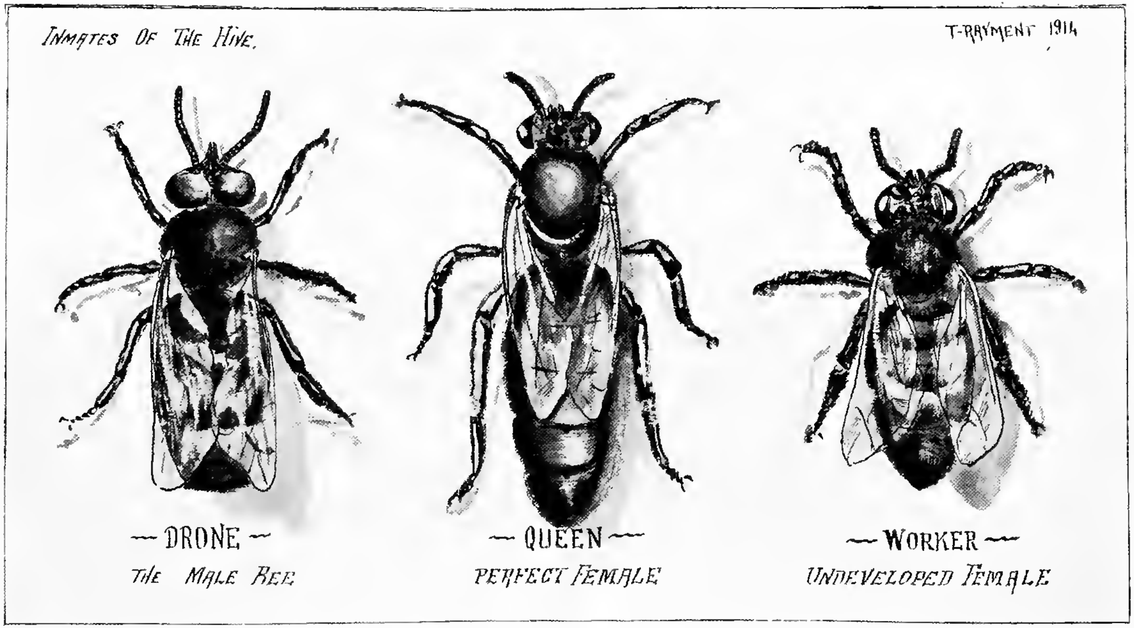
BY

TARLTON RAYMENT

MONEY

in BEES

in AUSTRALASIA



Frontispiece

Fig. 2.

MONEY IN BEES
IN AUSTRALASIA

A Practical Treatise on the Profitable Management of the Honey Bee in Australasia

BY

TARLTON-RAYMENT

Author of "An Alien Road Maker" and other short stories.
Contributor of illustrated Technical articles to "Gleanings in Bee Culture," Medina, O. U.S.A., "Australasian Beekeeper," Maitland, N.S.W., Aust.; "American Bee Journal," Hamilton, Ill., U.S.A.; "British Bee Journal," London, England.

With numerous illustrations expressly drawn for this work by the author, and a special section—the first of it's kind—dealing with the nectariferous value of the indigenous flora.

AND AN INTRODUCTION

BY

W. S. PENDER, Esq.
Editor "Australasian Beekeeper."

Melbourne:
Christchurch, Wellington, and Dunedin, N.Z.;
and London;
WHITCOMBE AND TOMBS LIMITED

to

JAMES FIRTH

A Guardian of the Indigenous Forest

and

A Friend of its "Feather and Fur"

this book is dedicated in appreciation of his work

during the forest fires of 1913 and 1914

INTRODUCTION.

No apology nor elaborate explanation need be made for the publication of a practical guide to bee-keeping in Australasia; so far the industry has been but little catered for. In this volume an attempt has been made—I think very successfully—to provide a concise, explicit, and eminently practical guide-book covering the elementary as well as the more advanced phases of practical Apiculture.

Australasian conditions are in many ways peculiar, so that works applicable to other lands are often ineffective here and involve a great deal of sifting—and, may-be, costly experiments—to determine whether such instructions are profitable or otherwise. This book therefore fills a great want, and I have much pleasure in commending it whilst predicting a ready sale, and that it will thus find its way into the libraries of all progressive apiarists and nature students.

The author has given us the result of his years of interesting experience under the "Southern Cross," and has proved in his own apiaries all he has written to be practical—not only from an experimental but also from a financial point of view—having made Apiculture a successful and profitable business. By following in the ways of the successful, others can obtain success; so this volume will prove valuable to everyone who takes up bee-keeping as a business or as a hobby.

It is extremely practical from beginning to end, while every operation is lucidly described, from the nailing and setting up of the hive parts to the extra delicate operations entailed by the modern system of rearing queen-bees: nor is the marketing of the honey and wax crop neglected in any detail. Sufficient of the natural history and physiology of the honey-bee has been given to whet one's appetite, and to incline the reader towards a closer study of insect anatomy so that he may better appreciate the marvels of its physical organisation.

Notable in this volume is the section devoted to the honey and pollen producing indigenous flora. The author has artistically attempted something quite original, and has successfully garnered a valuable collection of interesting data about Australasian plants and many exotics of value to Apiculture. It forms a unique work, treated in an artistic manner, while devoid as far as possible of technical and scientific terms, but which makes it of greater interest to the majority of readers. After explaining the misunderstandings among bee-keepers due to the confusing nomenclature of the native trees, the author gives a short list of our Wattles (*Acacias*)—which provide rich food for the rearing of the young bees—and then a lengthy section dealing with native and exotic plants, with period of florescence, quality and quantity of honey and pollen produced, while even the various colours are recorded.

Perhaps the portion devoted to the Eucalypts—from which by far the greatest quantity of Australian honey is produced—forms the most remarkable feature of the book. No one has previously attempted to compile such a comprehensive tabulation; so I specially commend this section, and can confidently recommend this textbook to every lover of bees and honey.

W. S. PENDER,

West Maitland, N.S.W.

PREFACE.

As the greyness of gloomy winter recedes before the clear bright days of the Australasian spring, the most casual human cannot fail to observe the industrious insects that crowd the garden-flowers. "Yes!" he remarks, "Bees! look out they don't sting you!" He sees the fertilising pollen heaped high on the little labourer's legs—"See him gathering the wax!" Such is the average man's ignorance of the honey-bee. Tell him of the queen-bee's marvellous egg production and his interest is aroused, he wants to enlarge his knowledge of the interesting insects.

This book, it is hoped, will enlighten the casual observer, and prove valuable to the beginner who is the proud owner of a solitary colony. The ambitious amateur working 20 or 30 hives may, by steadily assimilating the information contained in this volume, profitably expand his apiary until the increased income in hard cash will convince him that he has progressed on sound lines, without the usual costly elimination of the superfluous. The author paid a high figure for the latter experience, and the intelligent reader should benefit accordingly.

The professional apiarist, operating hundreds of colonies scattered through yards miles apart, will agree that "One is never too old to learn." The oldest honey-grubber will appreciate this book, which aims to be a thoroughly technical treatise on Australasian Bee-farming, incorporating some new information that will bear the test of practical use in the apiary.

Though the industry has been firmly established for a number of years, there is a total absence of literature dealing with the honey-bearing flora of Australasia, and in this respect the book breaks new ground. The botanical section is admittedly far from complete, though no plant that yields a crop of honey has been omitted, therefore it contains all that is practically required.

I desire to record my thanks to the following gentlemen for information regarding the flora, etc.:—Messrs. J. Firth, E. Garrett, and E. Penglase, of Victoria; F. J. McIlveen, W. S. Pender, and W. Reid, Sen., of New South Wales; H. M. Holloway, of Queensland; J. E. Myers, and F. H. Lloyd, of Western Australia; V. Jackson, B.A, of New Zealand; and W. Wiltshire, of South Australia.

