Davis' Transposition Process......228
Decoy Hives......292
Deserting Hives in Spring...... 2
Deserting, Swarms...... 1
Destruction of Bees by Milkweed......199
" " " (See ENEMIES OF BEES)......104
" " Drones in Fall......101
Development of Bee...... 47
Diarrhea (see DYSENTERY)......101
Dirty Combs, How to Clean......338
Diseases of Bees...... 92
" Other...... 94

Diseases, Prevention of 92
(See DYSENTERY, FOUL BROOD, SPRING DWINDLING).
Disease, The Nameless 141, 94
Distance Traveled by Bees (see Doolittle's 141th comment, also foot-note) 200
Dividing (also see ARTIFICIAL SWARMING) 94
Division-Boards, Made of Lath and Chaff 95
" " Of Wire Cloth 206
Dodecahedron, Rhombic 174
Doolittle Solar Wax-extractor 316
Dovetailed Hive—How to Make 166
" " How to Crate 166
Dovetailing Brood-frames 159
" Sections 167
Dress for the Apiarist (see VEILS) 303
" " Ladies 305
Drone-Laying Queens 233
Drone Eggs 96
" Excluder 100
" Guard 99
" Meeting Queen 97, 234
Drones, Age of 5
" Brood Distinguished from Worker 96
" Cells of 96, 176
" Destruction of in Fall 101
" From the Egg to Hatching 96
" From Workers 8
" Have but One Parent 97
" Larvæ of, in Queen-cells 227
" Mating with Queens 96, 67, 234
" Organs of 96, 234
" Rearing Out of Season 100
" Restraining Undesirable 98
" Trap for Getting Rid of 100
" with Colored Heads 101
Drumming Out for Transferring 298
Dwindling in Spring (see SPRING DWINDLING) 92
Dysentery 92, 102
" Agency of Aphides in Producing 102
" Cure of 103
" Prevention of 102
" Symptoms of 101
Egg of Queen, under Microscope 46
Eggs, Fertilized and Unfertilized 96
" Queen Laying Two Kinds 236
Egyptian Bees 46
Empty Combs, How to Keep 44, 322, 338
Enemies of Bees, Different Kinds 104
" " " King-birds 196
" " " Mice 104
" " " Parasites 104
" " " Skunks 104
" " " Spiders 104
" " " Thieves and Patent-right Venders 105
Entrances to the Hives, Auger-holes for 106
" Clogging of 105
" Contracted to Prevent Robbing 251
" For Ventilation 307
" Number of 106
" Position of 106
Entrances, Size of in Winter 106
Evaporation of Honey by Bees 108, 310
Excluders, Drone and Queen 100
Expense of Sugar Compared with Honey 123
Experiments in Artificial Heat 29, 334
Extracted Honey 107
" " Candying of (see CANDIED HONEY) 58, 111
" " First Ton of 107
" " Glass Jars for Retailing 112
" " "Green" 107
" " How to Keep 111
" " " " Seal Up 111
" " " " Sell 109
" " Pails for Retailing 111, 112
" " Peddling 110
" " How to Ship 111
" " Yield of, Compared with Comb Honey 115
Extracting to Prevent Swarming 290
Extractor, Honey, Advantages of 115
Extractor, Wax 313-317
" " Solar 316
Exudation Theory (see APHIDES) 178
Evaporation of Honey by Bees 108, 310
Fairs 122
" Educational Effect of 122
" Honey-packages for Exhibit at 121
" Model Exhibits at 121
" Thousand-dollar reward at 122
Fasteners, Foundation 71
Feeders 124
" For Open Air and Water 311
Feeders, Hains' 124
" Miller's 125
" Simplicity, Description of 124
Feeding at Nigh 255
" Back for Sections 83, 126
" Candy 57, 126
" Caution Concerning 127
" " In Using Brown Sugar and Burnt Honey 123
" Fast or Slowly 126
" For Brood-Rearing 123
" For Winter 125
" In Winter 57
" Meal 217, 221
" Outside or Inside of Hive 124
" Sugar or Honey 122
" To Procure Drones 98
" To Produce Comb Honey 83, 126
" When to be done 124
Fertile Workers, Cause of 127
" " To Detect Presence of 128
" " To Get Rid of 127
Fertilization, In Open Air 96, 97, 234
" of Ants 97
" of Plants 218
" (See QUEENS) 234
Figwort, or Simpson Honey-plant 128
Filing Saws, Cross-cut 172
" " Rip 169
" " Waste in, How to Avoid 171
Filled Sections, How to Remove 80
Finding Queens 141, 189
Fixed Frames 130
" " Advantages of 130, 132, 139
" " Bee-killers 132
" " Closed-end Quinby 130
" " Definition of 130
" " Handled More Rapidly 130, 132, 139
" " Hoffman 130, 139
" " Hoffman, How to Make 131, 160
" " Propolized 132
" " Spacing of 130
Flight of Bees, Distance of (see Doolittle's 141th comment 200
Floating Apiary 26
" " on the Nile 26
Flowers, Colors of 221
Folding Tent for Bees out of Sections 77, 257
" " for Transferring, etc 299
Food for Larvæ 228
" " Queens 218
" of Young Bees 47
Foot-power Saws, Barnes, How to Use 146
Foul Brood, Cause 136
" " Caution 135
" " Communicated to Other Colonies 135
" " Description of 133
Foul Brood, Drug Cures for 135
" " Remedies for 134, 135
" " Symptoms of 133
Foundation (see COMB FOUNDATION) 62
Fountain for Watering Bees 298, 311
" Pump for Bringing down Swarms 287
Four-piece Sections 167
Frames, for Hives 159
" Distance from Center to Center 130, 267
" Gauge for Making 158
" Handling 136, 274
" Hoffman (see HOFFMAN FRAME).
" How Many in a Hive? 145
" Langstroth, Size of 144
" Reversible 248
" Spacing of 130, 267
" Tall and Shallow 205
" Two Sizes in Apiary 205
" Wired 70
Frames, How to Manipulate 136
" Followers for 137
" How to Put Back in the Hive 137
" Hoffman, to Manipulate 138, 139
" Quinby, to Manipulate 139
" Two Kinds 136
" Two Positions for Loose 137
France, E., on Vinegar 308
Fruit-Blossoms, Honey from 140
" " Importance of 141
" Crop, Do Bees Hinder? 141, 220
Fuel for Smokers 264
Galvanized Iron Not Recommended for Honey or Wax Utensils 314
Garrets, Keeping Bees in 291
Gill-over-the-Ground, as a Honey-producer 142
Given Foundation-press 71
Glass Honey-jars 112
" Honey-pails 113

Glass Observatory Hive ... 161
Goldenrod, Fifty-three Varieties ... 142
" " Quality of Honey ... 143
"Good" Candy (Scholz) ... 57
Graduated Tin Pails ... 112
Grapevines, Concord, Growth and Cultivation ... 17
Gray's Machine for Making Sections ... 169
Grippers to Hold Sheets of Foundation ... 66
Hains Feeder, The ... 124
Handling Bees (see FRAMES, MANIPULATING) ... 274
" Italians ... 275
Hand-power Buzz-saw ... 147
Hanging Out ... 282
" " Indication of Swarming ... 282
" " To Prevent ... 282
Hatcher, Queen ... 198
Heat, Artificial ... 29, 217, 334
Heddon Shipping-case ... 88
" Way of Transferring ... 299
Hill's Device for Wintering ... 326
Hive-making, All about ... 144, 172
Hives, Chaff ... 153
" Corners ... 149
" Decoy ... 292
" Dovetailed ... 166
" Eight-frame ... 145
" Entrances to ... 105
" Frames for ... 159
" How They Become Damp ... 324
" " To Open ... 136, 274
" Lumber for ... 146
" Making by Steam Power ... 163
" Non-swarming ... 291
" Observatory ... 161
" Requisites of ... 144
" Shade boards for ... 21
" Size of ... 144
" Dovetailed, How to Make ... 145, 166
" " Lugs rough ... 166
" Story and a Half ... 145, 152
" Nucleus ... 204
" To Keep Boards from Warping ... 148
Hiving apparatus, Clark's ... 284
" " Morrison's ... 284
" " Manum's ... 285
" Swarms with Clipped Queens ... 28[illegible]
Hoffman Frames ... 137, 138, 139
" " Handling in Pairs ... 139
" " How to Make ... 160
" " Reversing ... 242
Holy-Land Bees ... 178
Honey, Apple-tree ... 141
" Basswood ... 3[illegible], 107
" Board, 90 (see Glossary)
" " Queen excluding ... 9[illegible]
" Boxes, Section ... 158
" Can, 58 pound ... 113
" Candied ... 58, 107
" Cases for Storing and Shipping ... 74
" Clover ... 60
" Comb ... 72
" " Boxes for Shipping ... 87
" " Keeping ... 89
" " Marketing ... 87, 88, 89
" " Show-case for ... 89
Honey-comb, Absolute Perfection of ... 175
" " A Famous Problem ... 175
" " Agassiz's Explanation ... 176
" " Base of Cells ... 173
" " Different Kinds of Cells ... 176
" " How Built ... 177
" " Mathematical Accuracy of ... 175
" " Mathematics of ... 173
" " Size of Cells, Drone and Worker ... 176
" " Tyndall's Theory ... 176
Honey-Dew Emitted by Aphides ... 27, 178
" " Manna ... 178
" " On Basswood Leaves ... 178
" " Produced by Bark-Lice ... 27, 179
" " The Exudation Theory ... 178
Honey Candied (See CANDIED HONEY).
" Evaporation of ... 310
" Extracted (See EXTRACTED HONEY) ... 107
" Fed Back ... 83, 126
" Flavored with Onion ... 168
" Horsemint ... 183
" Houses ... 179
" How Bees Make ... 129
" In Barrels ... 34
" In Tin Cans ... 113
" Jars, Muth's ... 112
" Knives ... 118
" of Hymettus ... 261
" Pails ... 112
" " Glass ... 113
Honey-Plant, Chapman ... 59
" " Simpson ... 128
" Plants ... 30, 181
" " Poisonous ... 214
" Ripening Artificially ... 108
" Sealing Up ... 59
" (See COMB HONEY) ... 72
" Show-case for ... 89
" that does not Candy ... 59, 261
" To Tell When the Yield Ceases ... 101
" Tumblers ... 113
" Unripe ... 108
" v. Sugar for Feeding ... 122
" Why Secreted in Flowers ... 221
Honey-plants ... 181
" List of ... 181, 182, 183
" Principal Plants ... 181
" Unimportant ... 188
House-Apiary ... 22
" " Advantages of ... 24
" " Description of Our Own ... 23
" " Entrances ... 106
" " Help for Spring Dwindling ... 336
" " Mice in ... 104
House-Apiaries, Objections to ... 25
" " Protection from Thieves ... 24
Houses, Honey ... 179
Huber's Experiment ... 228
Hunger Swarms ... 2
Hunting Bees, Bait for ... 39
" " Box, How to Use ... 39
" " Capturing the Swarm ... 41
" " Climbers ... 41
" " Cross Lines ... 40
" " Does it Pay? ... 43
" " In Vicinity of Large Apiaries ... 38, 39
" " Smudge, Use of ... 40
" " Spy-Glass for ... 40
" " Starting a line ... 40
" " To Determine Distance from Swarm ... 40
Hunting of Queen ... 226
Hybrids, Cross Between Blacks and Italians ... 184
" Equal to Italians as Honey Gatherers ... 184
" Vindictive Temper of, Extraordinary ... 184
Hymettus, Honey of ... 261
Inserting Queen-Cell ... 242
Introducing Queens ... 187
" " Balling ... 189
" " Benton Cage for ... 186, 187
" " Candy for ... 186, 187
" " General Principles for ... 186
" " Jenkins Cage for ... 187
" " McIntyre's Cage for ... 189
" " Miller's Cage for ... 188
" " Morrison's Cage for ... 188
" " Peet Cage for ... 186
" " Peet Process ... 186
" " Queenless, how long before ... 189
" " Sure Way of ... 190
" " Tobacco for ... 190
Inverting ... 248
Italianizing ... 194
Italians, Color of Imported ... 190
" Docility of ... 184, 191
" Five banded ... 193
" How to Tell from Hybrids ... 192
" Looks and Color ... 192
" Leather-colored ... 193
" Markings of ... 192
" Storing Below ... 53
" Superiority Compared with Hybrids ... 53, 193
Jelly, Royal ... 228
Jones' Honey-Pails ... 111
Keeping Bees in Upper Rooms or Garrets ... 291
Keeping Comb Honey ... 89
Kegs (see BARRELS)
King-Birds ... 196
Knives, Honey ... 118
Ladies' Bee-Dress (see VEILS ... 305
Lamplight, Handling Bees by ... 126, 255
Lamp Nursery ... 197
" " To Get Cells for ... 197
Langstroth Frame (see HIVE MAKING)
" Hive (see HIVE-MAKING)
Larvae ... 47
" Immature, Why Found at the Entrance ... 45
" Queens from Worker ... 226
Laying, How to Induce ... 123
" Workers ... 128
Leaky Barrels ... 34
Lace, Plant ... 27
Linden (see BASSWOOD)
Locust, A Well-known Tree ... 198
" Not to be Depended Upon as a Honey-producer ... 198

Lucerne.......... 6
Lumber, To Prevent Warping.......148
" Whitewood 321
Mailing Queens.......186, 187
Mandrel for Saw 164
Maple, Bark Louse....... 27
Marketing Comb Honey (see CRATE FOR HONEY)85, 87
Meal Feeding.........217, 221
Melilot 61
Mice 104
Mignonnette..........199
Milkweed Destructive to Bees..........199
Mixing of Bees in Different Hives..........135
Moth and Moth-worms (see BEE-MOTH)
Motherwort 199
Moving Apiaries North and South 26
Moving Bees, Caution Against Smothering..........200
" " During Working-Season..........200
" " Fastening Frames for..........207
" " Fixed Frames for 201
" " Getting All into the Hive..........202
" " In Spring..........201
" " In Wagon or Buggy..........203 207
" " Killed !..........202
" " Long Distances..........203
" " Loss by, in Floating Apiary.......... 26
" " Northward to strike Basswood or Clover Bloom 20
" " On Closed end Frames 130-201
" " Securing Combs..........201
" " Shipping..........201
" " Success in Moving Whole Apiaries..202
" " Supply of Stores..........202
" " To Prepare Carload for..........203
" " Ventilation..........201
Mustard..........203
" Chinese..........203
" Quality of Honey.......... 203
Nectar Not Secreted till Pollen is Ripe..........220
" Why Secreted in Flowers..........220, 221
New Swarms (see SWARMS AND SWARMING).
Non-swarming Hives..........291
Nuclei Absconding.......... 3
Nuclei For Queen-Rearing..........242
" How Small They May Be..........205
" L. or Gallup Frame?..........205
" Number of Combs in..........206
" Shape of Hive..........2 5
" Three-Frame Hive for Shipping..........206
Number of Bees in a Quart 204
Nursery, Lamp 197
Odor of Laying Queen..........238
Observatory Hives..........161
One-Piece Sections..........168
Out-Apiaries..........206
" " Dadant's..........211
" " Distance Between..........207, 209, 210
" " Hauling for..........207
" " Frames.......... 210
" " Manum's..........213
" " Number of Colonies in an Apiary for 206, 209, 210
" " Rent for..........207
" " Scale Hive for 212
" " Tools for..........208
Packages for Shipping Extracted Honey.111, 112, 113
Packing with Chaff 326
Pails, Honey..........112
Paraffine for Foundation..........320
" " Waxing Barrels.......... 35
Parasites 104
Parker Machine for Fastening Starters.......... 71
Pasteboard Boxes for Sections.......... 88
Pasturage, Artificial.......... 30
Pasturage, How to Increase.......... 30
Patent-Right Venders..........43, 46, 105, 250
Peavine or Mammoth Red Clover 61
Peet Cage, Introducing with 186
Pennyroyal 262
Perforated Zinc 90, 99, 290
Perrine's Floating Apiary 26
Peters, G. B. on Swarming 293
Pettit's Honey-Evaporator 169
Planer, Gem..........167
Planing with a Saw..........172
Plant-Lice 27
Plants, Fertilization of..........218
Play-Spell of Young Bees..........258
Poison of Bee as Medical Agent 276
" of Bee-Stings..........275
Poisonous Honey, Statement from Dr. Grammer.214
Pollen, Agency of Bees in Fertilizing Plants......218
" Animal Food Used for..........218
" Artificial Substitutes..........217
" Bee's Adaptations for Collecting..........215
" Effect of, on Confined Bees..........216
" excluded by Zinc 223
" from Maple and Corn..........216
" " Sawdust, &c..........217
" in Comb, Attracts Moths.......... 44
" " Section Boxes..........222, 223
" Milkweed 199
" Method of Gathering..........215
" Setting to Work on Artificial..........221
" Storing..........217
Preparing Bees for Winter 323
Press for Wax, Cary's..........315
Preventing After-Swarms 4
Prevention of Dysentery 102
" of Robbing 255
" of Swarming..........4, 290
Propolis, ...224
" Do Bees need it? Theory and Practice.224
" How Gathered..........223
" Paint to Keep it Off..........224
" To Keep from Surplus Boxes..........224
" To Remove from Fingers.......... 224
Queen-Cages (see INTRODUCING).
" Excluder..........99, 262
" Excluding Honey-Board.......... 99
" Hatcher 198
" How to Put in Cage..........244
" Laying Two Kinds of Eggs..........237
" Meeting Drone..........96, 234
" Noise Made by, in Swarming..........294
" Number and Kind of Bees to Accompany in Transportation..........244
" Sting of..........238
" Trap, Alley's 100, 291
Queen-Cells 226, 227, 242
" " Cutting Out to Prevent Swarming....289
" " " " to Use 241
" " Destroyed by Young Queens....26, 27, 214
" " Good Ones, How to Procure..........240
" " How to Insert 242
" " Large Number of..........194, 241
" " Protectors for..........243
" " To Tell When They Will Hatch..........227
" " When and How to Cut Out..........241
Queenlessness, How to Detect..........188
Queens, Age of.......... 5
" " " On Beginning to Lay..........232
" and Bees, Caging 233
" Attempted from Drone-larvæ, a Failure .244
" " " " " Distinction of Cells..........244
" Balling 189
" Clipping Wings of..........2, 3, 235, 288
" " " " Danger of Loss in..... 2
" Daily Number of Eggs Laid by..........238
" Drone-Laying 97, 233
Queens, Eggs of, Fertilized and Unfertilized...... 97
" Fertilization of..........96, 234
" " " In Confinement 29
" Finding 189, 226
" From Italy..........190
" How Produced from Worker-Eggs..........226
" Introduct'n of, Dif'nt Methods..........187
" " Of Virgin..........198
" Loss of..........238
" Longevity of.......... 5
" Mailing 187
" Meeting Drones On the Wing..........96, 234
" Mutilation of Drones on Meeting..........234
" Occupation of, While Sealed up..........228
" Odor of..........239
" On Leaving Cells..........228
" Rearing (See Rearing Queens).
" Rivalry of.......... 230
" Several in One Swarm.......... 4
" to Find and Remove Old..........189
" Transposition Process..........228
" Two in One Hive 4, 230
" " on Same Comb..........230
" Virgin 229
" " Introducing..........198
" Voices of..........230
" What to do when they fly away 189
" Wedding-Flight, When Taken 232
" What Kind to Rear..........240
" " to do with when Two Weeks Old and do not Lay..........236
" What to Do with When Uniting..........301
" Wings, Clipping..........236
" Wings of, Imperfectly Developed, to Test 220
Queenlessness.......... 188
Quinby's Hive..........131
Ragweed and Corn 218
Railroad Apiary, Description of 25