TARLTON-RAYMENT,

Bow-Worrung Forest,

Victoria.

CONTENTS.

SPRING.

AUSTRALIAN BEES.

LOCATIONS AND BUILDINGS.

WORKING EQUIPMENT.

PRELIMINARY WORK.

MANIPULATING FRAMES.

EXTRACTED-HONEY.

WORKING TO INCREASE.

OUT-YARDS AND ITALIANIZING.

SUMMER.

SWARMS AND SWARMING.

COMB-HONEY.

WORKING FOR COMB-HONEY.

QUEENS.

QUEEN-REARING.

QUEEN-MATING.

POLLEN AND POLLEN SUBSTITUTES.

GENERAL SUMMER WORK.

ROBBER BEES.

FEEDING BEES.

ENEMIES OF HONEY-BEES.

AUTUMN.

BEE DISEASES.

NECTAR AND HONEY-DEW.

SUPERSEDING QUEENS.

SPARE COMBS.

GENERAL AUTUMN WORK.

PREPARATIONS FOR WINTERING.

WINTER.

HEATING HONEY.

PREPARING HONEY FOR SALE.

A WINTER FLOW OF HONEY.

GENERAL WORK IN WINTER.

EXHIBITING.

BEESWAX.

FOUNDATION.

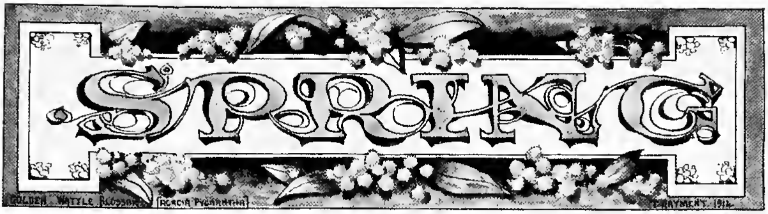
TRAVELLING BEES.

AUSTRALIAN HONEY-PLANTS.

HONEY-FLOWS AND THEIR SOURCES.

LIST AND PARTICULARS IN ALPHABETICAL ORDER.

LIST OF ILLUSTRATIONS.



AUSTRALIAN BEES.

SPECIES.

Here! look at the flowers on the Gum trees, just covered with bees—honey-bees. The bushman divides them into two classes, Black bees, and "Eyetalion." The bee-farmer recognises them as Black bees, "Hybrids" and Italians, rarely he notices a Cyprian or a Carniolan bee. There are a great many varieties, but they are not all honey-bees.*

In Australasia, the representatives of the order are limited to the four already mentioned. The scientist calls them *Apis mellifica* of the order *Hymenoptera;* this latter word really means four-winged. In this way the bee is distinguished from the fly, which has two wings.

ANATOMICAL STRUCTURE.

Generally speaking, those insects that live in crowded communities of cell-like structure, are provided by Nature with four wings that can in emergency be folded over one another, and so occupy less space. Witness a honey-bee "crowding" itself into a cell of comb. Flies do not require the wing area and power so essential to the bee, hence Nature's gift of two wings. In flight the wings of the honey-bee are "hooked" together on the edges, and so present two planes to the air instead of four; bees are thus enabled to travel very fast during working hours. The flight of the bee has been investigated by some able men, and Landois states the wing vibrations to equal those of a tuning fork, ranging between A and C of the

---

*Author's note—The small Native bees—no larger than flies—found in Australia are *Apis trigona.*

first and second ledger line of the treble clef. Cheshire makes this work out at about 440 vibrations per second, —truly a muscular phenomenon for so small a body.

The man in the street considers the sharp end of the bee of most interest, but it is hoped this book will interest him in both ends. The compound eye of 6,300 facets—take a diamond and study it closely; it is ground to a number of flat surfaces at varying angles. There are 6,300 little flat surfaces in the construction of the bee's eye. Each of these facets reflects a perfect image of the landscape, so we cease to wonder how bees find honey in blossoms so far from home. In the darkness of the hive the bees have the assistance of three simple eyes called *ocelli*, situated in front of the head.

When nectar is found, she brings into use the marvellous tongue. This looks to our eyes just a coarse red hair, but under the microscope it is no longer so. Three delicate "tubes" all well within the compass of a single thread: can we comprehend the **fineness of the hair lining the inside of the tubes?** As the bee "licks" up the nectar, these small hairs act as a strainer, and all pollen grains are caught in the fine "mesh." What wondrous architect designed this adjustable tongue? How simply the bee "unrolls" the pseudo tube, and with two front feet "brushes" away the pollen particles. Is there any mechanical action so worthy of our reverence?

Here from the head project the antennæ—the sensitive organs that guide the bees to their various duties in the darkness of the hive. Aye, even more, do not the antennæ help the owner to discover the suitable places on our body wherein to plant that excellent weapon, the sting?

That more people are acquainted with the sting than any other portion of the insect's anatomy, we can readily believe. However, in spite of scepticism, the sting is a weapon of defence, not offence. It is of wonderfully delicate construction. It has a sheath that punctures the skin, and a ratchet-like arrangement of darts, barbed in such a manner that they work in deeper and deeper when once they obtain hold. They continue to penetrate the flesh and inject poison (formic acid from a small gland at the base of the sting), until progress is stayed by a feathery bunch of extremely small muscles that furnish the motive power for this microscopical specimen of mechanical movement.

Should a feeling of inquiry impel the reader of the foregoing to desire a closer intimacy with the anatomical construction of man's greatest insect friend, there are a number of works dealing with the subject in a scientific manner. However, it is not proposed to invoke a multitude of Latin and Greek terms to assist in recording a mass of scientific and microscopical minutiæ.

The wonderfully formed systems that enable the bee to obtain air are situated along the sides of the body, and are known as spiracles—tiny apertures leading to internal tubes of which the worker-bee has fourteen. These spiracles are connected with a series of "air sacs." Most insects that fly are provided with these *tracheæ*, for they are of great assistance to the insect's aerial abilities. For instance, when a hive is suddenly opened, the bees are unable to fly for a second or two until the air sacs are inflated. The spiracles are internally fitted with "spiral springs" that prevent them closing when the body is bent or doubled up. Those of the drone are fitted with a special curtain-like attachment that exaggerates the sound of the insect's flight, thus causing the distinctive sound always associated with the flight of the male bee. Observant apiarists will recall many instances of honey-bees drowning with the head well above water. The submerged spiracles are thus cut off from air and the insect is suffocated. The apiarist should never daub bees with any liquid in such quantity that they are unable to free the spiracles: this is the chief reason why a swarm will not stay in a hive when furnished with wet extracting combs. Bees in a swarm are fully provisioned, and quite unable to clean up a further supply when it is stuck over their bodies.

Honey-bees are provided with a honey-sac which, Cheshire states "is about one-sixth of an inch in depth and one-ninth of an inch in diameter when full of honey." This is only a storage vessel. When fully provisioned it will hold a supply for six or seven days. There is also another organ, the chyle stomach—both are connected by a wonderful stomach-mouth (so named by Burmeister).

The chyle stomach performs the process of digestion, and together with a certain gland, is responsible for the formation of the rich food fed to queens and young larvæ. Within the abdomen are a number of glands, and other organs. In the abdomen of the queen are the ovaries or egg-producing system.

The hard portion of the body immediately separating the head from the abdomen is the thorax. It carries the leg and wing muscles, so is appropriately termed the centre of locomotion. The thorax is extremely hard, and to meet the wing strain is strongly braced with a perfect net-work of muscles and supports. The thorax, (also the delicate feather of a butterfly) is constructed of a substance called chitine of which more anon.