Rape........245
Raspberry........245
Ratan........230
Rearing Drones........87
Record-keeping of Hives........245
" " Books for........245, 246
" " Code for Position for........247
" " Individual Plans for........245
" " Position of Slate for........246
" " Register Cards for........248
" " Slate Tablets for........246
Repositories for Wintering........330
" " " (See WINTERING)........328
" " " Ventilating........334
Restraining Drones........96
Reversible Frames........132, 248
" Philosophy of........248
" Singly or Collectively........249
Rhombic Dodecahedron........174
Ringing Bells, &c., to Bring Down Swarms........293
Ripening Honey Artificially........108
Robbers, How to Circumvent........253-256
" " " Distinguish........251
Robbing........12, 126, 249
" Bee-Tent to Prevent or Stop........257
" Cause of the Disposition........249
" Caution........126, 258
" Changing Colonies........253
" During Plentiful Flow of Honey........251
" Effect of, if not Stopped........254
" Entrances Contracted........251
" How to Stop........252
Robbing, Prevention of........255, 257
" Stinging When........254
" To Distinguish Robbers........251
" Weak Swarms........249
" Where Robbers Belong........252
" Working by Lamp-Light to Prevent........2̃5
" " " Moonlight........256
Rocky Mountain Bee-Plant........258
Rolling out Wax Sheets........66
Royal Cells (See Queen-Cells)........227
" Jelly........227
Sage........261
" California White........261
" " " Quality of........261
Sagging of Foundation........69
Salicylic Acid........135
Salt Water for Bees (see INTRODUCTION)........312
Saws, Barnes Bros'........146
" Compared with Cutter-head........169
" Cross-cut, How Filed and Set........172
" Filing........171
" Gang........167
" Hand Power Buzz........147
" How to Wabble........151
" Mandrel for........164
" Setting........171
" Shape and Angle of Teeth........171
" Sharpening Without Set........172
" Speed of Circular........172
" Tables for........164
" Working Smooth as Planer........172
Scent of Bees........249
Scouts........292
Section-holder........75
Section Honey-Boxes, All About Making, One Pound........167-169
" " " Best Size for........84
" " " Crates for Holding........74
" " " Dovetailing........167
" " " Fastening Starters in........71
" " " Filled, How to Remove........80, 81
" " " Filled with Honey........84
" " " Four-Piece........167
" " " Getting Bees Out of........77, 78
" " " How to Get out of Wide Frames........81
" " " How to Handle........82
" " " How to Get Out of T Super........80
" " " How to Use With Separators........83
" " " Narrow........85
" " " One lb., Recommended........84
" " " One-Piece........168
" " " Open Side........85
" " " Pasteboard Boxes for........88
" " " Putting Foundation into........71
" " " Pollen in........90, 223
" " " Size to Use........84
" " " Scraping........82
" " " Surplus Arrangements for, Two kinds........73
Section Honey-Boxes. To Induce Working in........76
" " " What to do with Unfinished........82
Selling Bees........53
Selling Extracted Honey........109, 110
" Comb Honey........85
Separators or None........83
" Wood or Tin........84
Shade Better than Holes for Ventilation........306
Shade-boards for Hives........21
Shipping Bees, Cages for........54
" " Preparation for........54, 201
Shipping Case........87, 88
Show-Case for Honey, Sturwold's........89
Simplicity Feeder (see Feeders)........124
Simpson Honey Plant (See Figwort)........128
Single-Tier vs. Double-Tier Cases........88
Skunks........104
Sloping-Side Pails........111
Smoke, Not Always a Preventive of Stings........277
" Use of, in Uniting Bees........300
" When to Use........274
Smokers, Bingham's........262
" Clark's Cold Blast........263
" Fuel for........264
" Quinby's........262
" When to Use........274
Solar Wax-Extractor........316
Soldering........264
" Fluid for........265
" Implements for........265
Sourwood........266
Spacing Frames (see FIXED FRAMES)........267
" " Nature's Spacing........267
" " Results of Wider........267
" " Right Spacing........130, 267
" " Two Spacings Used by Bee-keepers........267
Spacing-sticks for Moving Bees........201
Spanish Needle........267
" " Amount of Honey from........268
" " Honey of........268
" " Where Grown........268
Spider Flower, Description of........268
Spiders........104
Spring Dwindling........92, 335
" " Care of Combs from Dead Swarms........338
" " Cure for........93, 337
" " Loss Immense........336
" " Report of '79........336
" " What Becomes of the Bees........337
" " What Causes........337
Standing in Front of Hives........273
Starters for Sections........71
" " Fastening them in........71
Starting Bees at Work in Sections........76
Starvation Cure of Foul Brood........134
" Swarms........2
Stimulative Feeding........123
Stings, Compared with Apparatus Used by Other Insects for Boring into Bark, etc........278
" Does their Loss cause Death of Bee........276
" Effects of........272
" Great Number of at Once........272
" Hardened to the Effects of........273
" How to Open Hive without Receiving........274
" How to Save Yourself from Stings........274
" How to Remove........272
" Jerking the Hands Back to Avoid........274
" Magnified........278
" Mechanical Construction of........277
" My Remedy........272
" Odor of........276
" Operation of Barbs in........278, 279
" Poison of........278
" Remedies Discussed........271, 272
" Severity of........271
" Single Bee Following About........274
" Smoke not Always a Preventive........277
" To Avoid........273, 274
" What Bees Give Most........275
Stores Needed (see WINTERING)........325
Straw Hives........325
" Packing........325
Sturwold's Show-Case for Honey........89
Sub-Earth Ventilation........334
Suffocation........252, 307
Sugar, For Candy........57
" " Wintering........57
" Syrup, How to Feed (see FEEDING).
" " to Make........122
" vs. Honey for Feed........122
" (See CANDY, FEEDING, WINTERING, and GRAPE SUGAR.)