It has been observed that a highly polished needle examined with a microscope of high power, resembles a bar of rough cast iron, but the sting of a bee under the same glass is of exquisite smoothness and polish. That the sting should be able to penetrate comparatively hard substances is worthy of note. Instances are recorded of bees, enraged, stinging fruit trees, and the author has often observed bees' stings penetrate pieces of leather. Honey-bees do not, usually, sting the first thing at hand. Certain substances, viz.:—woollen clothes, fur, hair, and, generally speaking, any rough clothing material apparently excite the bees to greater efforts. For this reason, when working among bees it is advisable to make a point of dressing in some variety of cotton clothes. Bee-keepers—with very good reason—affirm that bees sting dark material in preference to light.* John H.

*Author's Note.—Sir John Lubbock, in "Ants, Wasps, and Bees," has conclusively shown that bees have the power to distinguish the various colours, indeed they often exhibit certain preferences.

Lovell, botanist, U.S.A., conducted a number of experiments dealing with this peculiarity. He suggested the theory that bees on emerging from the darkness of the hive were unable to perceive white objects, whereas darker colours were plainly visible. Whatever the cause, experience shows the advisability of working in light-coloured cotton clothes where practicable. The writer finds cotton khaki to answer every requirement.

The sting of the bee is composed of that hard material, chitine. The "shell" or, if it is permissible to so describe it, the external skeleton (bees have no internal bony structure) is also of the same substance. The abdomen of both queen and worker is composed of six rings or belts of chitine, and is capable of expansion and contraction; the "plates" slide over one another with a telescopic action. The "bands" are not continuous, but are divided into dorsal (on the back) and ventral (on the underpart) plates. The overlapping plates are clearly shown on the chrysalis Fig. 25, and the larva Fig. 63A.

Chitine forms the scaly covering of most insects, and is of varying degrees of hardness. It is also moulded into tiny hooks at the extremities of the bees' legs, which enable the insects to hang in graceful chains whilst comb-building.

Few indeed have never observed a swarm hanging by the roadside, and wondered at the sustaining power of the few bees attached to the bough or fence rail.

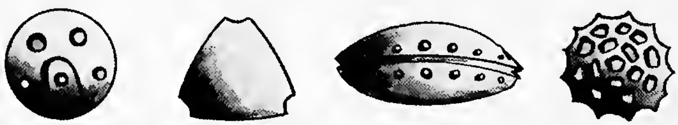
In walking over a smooth surface the hooks are folded out of the way, and a specially adapted portion of the foot called the *pulvillus* is brought into action. This acts somewhat like a small damp pad, capable of automatic expansion as a step is taken. High microscopical power is required to trace the minute clammy secretion left by the *pulvillus* on glass or some other suitable medium. (Cheshire—Scientific Beekeeping, Vol. 1).

The most important sections of the legs of the "worker-bees," i.e. those bees that perform the honey-gathering, food supplying and other duties of the socialistic hive community—are the wonderfully constructed pockets. These receptacles are so situated that they act as admirable baskets wherein to carry the daily bread.

POLLEN BASKETS.

The honey-bee with its load of "staple" is a common enough sight on any fine, bright day. Yes, the little pellets so prominently carried on the "hallowed thigh," are truly the bread of the bee-hive. Certainly it is not made of wheaten flour, but of tiny pollen grains (Fig. 1) or floral fertilising material that the industrious foragers gather from various blooms. Of course it is well known that bees

T.R. FIG. 1. POLLEN GRAINS. ENLARGED.



RED CURRANT. YELLOW BOX. WHITE CLOVER. PHLOX.

confer great favours upon the florist and horticulturist in transferring pollen from flower to flower. Where a number of bees are kept in an orchard the blossoms are more likely to be effectively fertilised and a greater proportion of fruit "set." Of a certainty the wind helps, but bees are the most reliable. Pollen, when analysed by the chemist, contains food values closely approximating those of pea-meal. During a dearth of natural pollen, bee-keepers often feed this substitute. The gathering of pollen by the honey-bee is an act calculated to delight the nature student. Look at this bee, hear its droning hum as it hovers over a blossom. See, it settles on the flower and executes a raking motion with its fore-legs. Again the hovering flight, and right under our eyes the insect conjuror performs a curious "sleight of hand" trick. The front pair of legs are moistened with the tongue, and the pollen grains rolled into a miniature pudding. In a flash the second pair of legs transfer the pellets into the baskets of those at the rear. Homeward she (for the worker-bee is an undeveloped female) flies to pack the food into a cell, and with a final cover of honey preserve it for the feeding of the young. All this and much more can be credited to the industrious worker.

·[Darwin stated that a dandelion flower produced 243,000 pollen grains, and one hazel blossom 4,000,000 grains.

J. E. Crane, a prominent American apiarist, counted over 100 flowers on a single dandelion plant. Each flower developed close on 250 seeds.

Pollen grains are very minute, those of the forget-me-not have a diameter of 0·0025 to 0·0034 millimeters; melons, 0·20 to 0·24.

It takes a single bee from two to eighteen minutes to secure its load of 100,000 pollen grains, according to Kirchner.

An analysis—by Planta—of hazel pollen showed a nitrogenous content of 30·21 per cent., while that of the Scotch fir showed only 16·6 per cent.]

Pollen grains are composed broadly of two substances—intine and extine—while a fine oil is secreted on the surface during bright days. This probably accounts for the extra large loads carried by bees in fine weather, as the oil would tend to cause more grains to cohere.

A COLONY OF BEES.

If a hive contained worker-bees only, it would make but poor progress. A queen-bee must be present.

Ancient bee-men always referred to the monarch insect as the "King-bee," but modern hives and keen observation exposed the error of our forefathers. The professional apiarist frequently witnesses queens in the act of depositing eggs. Queens attend to this portion of their work at a wonderful rate, and some have been known to lay four to five thousand eggs per day during the middle of the season.

There are also other inmates of the hive, drones or male bees, whose life's function is to mate with the young queens. (See Queen rearing, page 109). Further on we shall have something more to say about the queens, drones, and "worker-bees." (Fig. 2). For the present we will confine ourselves to the commonest varieties.

VARIETIES.

As already stated the honey-bees are represented in Australasia by four or five races: the Black, Italian, Cyprian, Carniolan and hybrids. These latter are invariably described by apiarists as a cross of Italian and black "blood." Hybrid may be hardly correct, but its use is universal. All the breeds mentioned possess queens, drones, and worker-bees. A description of a black bee's duties would apply also to one of any other variety.

The honey-bee, (like the rabbit and sparrow), was introduced to Australia from England. About 1822 Captain Wallace (S. Isabella) landed the first black bees in New South Wales. In 1840 Lady Hobson arrived in New Zealand with bees from the Mother State. They were of the variety known as English or Black bees. They are natives of northern Europe, and since their introduction to Australia, have spread over the entire continent in untold millions, so favourable are the conditions for insect life in the indigenous forests. This variety is now called in Australasia the "bush" bee. The Italian bee came later, from 1874 to 1878. J. Carroll—Bee-Master to His Excellency the Marquis of Normandy—endeavoured, unsuccessfully, to introduce the Italian (*Apis Ligustica*) race. I. Hopkins of New Zealand, (among others, E. Garrett in New South Wales) imported Italian queens about 1880-1883, and soon after large numbers were received in the various states. The Italian bee has three bands of a yellowy tan colour, and is easily distinguished from the Black species.

The "Hybrid" so called, is a cross-bred of the Black and Italian races. Cyprian bees are not very plentiful in Australasia, as only one or two apiarists breed this variety. They are very handsome in appearance, of a bright golden colour, but a certain irritability of temper makes them rather unpopular. The Carniolan bee can scarcely be distinguished from the Black bee. Throughout this book it is intended to deal only with the first three breeds mentioned. Other breeds in Australasia are a negligible quantity.

LOCATIONS AND BUILDINGS.

WHERE TO KEEP BEES.

Having made some acquaintance with bees of various races, the novice makes up his mind to keep a few colonies of bees to satisfy innate curiosity and incidentally to get some honey. In short he intends to become the proud possessor of a bee-farm. See Figs. 3, 4, 5. Now you cannot have a bee-farm, unless you have a suitable location. If you live in the city you will soon discover that half a dozen or so colonies (a colony is a swarm of bees with queen, brood, and combs in a frame-hive) are about the limit.

The amount of pasture in the cities is not great, and the risk of bees getting diseased is increased a hundred-fold. Therefore the prospective apiarist must hark back to the great Eucalyptus forests of the State in which he resides, or seek the huge lucerne fields of New South Wales and Victoria, or, perhaps, the clover fields of New Zealand. In southerly Victoria, especially the province of Gippsland, hundreds of acres of clover furnish a short term of pasture. Along the flats bordering the Tarwin river, strawberry clover waves knee-high in the Southern Ocean's breeze. But the yield of honey from clover is not large, so the professional "honey-grubber" seeks the wealth of the indigenous forests.

Fig. 3. An Alpine Bee-farm.

Fig. 4. A Bee-farm in Victoria.

Fig. 5. Garrett's Apiary, Gippsland, Victoria.

Fig. 6. Typical Australian Bee-country.

PASTURE LEGISLATION.

Victoria is the only State that has any legislation dealing with bee pasture. The Forest Department administers the Act dealing with licenses and bee-ranges. A Bee-Farm Site is an area (up to ten acres) on which to place the bees. A Bee-Range is an area of a mile radius (with the bee-farm as the centre) to be used as a foraging ground. The bee-farmer rents the tops of the trees only; he has no right over the grass or land. (A note of enquiry should be addressed to the Conservator of Forests, Melbourne, who will be pleased to furnish all necessary information).

Having made a selection of an area in, or adjoining a forest, it is necessary to clear and fence a site. This is a most important act. Take care that it is well above flood level. One of the best situations is a hill side, not too steep, with preferably an eastern slope so as to get full benefit of the morning sun. Nothing like the early solar rays for bees, and for that matter, humans too. If it is possible to secure a location well protected from wind, and fairly free from risk of bush fires, an eastern situation would do very well. Undoubtedly each district possesses peculiarities that should receive careful attention.

In Australasia, it is very advisable, owing to the dryness of certain seasons, to exercise some forethought on the subject of bush fires, before the plant is in working order. On account of this risk, do not locate on the south or eastern side of a forest subject to fires. Prevention is better than cure. However, if a strong north wind should blow during a big forest blaze, it is impossible to stay its progress. The writer in 1913 experienced the loss of entire apiaries of hundreds of hives, together with honey-tanks, honey-house, extractors, etc., through a fire sweeping the slopes of the Australian Alps. On this occasion the grass was carefully burnt off a few days before, but miles of forest on fire produce terrific heat. The hives—facing east—were continually swept by flames beaten down from the timber, until the north and west sides of every hive caught fire. Man is unable to cope with a forest fire of this magnitude, and the sensible thing is to avoid the risk.

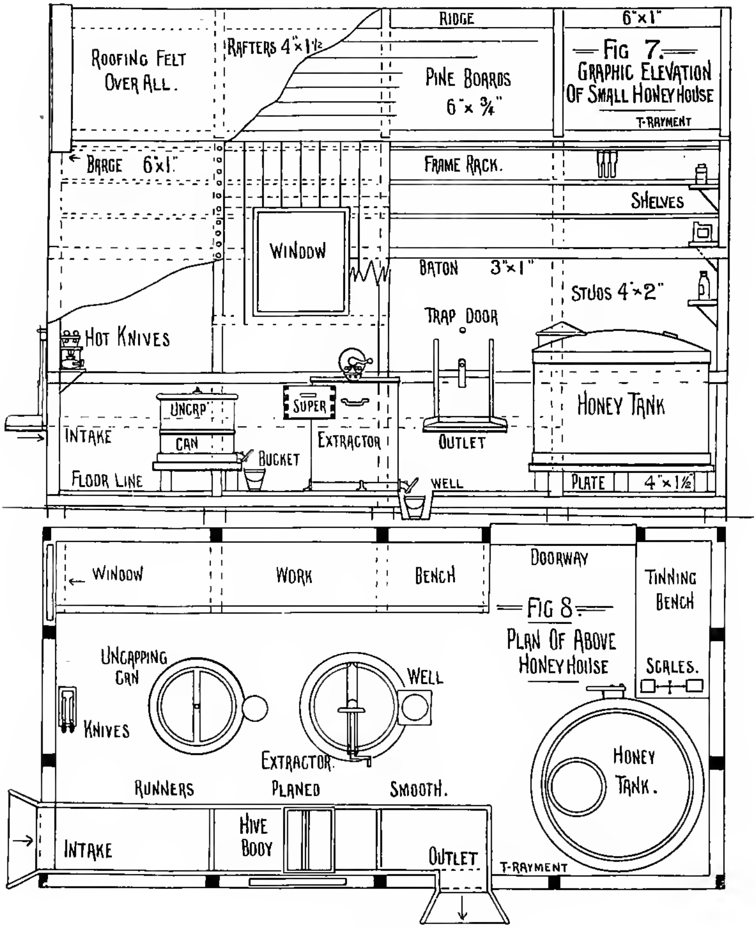
After selecting and clearing the site, a fence will be required to keep the cattle from molesting the bees. If sheep graze on the surrounding land, it is a good plan to let them have free range of the apiary as they are first-class grass mowers. Now about the fence. If white ants are numerous, the 100 posts required had better be split of Red gum, or Box; both these timbers are very durable. About 2 coils of No. 8 wire will make the fence horse and cattle proof: the sheep will do no harm.

HONEY-HOUSE.

After the fence is up, the honey-house ought to receive attention. This should be placed at the lowest corner of the yard, because it is easier to wheel the empty barrow up hill. A barrow full of honey-combs ready for extracting is of considerable weight, and it saves energy to use a down grade. (Fig. 39 depicts a favourite plan of the author's in laying out a small yard, the diagram needs no further explanation except to remark a bias in favour of hives in rows **a wide distance apart**). From the remarks made on the subject of fires, the wisdom of advocating a galvanised iron honey-house is apparent. There is no material more suitable for the Australasian climate; it presents no opportunity to catch alight from bush fires, requires very little in the way of repairs, and white ants cannot eat it.

Figs. 7 and 8 give a plan and graphic section of a honey-house suitable for a small apiary, safe from fire. In case of extended operations and as the business grows, the question of a suitable honey-house becomes one of considerable import.

Where extracting is carried on in a wholesale manner, every step saved in the course of the day's work is a desideratum. The plan of a concrete honey-house (Fig. 9) for a large apiary is designed to enable a heavy crop of honey to be handled in an economical manner. The plant here shown will handle up to fifty tons of honey. Where gravel, sand and water are at hand, concrete is cheap and substantial. If the location is on a hillside,



Figs. 7 and 8.

this plan of building a two-storied house is simplified considerably; there is no easier method of extracting than the gravitation system, *e.g.*, honey tanks on a lower floor than the extractors.