Sulphur to Kill Wax-Worms ... 45
Sumac ... 279
Sunflower ... 279
Surplus Honey (see COMB HONEY, EXTRACTED HONEY, and SECTION BOXES.)
Swarm-Catchers ... 263-285
Swarming ... 1, 279
" After ... 3-5
" Artificial ... 31
" Automatic ... 291
" Cause of ... 280
" Choice of Location Before ... 292
" Does the Queen Start First? ... 280
" From Upper Rooms and Garrets ... 291
" Hook ... 286
" Natural, and Its Attendant Clustering ... 293
" On Sunday ... 283
" Preparations for ... 283
" Prevention of ... 289
" " " by Cutting out Queen-Cells 289
" " " by Removing Queen ... 289
" Prevention of by Use of Extractor ... 290
" Season of ... 280
" Strimpl's Ladder for ... 286
" Symptoms of ... 280
Swarms Absconding ... 1
" After ... 3
" Apparatus for Catching ... 283-285
" Bringing Down by Ringing Bells, &c ... 293
" Clarke's Device for Hiving ... 284
" Clustering ... 1
" Hook to Assist in Taking Down ... 286
" Manum's Device for Hiving ... 285
" Making them Cluster ... 287
" Morrison's Device for Hiving ... 284
" Selection of Tree Before Swarming ... 1, 292
" To Separate When Two or More Unite ... 288
" Value of (Poetical) ... 280
" With Clipped Queens ... 288
" Sweet Clover ... 61
Teasel, Cultivation of ... 295
Temperature of Cellar or Bee-House ... 334
Tent, Folding Bee ... 77, 257, 299
Thistle Blue ... 49
Three-Frame Nucleus Hive ... 205
Tinkering with Bees Unnecessarily ... 335
Tin Separators ... 84
" " or Wood ... 84
Toads Eating Bees ... 296
Touch-me-not, Wild ... 220
Transferring, Appliances for ... 298
" Drumming Out ... 298
" How to Proceed ... 296
" In Fruit-Bloom ... 297
" Price for ... 298
" Success of Inexperienced Apiarists 298
" What Amount of Comb to Save ... 298
" " Length of Time Required ... 298
Transposition Process ... 228
Trespassing For Wild Bees ... 43
T Tins ... 161
Tulip-Tree (See Whitewood) ... 320
T Super ... 74, 161
Turnip, Attractive to Bees ... 300
" Seven-Top Used for Greens ... 300
Two-Frame Nucleus Hive ... 205
Uncapping Cans ... 117
Uniting In Spring ... 301, 337
" New Swarms ... 302
" Two Large Colonies ... 301
" When to Unite ... 302
Untested Queens ... 239
Veils ... 303
" Axtell's, Mrs ... 305
" Brussels Net ... 303
" Capehart's ... 304
" Coggshall's ... 304
" Harrison's, Mrs ... 305
" Holmes, Mrs ... 305
" Merton's ... 304
" How to Get Along without a ... 306
" Injurious to Eyes ... 301
" Necessary or Unnecessary ... 301
Ventilation ... 252, 306, 307
" How Produced by Bees ... 307
" In Winter ... 326
" Its Relation to Dampness and Frost ... 324
" of Cellars ... 334
" of Queen-Cages During Shipment ... 307
" Sub-earth Ventilators ... 334
" When Shipping ... 201
Vinegar, A Product of Honey ... 308
Vineyard Apiary, Directions for Starting ... 17
Virgin Queens (See Queens) ... 198, 228, 230
" " to Introduce ... 198
Voices of Queens ... 230
Warping of Lumber, to Prevent ... 148
Water for Bees, Amount Needed ... 310
" " " New Honey a Substitute ... 310
" " " Salt ... 312
Watering Bees By Means of Fountain ... 311
" " Experiments in ... 310
" " Jar for ... 311
Wax, Adulteration of ... 320
" " " to Detect ... 320
" Bleaching ... 318, 319
" " By Use of Acids ... 318
" " In the Sun ... 318
" Clarifying ... 63
" Cleaning from Utensils ... 317
" " " Rolls ... 67
" Exportations from Different Countries ... 318
" Extractor ... 313-316
" Galvanized Utensils ... 314
" from Other Insects ... 319
" " Vegetables ... 319
" Melting point of ... 313, 318
" Moth ... 43
" Press, Cary's ... 315
" Refining for Foundation ... 63
" Solar Wax-extractor ... 316
" Sheets to Make ... 65
" To render without an Extractor ... 315
" To Improve the Article of Commerce 63, 318, 320
" Use of Different Kinds ... 319
" Worms ... 43
" Yellow or White for Fdn.? ... 64
Waxing Barrels against Leaking (see BARRELS).
White Clover (see Clover.)
" Sage ... 261
Whitewood, or Tulip or Poplar ... 320
" As an Ornamental Tree ... 320
" Flower of ... 321
" Honey of ... 321
" Lumber for Hives and Honey Boxes ... 321
Wide Frames for Sections ... 73
" " " " Use ... 73
Wild Bees (see BEE HUNTING).
Windbreak for Apiary (See Introduction.)
Winter-cases (See APPENDIX) ... 157
Winter Feeding ... 125
Wintering Amount of Honey Needed ... 325
" Advantages of Outdoor ... 328
" " " Indoor ... 328
" Artificial Heat in Cellars for ... 334
" Boardman's Repository for ... 334
" Bottom Ventilation for ... 332
" Carrying Bees in and out of Cellar for ... 330, 331
" Cellars vs. Repositories ... 332
" Chaff Cushion for ... 326
" " Cushion Division-Boards ... 95
" " For Out-door Packing ... 327
" " Packing, Success of ... 339
" Cutting Winter-passages in the Combs ... 326
" Dead-air Space for ... 327
" Dead Bees on Cellar Bottom ... 334
" Disturbing Bees in Cellar ... 335
" Doolittle's Cellar for ... 332, 333
" Early Preparation ... 325
" Effect of Different Kinds of Food ... 123
" Young Queens for ... 323
" How to Examine Colonies in Cellar ... 335
" In Cellars Temperature of ... 334
" " " When to Put In ... 329
" " " " " Take Out ... 334
" Main Points ... 323
Wintering Miller's Bottom-board for ... 332
" Paper packing for ... 327
" Putting Bees on Old Stand or Not ... 332
" Short of Stores for ... 27
" Size of Apartment ... 333
" " " Entrance for ... 106, 326
" Size and Shapes of Frames for ... 205
" Spring Dwindling ... 92, 335, 336, 337
" Stores Prepared for ... 335
" Spring Dwindling Cure for ... 337
" Sub-earth ventilators ... 334
" Successful ... 339
" Summing up ... 335
" Taking Bees out too Early ... 329
" Ventilation, Its Relation to Frost and Dampness ... 324
Wired Frames for Foundation ... 70
Wood Separators vs. Tin ... 84
Worms, Wax ... 43
Yield of Honey per Acre ... 30, 270
" " " " Day ... 31
Young Bees ... 37
Zinc, Perforated ... 90, 99, 100

APPENDIX.

So rapid is the progress of our industry, that, even after some of the forms in the body of the work had been printed, it seemed necessary to add an appendix, giving some of the very latest developments together with some slight changes which could not be incorporated in their appropriate places in the body of the work. It is proposed to print only short editions of this appendix so that it may be revised every few months. This will bring the whole work up to the very latest state of the industry.

The figures, where they are used, just before the heading, indicate the page in the body of the work to which the matter refers. Where they are omitted it means a new article that will in the next edition of the book be incorporated in its alphabetical order.

ANATOMY OF THE BEE. Although I have spent much time with the microscope in dissecting the bee and studying its wonderful structure, yet for the main facts of this article I am indebted to that admirable little scientific work, "The Honey-bee," by Thos. Wm. Cowan, a microscopist and scientist of the front rank, as well as editor of the *British Bee Journal.* Mr. Cowan is so careful and candid in his conclusions, and so well posted as to the results of the investigations of other eminent microscopists, that I have no hesitancy in accepting his statements. All I shall endeavor to do is to put the material in a condensed and popular form, with a few side-lights thrown in from other sources.