For some reason the apiarist may be limited to one floor on the level of the apiary. When so circumstanced, it is advisable to sink a "well" or trench under the

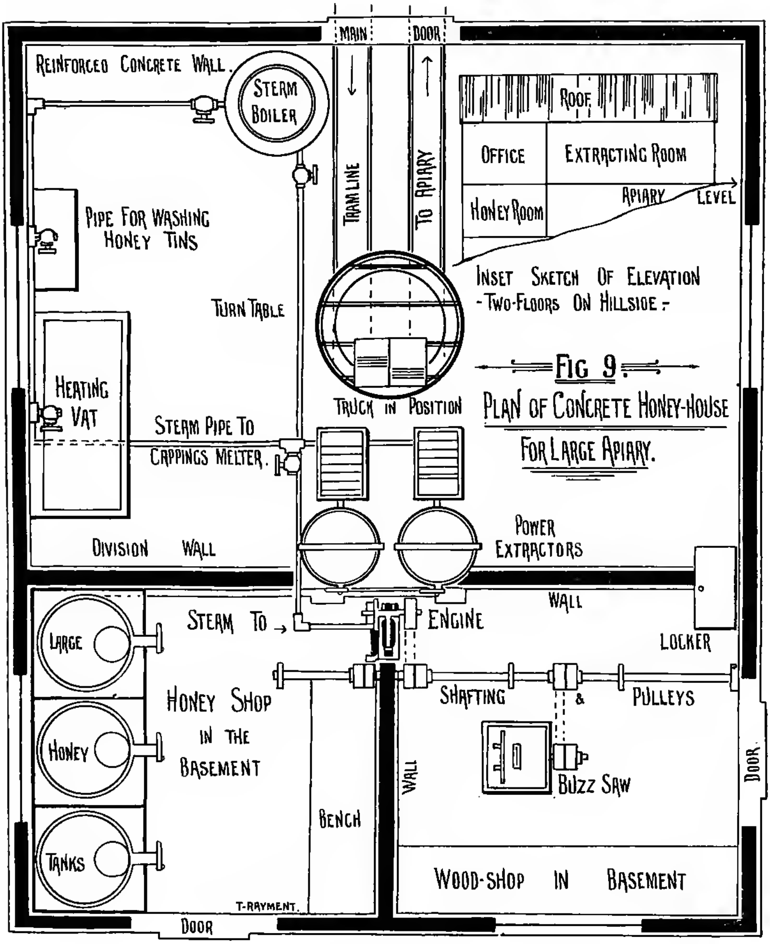


Fig. 9.

gates of the extractor and honey-tanks sufficiently deep to take the bucket that receives the honey from the extractor, and to accommodate the 60 lb. tins when filling from the tanks. Sinking a well as stated, permits the extractor to be anchored on the floor, and this makes the turning of the machine less laborious. A high lift is also obviated when emptying buckets of honey into the tanks. The method of "anchoring" the extractor will receive further attention under that head.

The windows require screening with fly wire or wire gauze, and should also be provided with two cones or bee-escapes, to enable the insects to leave the honey-house. The bees confined inside immediately fly to, and crawl up the wire covered windows, hence the necessity of placing the escapes at the top of the apertures. There is a specially manufactured article called a bee-escape (Fig. 10) that permits egress but prevents ingress. The

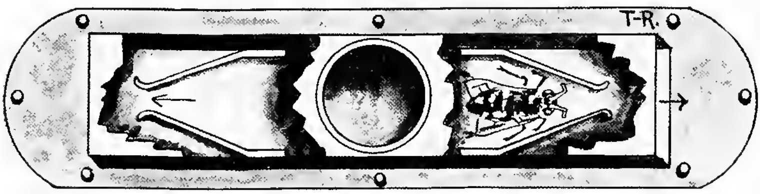


Fig. 10. Porter Bee-escape.

cost is a few pence only, but it saves pounds worth of trouble. Do not forget a water tank. The author knows of no nicer floor for a honey-house than a concrete one; it is so easily washed, and kept clean, and there is no risk in leaving the lighted smoker on the floor unattended. For an apiary of 50 colonies or lesser number, the honey-house will not require to be a very expensive one. The question of economy should be considered; at the same time it is foolish to work without a certain amount of convenience, for the apiarist is not handing out justice to himself.

WOODEN HONEY-HOUSE FOR SMALL APIARY.

Figs. 7 and 8 depict a method that permits a medium honey-crop—say up to 12 tons—to be handled with convenience and despatch. It will be noted that a portion of the side wall has been removed to show the construction of the building. The average bee-keeper will find no great difficulty in erecting a frame work and covering it with tongue and groove (seven-eighths of an inch thick) pine boards. The studs of the building, 3 inches by 1 inch hardwood, will provide—together with the top and bottom plates—a solid frame on which to nail. The boards should be put on perpendicularly, and the requisite spaces must be left for the windows. The roof is also covered with pine boards running from the ridge to the eaves. The whole structure is then covered with building felt or "Ruberoid." This makes a honey-house bee and rain proof. 15 feet by 12 feet over all would make a suitable building.

Along the top of the west wall 4 pieces of wood should be nailed for a handy frame rack. At the south end of the building stands the tinning bench, with shelves overhead for tins, jars, etc. The small projection on the northern end—intake—is a small shelf with sliding trap door. The same apparatus is repeated on the west side, the two traps are connected by runners planed smooth for supers to slide along. In working, the full supers are pushed in at the intake along the runners until the slides are full.

If one man is taking off and extracting, he now proceeds inside and extracts. The empty supers are removed at the outlet. If two men are working, one operates the machine while the outside man brings the full combs along. This gives the robber bees no chance to gain admittance to the honey-house. This plan of two trap doors, one to receive full and the other to remove empty supers, is an extension of the method used by the American bee-keeper, Alexander, in his extracting-house. The apiary consisted of over 700 colonies, and the honey-house was smaller than the size here recommended, yet the honey crop of many tons was successfully extracted by a system similar to the one here explained.

Unfortunately the structure here illustrated is best suited for a situation quite free from fire risk; use galvanised iron wherever possible. The diagrams are self explanatory. This system of handling honey is splendid when the whole super is removed at once.

A LARGE PLANT.

For a large honey-house the best material is undoubtedly concrete. Few bee-keepers are so situated that they are remote from the necessary material in the way of small stones, gravel or tailings, etc. It is a noteworthy fact that the great crops of honey in Australasia are gathered in country of rocky, gravelly, or sandy formation. Select a hillside if possible, so that the elevation will appear as the inset in Fig. 9, *e.g.*, have the honey-extracting floor on a lower level than the hives, the full trucks will then run easily to the machines.

The tramline should be carried right up to the extractors, on a turntable, which is given a quarter turn, to place the truck in a suitable working position; drop checks are provided to hold the turntable firmly. The trucks are fitted with sliding doors, the empty combs are returned as extracted, and when full are swung on to the exit rails, and the line is again clear for work. The honey is conducted by pipe to the strainers under the extractors. The wire strainers are fitted into a space cut out of the floor.

Power is supplied by an oil engine or steam, which is also connected with a saw in the carpenter's shop. It could also be attached to any other machinery in use. Reference to the design will show that the wood shop is in reality a basement together with the tinning room. A partition wall divides the departments, but it would be convenient to have a door connecting them.

The area over the tinning room and the adjoining workshop provides for honey storage room and office. Along one side of the building is a wax-working bench, with foundation rolls, also a cupboard for the finished sheets. The other end of the bench accommodates the dipping tanks, and a steam boiler is set in the corner. The stoke hole if situated on the outside of the building, obviates ashes, chips, dust, etc. The wax-press is close handy to the boiler when melting combs. On the opposite side of the building is ample storage for empty supers, frame racks, etc.

The disposition of the engine and extractors is apparent from the diagram. The engine is either of the oil or steam type, and the method of transmitting the power from the engine to the extractors is explained under the head of Power Extractors.