I will first call your attention to the alimentary canal—that is, the organs of digestion and assimilation. What is digestion? Our author says, "It is the separation of the nutrient part of food from the non-nutrient, and the conversion of the nutrient into a liquid fit to mingle with the blood, and thus nourish the body of the insect." We all know how the bee gathers up her food through her wonderful and delicate little tongue. It then passes into a little tube just below the point A, in the engraving, called the "œsophagus," or "gullet." We find a similar organ in our own bodies, leading from the mouth and communicating directly with the stomach. This œsophagus passes through the waist of the bee, or thorax, as it is called, and to the honey-stomach G in the abdomen. It is in this little sac, although it can hold but a tiny drop at a time, that millions and millions of pounds of nectar are carried annually and stored in our combs. This sac G is located in the fore part of the abdomen, or "hinder" part of the bee, as the boy said.

Several years ago I had a curiosity to know what the bees were working on. I suspected that they were gathering juices from over-ripened raspberries on the vines. In order to satisfy myself I grasped a bee by her waist and abdomen, and pulled until the parts were separated, and then was revealed the little honey-sac, which had disengaged itself from the abdomen. This contained a light purple or wine-colored liquid. The size of this honey-sac, as nearly as I can recollect now, was a good big eighth of an inch; and I should remark that the bee had all she could contain in her little pocket. Cheshire says that, when the honey-sac is full, it is $\frac{1}{7}$ of an inch in diameter. This would agree with my observations.

STOMACH-MOUTH.

The next thing that engages our attention is a sort of valve, which has been called the stomach-mouth, and is located between the honey-stomach and the true stomach; viz., at H. This is one of the most interesting of organs; and I suppose that no part of the internal anatomy of the bee has been studied more, theorized about, dissected, and examined, than this delicate and beautiful little valve. At H its true structure does not appear. It has been likened in appearance to a bud just about to open. It is a sort of valve, fringed on the inside with rows of bristles, or hairs, the object of which seems to be to separate the pollen grains from the nectar, the former passing into the stomach L.

TRUE STOMACH.

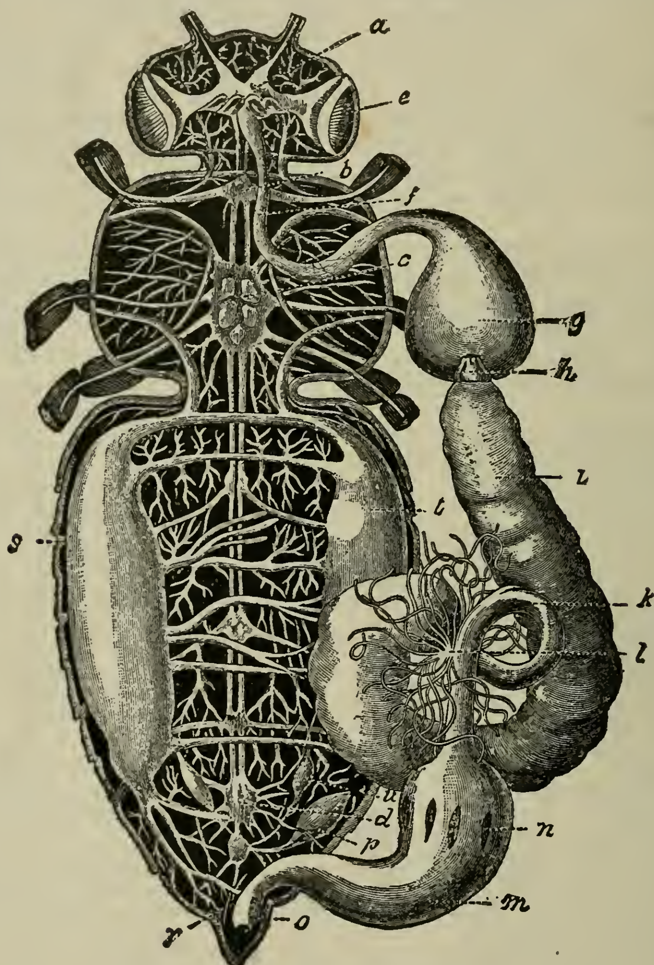
This corresponds to the stomach in our own bodies, and performs the same function in the way of digestion in converting the nutrient particles of the food into blood. The inside walls of the stomach have certain cells which perform certain offices; but without more definite engravings it will be impossible to describe them in detail.

The next organ is the small intestine, or, as it is sometimes called, the "ileum." In the human body the small intestines are much more elaborate. It is in this that the food, after its digestion, passes, and where, by absorption, the nutrient particles not already absorbed pass into the blood, and so on throughout the system.

You will notice, also, at L, some small radiating filaments. These are called the malphygian tubes. It is not certain what their office is, but it is thought that these are the urinary organs.

At the end of the small intestine, K, you will notice an enlargement, M. This is what is called the colon. Although the appearance of the colon in the bee is different from that in the human body, yet its functions are very much the same; and if allowed to become dammed up by excreta (that is, by retention during winter) it is liable to cause disease in the bee, just the same as in the human body. Mr. Cowan, the author of the book I mentioned at the outset, says:

From the colon, what remains of the undigested food is expelled by the anal opening. For this purpose strong muscles exist, by which the colon is compressed and the excreta ejected.



HONEY-BEE DISSECTED: AFTER WITZGALL.

The quantity of the excreta voided, usually of a dark brown color, is regulated by the nature of the food; bad honey, an improper substitute for honey (such as glucose) producing a larger amount, while good honey and good syrup produce less, a larger proportion of it being digested and absorbed. It is, therefore, important that bees should have good food, as, in a healthy condition, workers never void their fæces in the hive, but on the wing. In the winter it is retained until voided on their first flight.

So you see, then, that bad food makes mischief, just the same as it does in the human body, and it is in this that the overplus of fæces is stored during winter.

HOW THE BEE "MAKES" HONEY.

After the nectar is gathered it is then transferred from the tongue to the œsophagus and thence to the honey-stomach, G. It has been shown repeatedly by experiment that there are many more pollen grains in the nectar than in honey; hence the little stomach-mouth H comes into play in separating the grains from the honey. On arrival at the hive, the bee regurgitates—that is, expels the contents of the honey-sac into the cell; but during its stay in the honey-sac the nectar has undergone a change; that is, it has been converted, says Mr. Cowan, from the cane sugar of nectar into the grape sugar of honey, by the agency of a certain gland. This sustains the position held so persistently by Prof. Cook, and his view is doubtless correct.

But the bee may not regurgitate the honey, for it may pass directly into the chyle-stomach. We see, therefore, that, when a swarm issues, the bees, after filling their honey-sacs to their full capacity (a very small drop), can carry with them a supply of food to last them for several days; and even while on the wing, through that little stomach-mouth, H, they may take nourishment. So much for the alimentary canal, its office in digestion, and the honey-stomach.

THE NERVOUS SYSTEM.

Let us now turn our attention to the nervous system. By referring to the engraving you will see parallel and medial lines passing the entire length of the bee, and finally communicating with the brain A. Along at irregular intervals will be seen thickened masses called "ganglia." These are really little brains, and, as in our own bodies, preside over the involuntary muscles. The largest ganglion is the brain, at A, and is the seat of voluntary action and intelligence. One is surprised in reading through chapters 10 and 11 of Mr. Cowan's work, how thoroughly scientists have studied the structure of the nervous system as found in the bee. Even the tiny brain has been dissected, and its various functions pointed out—that is, what parts communicate with the antennæ, what part with the eyes, etc. I was greatly interested, in looking over the sizes of different brains found in different insects. I quote here a paragraph found on page 70 of Mr. Cowan's book:

> It is generally admitted, that the size of the brain is in proportion to the development of intelligence; and Dujardin, who made careful measurements, gives the following sizes: In the worker bee the brain is the $\frac{1}{174}$ of the body; in the ant, $\frac{1}{286}$; the ichneumon, $\frac{1}{400}$; the cockchafer, $\frac{1}{3920}$; the dytiscus, or water-beetle, $\frac{1}{4200}$.

In man the proportion is 1 to 40, I believe; but we all know that he is of the very highest order of intelligence. However, we are not very much surprised to learn that the bee has the largest brain of any of the insects, exceeding by far even that of the ant, whose intelligence we have admired over and over again.

THE RESPIRATORY SYSTEM.