Mr. Holterman, an extensive Canadian bee-keeper, operates a tramline in the apiary, and speaks highly of its efficiency. The plan of honey-house as given at Fig. 9, formed the basis of a design for the honey-house of Messrs. Adamson and Phillips, extensive and enterprising apiarists of Tamworth, New South Wales. This is sufficient to show the practical nature of the drawings. The designs here given secured first prizes in the competitions conducted by the *Australasian Bee-keeper*, the only bee-journal published in the Commonwealth.

WORKING EQUIPMENT.

BEE-VEILS.

FIG 11. BEE-VEIL.

The bare walls and water tank will not do much of the extracting; other tools are required to assist us. However, we will defer a description of the extracting gear until there is occasion to use it.

Almost the first things required are veil and smoker. The veil (Fig. 11) is simply made. About a yard of **black** brussels net with a hem turned on both edges. This allows a tape to be drawn through the top, the bottom hem prevents fraying. Black permits better vision than white net, and is not so trying on the eyes. The way to put on the veil is to simply drop it down over a wide brimmed straw hat; draw the tape tight round the crown, and it is ready for use. The loose end should be tucked inside the coat or waistcoat. In hot weather whilst at

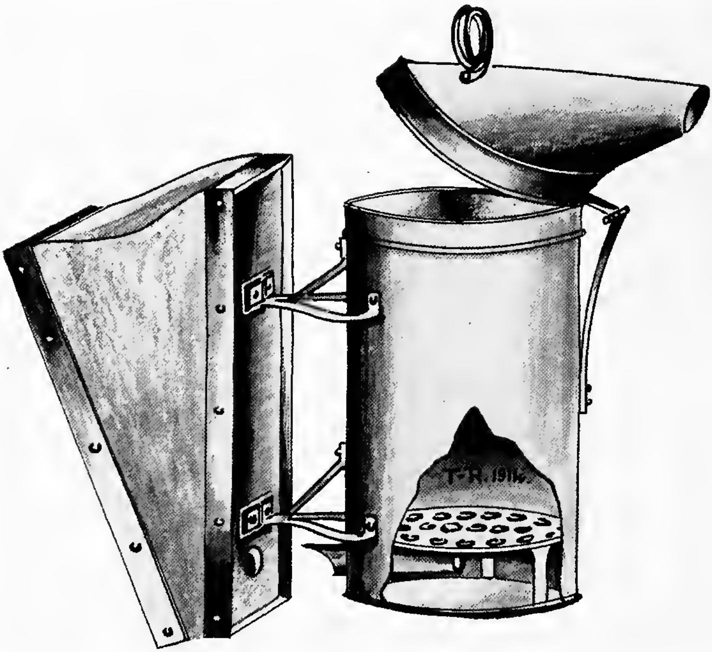


Fig. 12. "Bingham" Smoker.

work, many men reject coat and waistcoat, preferring to work in "shirt sleeves." In this case the loose end should be pulled tight under the braces or suspenders. It is very convenient and cool to work this way. There are a great number of bee-veils advertised, ranging from wire cloth to tulle, but having given a number of them a trial, the author regards the simple black net as easily first.

SMOKERS.

Now, about the smoker (Fig. 12); years ago, two smokers (one blowing hot, the other cold smoke) were offered for sale. There is no need to enter upon a dissertation on the respective merits of hot and cold blasts. Time has eliminated the cold blast smoker; it is now rarely met with. The smoker in almost universal use to-day is known as the "Bingham" (named after the American apiarist Bingham who first constructed it). It has been considerably improved by the A.I. Root Co., U.S.A., and as represented in the illustration leaves little to be desired. The construction is apparent; it is simply a metal fire box on a small pair of bellows. It is easily lighted, and with suitable material will give a dense volume of smoke for hours.

A great many materials form excellent smoker fuel: greasy waste from an engineer's shop, wood shavings of pine timber, pressed in tightly, old chaff sacks, or cotton rags. But the fuel we favour is something right to our hand in the forest; the fibrous bark of the Eucalyptus trees, especially the common stringybark tree (*E. macrorrhyncha*). To light the smoker drop in a little bark or rag, apply a match, allow fuel to get well alight, then start gentle blowing and fill up the fire box rather tightly. Some smokers have a curved "snout" and some are straight; there is little to complain of in either. The sizes of the furnaces range from 3 to 5 inches in diameter. The amount of work to be performed determines the size of the smoker. A small hook is attached to the bellows, and this is handy for hanging smoker on hives or barrow.

HIVE TOOL.

There will also be required some sort of hive-tool (Fig. 13). Many apiarists use a screw driver, or a chisel, or even an old knife, but they are not as handy to use as the tool itself. A simple pattern is made of iron, shaped like a screw driver one end, the other flattened out. The tool is to lift or ease any portion of the hive that gets stiff with wax. Any burr comb (*i.e.*, pieces of wax built about the frames by the bees as braces and ladders) can be removed with the chisel end.

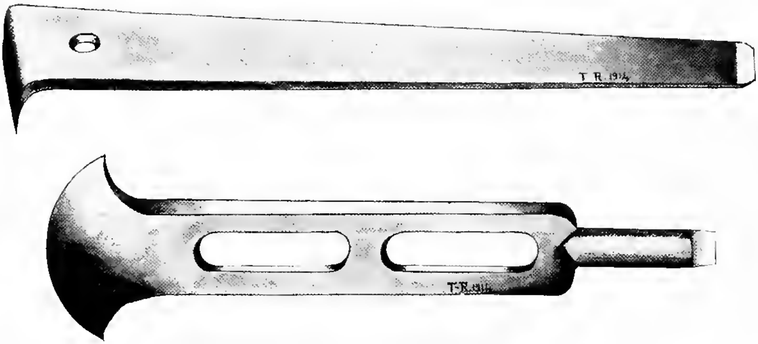


Fig. 13. Hive Tools.

BOX HIVES.

Having secured a location, fenced a site, and built the honey-house, one is prepared for the next step. Time was, in Australasia, when bees and gin case hives were inseparable; at a later stage, the kerosene box occupied the same relationship. Apiculture has progressed considerably since the gin case period, and "patent" hives are to-day scattered throughout the length and breadth of the Continent. Of course it is not to be inferred that all bees in Australasia are "housed" in patent or frame-hives, for they are not, by many thousands. Professional bee-keepers in New Zealand and Victoria are protected by an Act entitled the "Bee Diseases Act." This deals with the spread of bee diseases and bee pests in general. In the countries mentioned, the "box" hive, *e.g.*, any box, case or other article that cannot be examined except by breaking the combs, is proscribed.

Before one undertakes the care of bees, he should make himself acquainted with the provisions of the Act, the penalties for the disobedience of any of its clauses being of a drastic nature. For the present the operations of the Act are confined to the State of Victoria and

New Zealand, but it is only a matter of time before the whole of the States in the Commonwealth fall into line. Farmers and also suburban householders who like to keep a swarm or two hived in any sort of old box, will probably think Acts such as the one mentioned are rather uncalled for. A little deeper thought on the matter will convince these good people of its justice. There are hundreds of apiarists engaged in the industry as the sole means of livelihood. Many have a considerable number of bee-farms equipped with expensive honey plant, the colonies of bees numbering some hundreds, and a large capital is required to operate the business.

Alongside this man of many hives (who makes a speciality of bee-farming) is the neighbour who has one or two swarms in kerosene cases. He gives them no attention whatever except to take once a year what little honey they have gathered. If the bees are diseased he is unaware of it, and consequently takes no steps to effect a cure. He probably leaves many little pieces of honey-comb about for the bees to clean up. Herein lies the trouble: honey is the medium that carries the disease "Foul brood" to his neighbour who has hundreds of pounds at stake. Here is the position, the man who places little or no value on his box hive constitutes himself a continual menace and source of expense to his neighbour. Therefore, the days of the box-hive are numbered; with its two cross sticks—like the perches of a bird cage—to prevent the combs falling from their attachments during the hot weather, it was never convenient, mostly diseased, and was by proclamation proscribed in Victoria from January 1913.

PATENT HIVES.

Are we bound to use one particular expensive hive to comply with the provisions of the Act? No, decidedly not. A hive to meet all requirements must be what the Act describes as a "properly constituted frame-hive," that is the hive must embody the important principle of a "bee space." This is usually regarded as a quarter of an inch separating the various portions of a patent hive.

Hives are not all of the same size, but they mostly embody this principle: they are all composed of hive body (Figs. 14, 15) bottom-board and lid or cover, with frames to hang or stand inside.

In Australasia there are but two kinds of hive in general use. One is called the Langstroth (Fig. 15)

Fig. 14. Bolton or Heddon Hive.

named after its inventor the Rev. L. L. Langstroth; the other is known as the Heddon (Fig. 14) or "Bolton" hive. Both these patterns emanated from the United States, but the "Heddon" is also known as the "Bolton" hive, (so named after an apiarist in the western district of Victoria, who modified and operates this hive in a very large way. Mr. Bolton disclaims the use of his name in this connection, but to Australasians continued use has made the name "Bolton" synonymous with "Heddon").

Fig. 15. The Langstroth Hive.

One or two bee-keepers use hives of a special size, but it is unwise to suggest equipping an apiary with odd-sized goods. In these times of high cost of production, standardisation helps to make things a little cheaper, and apiculturists will appreciate this advocacy of a universal standard. The hives and plant described in this book have been, and in most instances are still, used in the apiaries of the writer, who is professionally engaged in the production of honey and queens. That the catalogues of the supply manufacturers contain many goods not enumerated in this work goes without saying, but the reader can rest assured that the articles recommended are practically and economically constructed for the work. Years of experience enable one to eliminate the things that are unnecessary.

LANGSTROTH HIVE.

The Langstroth hive is known and used throughout the apicultural world, and since it is most generally used will be described first.

The hive is made in 8, 10, and 12-frame sizes, that is to say the body contains the number of frames specified. Australasians generally use the first two of the above sizes. The timber for the bodies, bottom-boards, and covers, is ⅞ of an inch in thickness. The bodies of the hive as now manufactured are lock cornered, *i.e.*, are fastened together by a species of dovetail, in a very strong manner. It requires a considerable amount of skill as a wood-worker to make a satisfactory hive, and it is impossible to make them by hand at the prices charged for the machined goods. The factory-made hives when once nailed squarely together are good for a lifetime. For these reasons one cannot recommend home-made goods. A glance at the illustrations will explain the "dovetail."

The body is without top or bottom, just four pieces of pine with the two ends rabbeted out at the top to form a projection on which to suspend the frames. To allow manipulation of the frames in groups from side to side, the rabbets have a strip of tin nailed on. On the outside of the ends there is a small handhole cut out with a circular saw. The bodies measure over all (8-frame size) 20 inches long by 13⅞ wide by 9½ inches deep. The 10-frame hive is 16 inches wide, but the measurements coincide in all other respects.

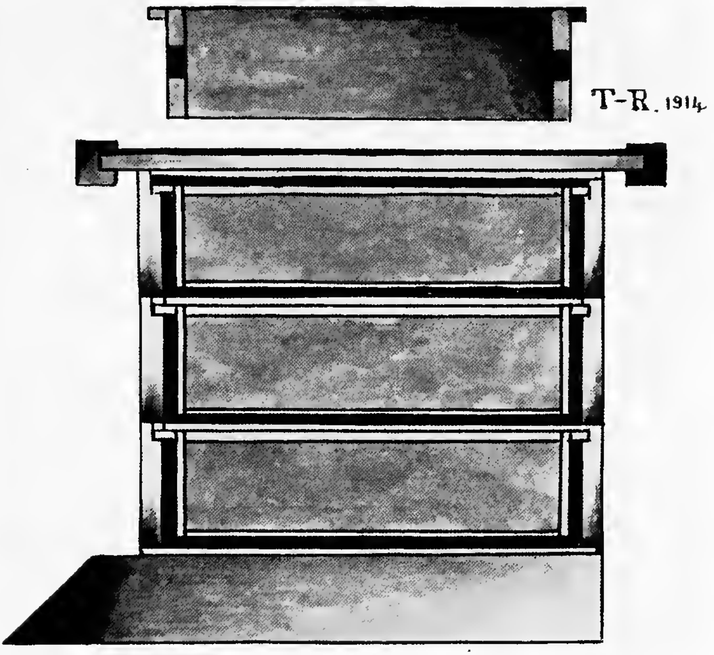


Fig. 16. Interior of Bolton Hive.

The bottom boards are of various designs (Figs. 14, 15, 16), but the one preferred is a plain board 2 feet long by 14 inches wide by ⅞ inch thick. Two pieces of 4 inches by 2 inches Red gum timber are nailed on the underside to raise the board off the ground—planted on the top are three slats ⅞ inch wide by ½ inch thick. They are of the same dimensions as the hive-body, *i.e.* two are 20 inches long, the third occupies the space between at the rear. This arrangement leaves an entrance at the front ½ inch deep by the width of the hive. This is apparent in Fig. 14.

Covers are of all shapes and sizes. The climate is the principal factor in determining the class of cover required. Very hot districts require a ventilated gable lid (Fig. 3); where the summer will permit the use of

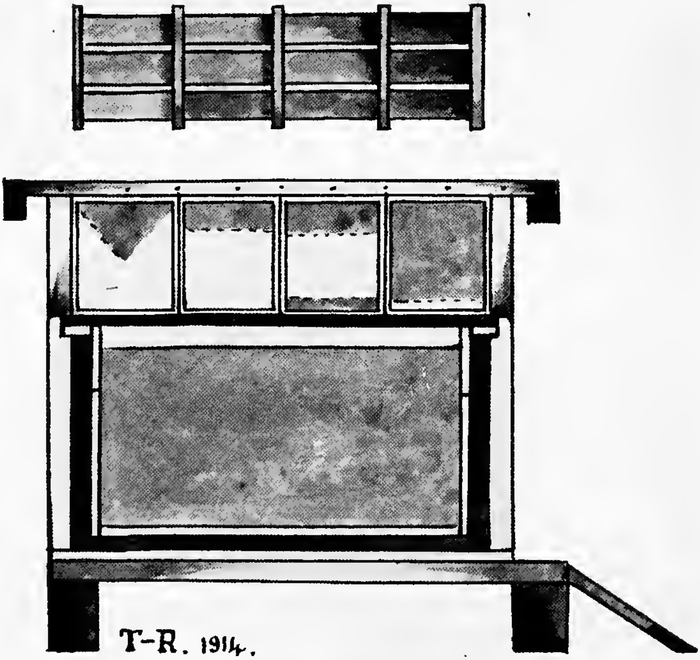


Fig. 17. Langstroth Hive for Comb-honey.

a flat cover use a single board ⅞ inch thick, 2 feet long by 14 inches wide, nailed to two pieces of hardwood 1¼ inches by 1¼ inches by 14 inches. The whole is then covered with galvanised iron. (Fig. 15). No nails should be placed on top; it is simply nailed round the edges. It will be noticed that the dimensions given are mostly eight-frame size. For this reason, it is a convenient size, perhaps the most convenient. Used as a winter hive one body crammed full of bees is easier kept warm, and as the hive expands in summer any number of bodies may be added.