It is also interesting to inquire how the bee breathes. By referring to the engraving given, we observe a couple of large air-sacs, called the "trachea," corresponding somewhat to the lungs. These are located on either side of the abdomen, as at T. These are divided and subdivided into smaller trachea, and these in turn ramify all through the entire body. Instead of fresh air being received in at the mouth, as with us, fresh supplies are admitted through 14 little mouths called "spiracles." Ten of these are located in the abdomen—five on each side—and are situated just about on the margin of the scales, between the dorsal and ventral segments. Four others are situated on the thorax, or waist, two on each side. You may, therefore decapitate a bee and she will continue breathing as before. If you place a pencil dipped in ammonia near her body, the headless insect will struggle to get away; and if the pencil touches her feet, the ganglia already spoken of communicate the sensation to the other ganglia, and at once all the feet come to the rescue to push off the offending object, or, it may be, to take closer hold so the sting may do its work. Besides that, if bees are daubed with honey they will die very soon from strangulation, because these little mouths or spiracles are closed. A bee may swim around in a trough of water, and, though her head be entirely out, she will drown just the same, because these spiracles or breathing-mouths are submerged under water. On a hot day, if the entrance of a hive be closed, the bees will soon begin to sweat; and, thus becoming daubed, the delicate spiracles are closed, and the bees die.

ROYAL JELLY, AND WHAT IS IT?

Cheshire insists that it is a *secretion* from one of the glands; but Prof. Cook has maintained that it is the product of the chyle-stomach; and Mr. Cowan proves conclusively that this is the right view.

This chyle is produced in what is called the chyle-stomach, shown at L, in the engraving; and worker larvæ are fed on this concentrated food for three days, after which they are weaned. "On the fourth day this food is changed and larva is weaned; for the first pap has a large quantity of honey added, but no undigested pollen, as Prof. Leuckhart had stated. The drone larvæ are also weaned, but in a different way; for, in addition to honey, a large quantity of *pollen* is added after the fourth day." And right here I can not do better than quote from Mr. Cowan:

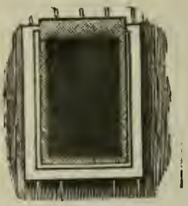
> Microscopic examination showed that, in the queen and worker larvæ, there was no undigested pollen; whereas in the drone larvæ, after the fourth day, large numbers of pollen grains were found. In one milligram, no less than 15,000 pollen grains were counted, and these were from a number of different plants. . . . This work of Dr. Planta's, we think, conclusively proves that the food is not a secretion, and that the nurses have the power of altering its constituents as they may require for the different bees. . . . Royal jelly is, therefore, chyle food, and this is also most likely the food given to the queen-bee. Schonfeld has also recently shown that drones are likewise dependent upon this food, given to them by workers, and that, if it is withheld, they die after three days, in the presence of abundance of honey. This, he thinks, accounts for the quiet way in which drones perish at the end of the season. It will now be easily understood, that, if weaning of the worker larvæ does not take place at the proper time, and that the first nourishing food is continued too long, it may be the cause of developing the ovaries, and so produce fertile workers, just as the more nourishing food continued during the whole of the larval existence in the case of a queen develops her ovaries, or even in the absence of a queen the feeding of workers on this rich food may tend to have the same effect. This, then, is the solution of royal jelly and brood food.

For a more exhaustive treatment of the whole subject, see Cowan's work, The

Honey-Bee; Cook's Manual of the Apiary, or Cheshire's Bees and Bee-keeping, Vol. 1.

PAGE 25—LATER DEVELOPMENTS ON THE HOUSE-APIARY.

Since printing our article on house-apiaries the subject has been revived, and some of the objections pointed out on page 25, in the body of the book, have been overcome. We have again put bees in our house-apiary, and are now working it on a slightly different plan. The windows, although darkened as formerly, are made so as to hinge and hook at the top. The outside of the window-casing is covered with wire cloth, the wire cloth extending some four or five inches above, the upper part of the casing being cut away. The following cut shows how



this is done; and if you will turn to page 77 you will find a cross-section of Dr. Miller's bee-escape, which illustrates the same thing. While bees and robbers will fly toward the wire cloth, they will never think of going to the top and running *down* a passageway four or five inches long, to get into the building. But the bees inside, in accordance with their instincts, crawl *upward* and pass out readily. Our three windows are now screened with wire cloth, in the manner above described, and Reese bee-escapes are attached to some of the entrances of the stands not occupied by bees; therefore all bees that happen to collect inside can easily go out, but they can not get back in. Instead of having the bees crawl all over the floor the moment you open the door, they will readily fly toward where the light shines through, where the bee escapes are attached to the unoccupied entrances.

After going inside we raised the three windows that have tarred paper tacked on the sides, to keep out the light, and to let in all the light we need. This gives perfect ventilation; at the same time, the bees that happen to fly off the combs while handling them in the house collect on the wire cloth and pass out.

To further add to the convenience of the apiarist, there should be a ventilating-shaft communicating through the roof; and while the smoker is not in use it should be set under this shaft.

We have discovered that, in order to make the house-apiary a success, the bees must be shut up in their compartments absolutely. These compartments, therefore, must be so made that not a bee may escape and crawl out upon the floor during the time you are not inside.

We have always observed that the crossest bees are but little inclined to sting *inside* of a building. When they fly from the combs that you are handling, they find themselves inclosed; and this so disconcerts them that they immediately fly to the screen windows and escape. James Heddon says, "If you have a cross colony, put it in the house-apiary and see how tame it will become."

It is now made possible, by the bee-escape spoken of under COMB HONEY, to take off extracting combs or comb honey, without a single bee getting on the floor; and the great convenience of being able to extract combs without shaking, and having thirty or forty colonies within a radius of six feet of the extractor, is a big thing.

PAGE 70—WIRING FRAMES.

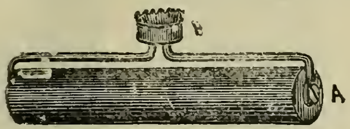
Since the form for COMB FOUNDATION was printed, we find that it is very much better to wire frames on the Keeney plan the other side up from those shown on page 70. This will bring the horizontal wire at the bottom, and bring the loop 5 near the top. The plan shown on page 70 has given us some good combs, though we found there was a little tendency at times for foundation to bulge between points 1, 5, and 2. If the wiring is turned the other side up, and the loose edge of the foundation is rubbed on to the comb-guide, the results are very much better.

PAGE 70—WIRING FRAMES HORIZONTALLY.

We have recently run across a plan for wiring that pleases us even better than the Keeney. It is simply the one that has been used by Dadant & Son in their extensive apiaries, and by George E. Hilton and others. In our earlier experiments with wiring frames horizontally, the foundation would bulge between the wires, and yet the Dadants, Hilton, and others, assured us that they secured nice, beautiful, straight combs. The foundation should be trimmed one-fourth inch or so shallower than the inside depth of the frame. Our later experiments have shown us that we have by this means secured most beautiful frames of comb. We are of the opinion now that it is far ahead of any other way of wiring. Combs are not only nicer and straighter, but the work is very much less. The end-bars should be pierced about 2 inches apart, ¾ inch from the bottom-bar and 1 inch from the top-bar. This will make four horizontal wires.

IMBEDDING WIRE BY ELECTRICITY.

If a wire is too small to carry a given current of electricity, it will heat; and if too great, it will melt. There are just 60 inches of No. 30 tinned wire used on the four-wire horizontal plan mentioned above. It remains, therefore, to secure just battery power enough to heat this 60 inches its entire length to a temperature of about 140°, or hot enough to sink into the foundation when a sheet is pressed on the wires. To do this a frame is laid upon a form in such a way that the two ends of the No. 30 tinned wire sticking through the end-bars of the frame come in contact with the two poles or wires of the battery. The poles should be a couple of brass springs (fastened to the battery wires), which shall press against the terminals of the tinned wire. If there is sufficient current the wire will heat quite hot while you are laying a sheet of foundation on the wire. Press or rub the sheet with the fingers along the line of the wires until they melt half way through. We use a wooden roller like that shown in the cut below. This, passed over the sheet, presses upon all four wires at once. As soon as the wires are imbedded (it ought not to take more than ten seconds), remove the frame from the form and the current is broken.

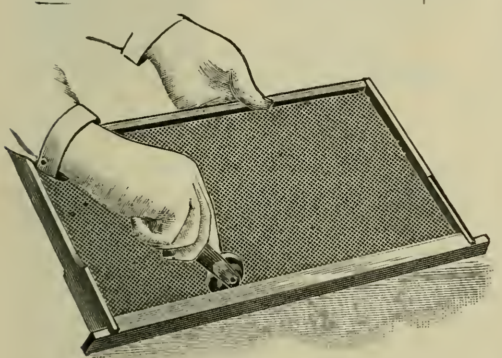


BLOOD'S ROLLER.

We get our current from three cells of what is called the "bichromate of potash" plunge battery. This battery and the necessary outfit can be bought of your dealer for about $2.50. Unless you have more than an ordinary knowledge of electricity you would not be able to make one.

Wiring by electricity is very much faster and nicer in its results, and we have used it exclusively of late.

After the wires have been imbedded to, say, 100 frames, we use what is called the Daisy foundation-roller, shown below.

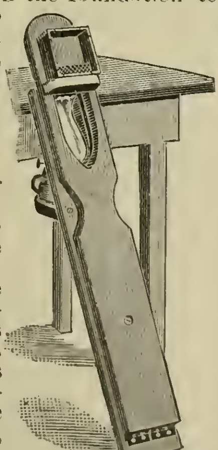


DAISY FOUNDATION-ROLLER.

The pressure of the wooden wheel two or three times will stick the foundation to the comb-guide. To prevent the wheel from sticking to the wax, dip it in water occasionally.

PAGE 71—FASTENING STARTERS IN SECTIONS.

We very much prefer to put our foundation in sections with the machine shown in the adjoining cut.

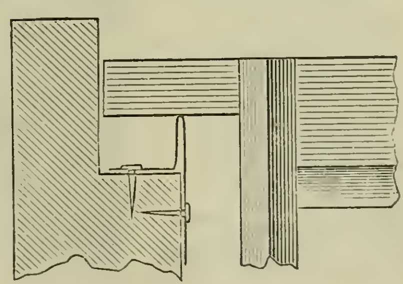


DAISY FOUNDATION FASTENER.

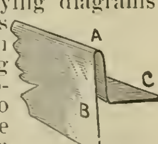
The principle of the machine is this: A metal plate or tongue is kept heated by means of a lamp beneath. This plate, by a slight pressure of the hands while holding the foundation, is made to pass directly under and come in contact with the bottom edge of the starter. Instantly the edge of the foundation melts, the pressure of the hands being released allows the tongue or plate to withdraw, and the starter is allowed to drop on to the section, when it instantly cools and is held firm. This method of fastening foundation is not only more rapid, but it does much nicer work, and at the same time saves foundation. The pressure method spoken of on page 71 always wastes an edge of the foundation that is bedded into the top of the section. This waste amounts anywhere from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch. All this is saved by the method above. Its manner of construction will be apparent from the engraving.

PAGE 158—THE NEW HOFFMAN FRAME.

In the body of the work we describe how to adapt the Hoffman frame to the Dovetailed hive. It should be borne in mind that the standard Langstroth top-bar is $19\frac{1}{8}$ in. long, and the regular Hoffman top-bar is widened at the ends. This would make a bearing surface in the rabbet, $\frac{1}{2}$x$1\frac{5}{8}$ inches; in other words, it would be necessary to use a rabbet $\frac{1}{2}$ inch wide; whereas, with the Hoffman frame it should be only $\frac{1}{4}$ in. wide. Appreciating this difficulty—that is, that so wide a bearing surface would necessarily kill bees—we recommended, on page 160, shortening the top-bar, that is, making it $18\frac{5}{8}$ in. long. This would narrow up the hive rabbet to $\frac{1}{4}$ inch. We have since found that it is impossible in practice to change the standard length because the short top-bars would not work well in old standard size hives, and it was therefore necessary for us to adhere to the old length—$19\frac{1}{8}$ inches, or, more exactly, $19\frac{1}{16}$. To avoid crushing bees we use a *straight* top-bar and a tin rabbet,

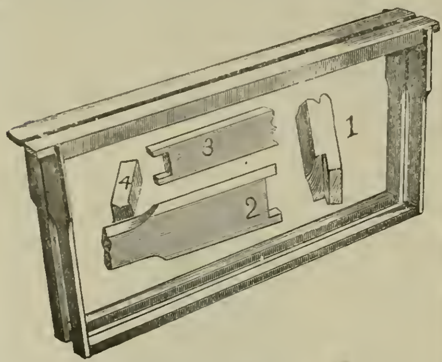


as shown in the accompanying diagrams, the rabbet being made as shown in A, B, C. With such a rabbet there is no creasing of the under side of the top-bars, no bending over, and no cutting of the fingers. The edge A, being folded, allows a perfect lateral motion.



The straight top-bar cheapens the construction of the frame, and at the same time affords a little advantage in allowing finger room between the ends of the top-bar. The *end*-bars are left as before, only being notched at the top so as to receive the top-bar, as shown in the cut. We have, therefore, the same lateral sliding motion and self-spacing feature of the old Hoffman frame, at a reduced cost, and, moreover, the dimensions of the frame are standard throughout with that of the old Langstroth.

The reader may follow his own discretion as to the style of Hoffman frame he will prefer. Should he choose the one above illustrated, it will be necessary to modify the directions slightly for cutting out the rabbets of the hive on page 151.



THE NEW HOFFMAN FRAME FOR THE DOVETAILED HIVE.

We might add, incidentally, that the majority of bee-keepers seem to prefer the frame modified as above; and if you desire to keep in line, perhaps you had better decide on this one.

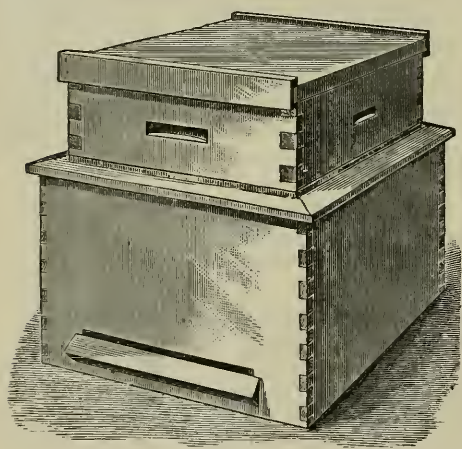


FIG. 4. OUR PERMANENT DOUBLE-WALLED CHAFF-PACKED DOVETAILED HIVE.

A one-story chaff hive is preferable to one made of two stories. First, to secure lightness; and second, that the same may be interchangeable with the Dovetailed hive or any of its furniture. The hive above secures both of these advantages, and at the same time it weighs but a trifle more than the permanent single-walled hives. It is made of ⅜ inch lumber, also dovetailed at the corners.

The inside width is 12¼, and will take eight frames and a division board with wedge. This same hive may also be made to take a full-depth story. The water-table has a raised projection, so that the separate parts of the hive come together as square joints, a feature that is nowadays so much prized by bee-keepers.

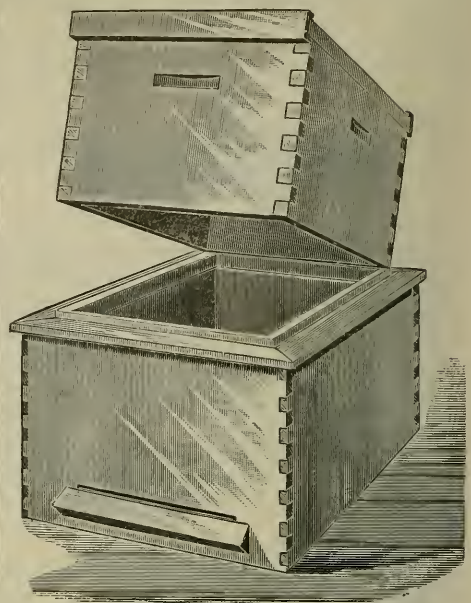


FIG. 5. DOVETAILED CHAFF HIVE WITH A SINGLE-WALLED UPPER STORY.

The space between the walls is 1⅝ inches. There is also a double bottom and tarred paper to prevent rotting. The hive may be packed or not, as desired, and the whole weighs only 2 lbs. more than the single-walled hive with bottom-board. It will be observed that we have dispensed with the expensive corner posts, and use instead the cheaper dovetailed corners, which are equally strong. Instead of having the hive made of a lot of 3-inch slats, the sides and ends are made of whole pieces. This makes it much simpler to put together, and also makes the two separate walls as near air-tight as possible. The hive in inside dimensions is the same as the Dovetailed hive, and in *outside* dimensions it is 16⅝ x 23, and can be loaded into a wagon with almost as much economy of space as the single-walled hive. This makes it possible to secure in this hive nearly all the advantages of the single-walled hive, with the additional advantages of a winter and spring hive. Such a hive *can* be carried into the cellar, the projection of the water-table affording an excellent grip to hold the hive by. Then the advantage in setting out a double-walled hive in spring, when the weather is so uncertain, will be apparent, but we intend this hive to be a successful *outdoor* winter hive.

PAGES 198 AND 241—THE UPPER STORY FOR QUEEN-REARING.

During the summer of 1891 we had considerable trouble in getting our upper-story colonies to accept the Doolittle cell-cups. Quite by accident one of these upper-story colonies became queenless, and *then* the bees would accept and build out nine-tenths of the cups given them. We have not had very good success in getting the upper-story colonies having a queen to *start* the cups, although they will complete them if they are *first started* in a queenless colony. We now give the cell-cups to a two-story *queenless* colony; and after this two-story colony has built several batches of cells, we let them have one of the cells and we then prepare another one. These artificial cups are often a great help. During the summer of 1891 we should not have known how to get along without them. This made it possible to breed most of our queens from the very best breeding mother we had, *after* we discovered that we were obliged to have *queenless* colonies in order to make the bees accept the cups.

PAGE 263—THE NEW CLARK SMOKER.

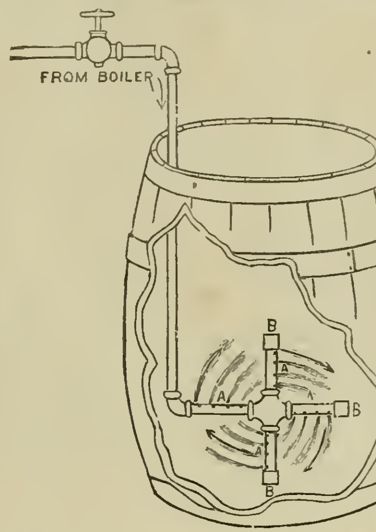
We have greatly improved the new Clark smoker by putting a set of perforations on the end of the fire-cup as well as under it. If you have an old Clark smoker that does not work very well, just puncture a lot of holes immediately in front of the grate, with a wire nail, and see how much better it will work.

PAGES 63 AND 314 — SULPHURIC ACID FOR RENDERING WAX.

We have lately come across a method for rendering wax in connection with a wax-press, that is far superior to any thing else we have ever tried. The method was suggested to us by F. A. Salisbury; and as every statement that he has made in an article on the subject is true in our experience, we publish it just as he gives it in *Gleanings:*

I will give you a plan that will make dark-colored wax into as nice wax as any you ever saw. It will be so clear, that, when melted, you can see to the bottom of a dipperful, looking like wine. By this plan you can take the refuse of cakes of wax, that which is scraped off the bottom after cooling, and looks like sand, and make it into as nice wax as can be made. This last season we had a barrel of this dark stuff, which looked like dirt, and you would have said it was not worth the trouble; but I put it through the process, and got from it 60 lbs. of yellow wax, worth at least $15.

I know that iron or galvanized iron will turn wax a dark color. I went to quite a little expense rigging up steam-pipes, and tanks of galvanized iron for my foundation business. The first melting did not show much, but after melting the scraps over three times I stopped making and tried to find out what was the matter. I knew the wax at first was all right, and concluded after a while it was either the galvanized iron or steam of too high pressure. I then went to work, tore down all the fixtures, and went back to melting in a large wooden tub. This wax, which was almost a dark green, I put through my process of melting, and had yellow wax again. My plan, whereby I can render 100 lbs. of wax from old combs in three hours, is as follows: Get a barrel that is good and strong, and ¾ steam-pipe, long enough to reach from a steam-boiler to the bottom of a barrel. Copper pipe would be better, but I find the small surface of the pipe touching the wax does not make any appreciable difference. You want a valve to shut off the steam, four pieces of pipe five inches long, an elbow, a cross, and three caps. In the pieces of pipe five inches long drill three 1/16-inch holes, spaced about two inches apart; screw an elbow on the bottom of the pipe coming from the steam-boiler; then one of the short pieces of pipe in the elbow; now screw on the cross, then the three pieces of pipe, and put a cap on the end



APPARATUS FOR RENDERING REFUSE WAX WITH SULPHURIC ACID.

of each. Turn the pipes until the small holes point all one way, so the steam in issuing will set the water whirling. Now fill the barrel one-fourth full of clear water. Put in one pound of sulphuric acid; turn on the steam, and when boiling put in the old combs Let all boil until heated thoroughly, and stir with a large stick at the same time.

Now you will want a press. Mine is simply a box made large enough to hold three racks, made of ⅜x½-inch-square sticks 15 inches long, nailed to two end pieces 15 inches long, so there will be ⅛ inch between the slats. In the bottom of the box I have a tin dish one inch deep, and it just slips down inside nicely. At one side the tin is turned down, and a hole is made in the bottom of the box for the wax and water to run out. Get a rim two inches wide and twelve inches square made from ⅜-inch stuff, and three pieces of burlap three feet square. Lay one of the racks in the tin dish in the bottom of the box; on this the two-inch rim; over this one of the pieces of burlap. Press the burlaps down in the rim, and dip the melted wax over into it until full to the top of the rim. Bring the burlaps over the top; take out the rim; lay another rack on top of this, and so proceed until you have the three filled; then place a follower on top of all, and a common jack-screw on top of the follower. Make a frame out of 2x4 scantling to go under the box and come to the top of the jack-screw. You will want two bolts to go through the top and bottom pieces of the frame. Have them of ⅝ round iron, and screw the nuts up tight. Put the top piece of the frame over the jack-screw, and turn the screw slowly so as to give a chance for the wax to run out. After it has stopped running, take out the refuse, and you will find the wax nearly out. You could not get out of a barrel of comb, after pressing, if it were possible to get it out, over a teacupful of wax. We have tried a number of ways, but the above is the best.

I tried an arrangement inside of a barrel to continually stir the comb; and over the comb, under water six inches, I had a screen to keep refuse from rising. I thought all the wax would in time rise to the top, but more stayed under the screen than came to the top. I also tried keeping two barrels of comb, that was thoroughly broken up, moist with water for two years, to see if I could not rot the cocoons and pollen so it would be like dirt. If I could rot it, I could get out all the wax, and not make me a press, but simply melt it in water, and the dirt would settle. This was a failure. The smell of the stuff when melting would fairly knock a man down at ten rods. I was very sick with malaria shortly after. Some thought I caught it from that bad-smelling boiling mixture. The wax I did get out of it was all right. I had to use the press to finish up. No more jobs like that for me. I can take cakes of wax that come to me dark, and, after rendering, they will be a nice yellow color. You simply want to melt them in the acidulated water, cover the barrel over tight, and throw an old horse-blanket over the whole; let it stand five hours, and then dip out in pans carefully, so as not to disturb the dirt at the bottom. Save all the refuse from scraping the bottom of cakes, and put through the same process.

Syracuse, N. Y., Dec. 5, 1890. F. A. SALISBURY.

In the summer of 1891, after our comb-foundation season ceased, we had as usual a lot of dirt from wax renderings, which we had proposed to throw away; but after receiving the article above we decided to keep it and try the acid. The result was, we secured many dollars' worth of wax, more than paying for a man's time in doing it, to say nothing of the valuable experience obtained. We have since taken cakes of commercial wax that were as black as ink, treated them to sulphuric acid as above, and the result would be invariably clear and beautiful yellow cakes of wax. In the bottom of the barrel will be left the residue of dirt in which there is no wax. The action of the acid, in conjunction with the heat, is to carbonize or burn the organic matter held in suspension in the wax while cooling. This frees the organic matter, causes it to sink, and leaves the pure wax on top, which may afterward be dipped off after standing four or five hours, as explained in the article. There is no excuse now for sending wax to market with a dirty color. A few cents' worth of sulphuric acid will make your wax so much nicer and yellower that it will bring you several dollars more in market price.

HOW TO REFINE WAX BY SULPHURIC ACID WITHOUT STEAM.

There are very few bee-keepers who have access to steam. They can refine wax without it, in a smaller way, but, of course, with proportionally more trouble. Take an ordinary earthenware milk-crock or stew-pan, such as is used on the farm. Put into this about a quart of water, and then add a dram or two of sulphuric acid. Add wax until the crock is full to within an inch of the top. Set this on the stove, and allow it to boil over a slow fire for 15 or 20 minutes, or, better, an hour. Set it aside and allow it to cool a little, and then dip off the wax from the top, being careful not to stir up the dirt and refuse that have settled to the bottom. If you have very much wax to refine, it will pay you to go to your tinner and have him make you a ten or fifteen gallon copper boiler, tin-lined on the inside (you can't use tin or iron). If your wife already has a copper boiler, you are so much better off; but be sure to return it to her clean and nice. After it has been used for rendering wax with sulphuric acid, clean it as well as you can, and then put in clear water and let it boil for an hour or so, after which pour off and rinse.

CAUTION.

In pouring the sulphuric acid into the water, be careful not to pour it in too fast. Pour slowly, and hold your head away. There is danger of its flying; but by pouring it in very slowly you will have no trouble. Sulphuric acid is very corrosive. If you get any on your fingers, immediately plunge them into water, and no harm will result. If any spatters on your clothing, dash water on as soon as you can, and then apply a little ammonia to arrest the further action of the acid.