The frames (Fig. 18) that hang inside will now receive attention. Those principally in use are the "Simplicity" and "Hoffman." Both frames may be used in Langstroth hives, and measure the same top and bottom; the

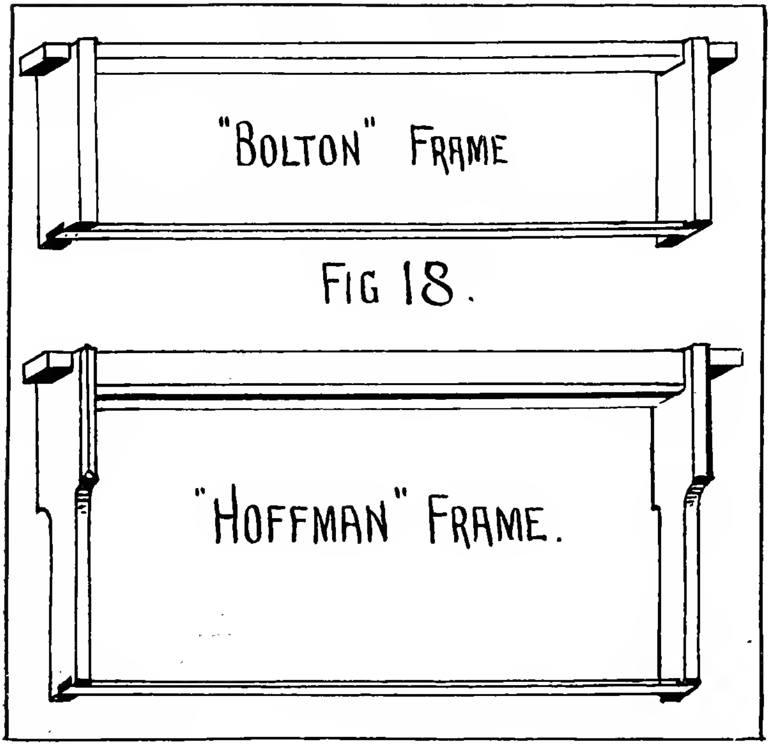


FIG 18.

difference exists in the side bars. The Simplicity (Fig. 20) is of even width all round, top, bottom and sides. To prevent the combs butting up against one another and crushing the bees, the frames require to be spaced a certain distance apart. The apiarist must rely on his eye to gauge the spacing. On the other hand the Hoffman style (Fig. 18) has small projections on the end bars to prevent the frames getting too close together. They can also be handled much more quickly; the dimensions over all are 19⅛ inches by 9⅛ inches.

The half-storey body is sometimes used with this hive for producing comb, and often for extracted-honey. This half-body is very similar to a section of the Bolton hive. In Fig. 15 the half-body is shown raised above the hive; Fig. 17 is a section of same fitted up for comb-honey production. Another view is shown under the heading of Comb-honey. When fitted up for building comb, the half-body is referred to as a comb-super, and may be used equally well with the Bolton hive.

BOLTON HIVE.

As reference to the illustration will show, the Bolton hive (Fig. 14) is composed of any number (mostly four to six) of shallow bodies capable of being used with the bottom-board and cover of a Langstroth hive. The bodies of the Bolton hive measure 20 inches by 13⅞ inches by 5¾ inches deep. The Langstroth style usually has the brood-chamber in one body; but the Bolton hive is peculiar in using two shallow bodies as a brood-nest. The comb space of two Bolton bodies is equal to that of a ten-frame Langstroth. This peculiarity of a divided brood-nest has earned for itself the cognomen of "The divisible hive."

The manipulation of this hive is necessarily different from that of the Langstroth pattern. It is capable of inversion (*i.e.* turning the body upside down) because the hanging frames (Figs. 16 and 14) are tightly wedged together by a follower (represented over the hive in Fig. 16) with pressure derived from two thumbscrews in the side. The follower has two pieces of metal attached to take the ends of the screws and prevent them boring into the wood. This is also used in the comb-honey super for crowding the sections together in a similar manner.

A great many advantages are claimed for this hive. The chief one is that it permits the handling of hives instead of frames. Another point claimed is control over the swarming propensity. It is not desirable to argue the merits or demerits of the two hives, because they are, after all, of only secondary consideration. The apiarist who can make a success of bee-farming with eight-frame hives, can repeat the trick with ten or twelve frames, divisible or otherwise. The frames used in connection with the Bolton hive are self-spacing, like the Hoffman. The end bars have small projections, or to be precise, the end bars are slightly wider than the top and bottom bars (See Fig. 18). Bolton frames are catalogued as "closed end hanging frames" 17⅝ inches by 5⅜ inches, having top bar 19 inches by ⅜ inch.

NAILING HIVES.

The style of hive desired is ordered, and comes promptly to hand. If a quantity has been obtained, they are usually shipped in lots of five or a multiple thereof. On arrival, before unpacking the bodies, it is a trick well worth knowing, to get some linseed oil (raw) or paint—red oxide is very good—and go over the "dovetails" while the bodies are still held together. A great saving of time is effected by painting them in this position. After the joints are coated, the bundle may be unpacked.

It is almost impossible to make a mistake in nailing the hives. However, always remember to paint all joints, and if the "edges and ends are securely nailed, the flat will look after itself." When ordering hives it is also necessary to order nails. There are special nails—"cement-coated" for bee-keepers' use—very fine in gauge. The substance with which they are coated enables them to obtain a very firm hold. They cost a little more than ordinary nails, but as a greater number are required to make a given weight, the extra cost is infinitesimal. Some two inch nails are required for the bodies; 2 or 3 lbs. of 1¼ inch by 17 gauge, and also some 1 inch by 18 gauge for nailing the frames.

NAILING FRAMES.

The Hoffman frame is the only one that presents any difficulty to the novice. It is the writer's experience that others than beginners have difficulty in nailing Hoffman frames; in fact it is a rare thing to see them properly put together. A reference to Fig. 18 will show two end-bars of similar pattern. Now, the upper half of the end-bar on the left is planed to a V edge; that on the right-hand is flat. If the frame is turned end-for-end so as to obtain a view of the other side, it will be remarked that the V edge is again on the left hand. When the frame is held up before the operator it should resemble the diagram.

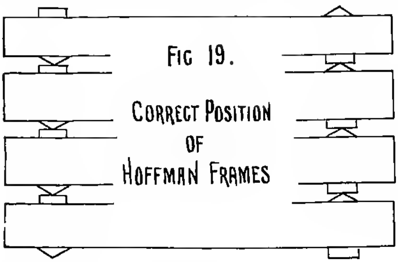


FIG 19. CORRECT POSITION OF HOFFMAN FRAMES

To nail the frames together, place a top-bar upside down on a solid bench, pick up two side-bars, taking care that the flat edge is on the **left hand** (this is necessary because the frame is upside down), and press them down over the top-bar—they will stand there by friction—place a bottom-bar in the mortice of the side pieces and secure with two nails (using 1 inch by 18 gauge) in each end. Turn the frame up the right way and drive two nails ($1\frac{1}{4}$ inches by 17) each end through the top-bar into the side pieces When correctly nailed, and placed in the hive, they should appear as in Fig. 19.

WIRING FRAMES.

Should the beginner wire the frames? Well, it depends on the number of hives. If one only is wanted or cared for it is waste of time to wire. A hive to build comb-honey in frames for the household is better not bothered with wire. It serves no purpose, and is only a hindrance when the comb is cut clear from the frame and placed on the table. When Bolton hives are in use, the shallow frames render the use of wire quite unnecessary. The metal strand is for the purpose of bracing the comb. It is absolutely essential where the combs are extracted by machinery, for without wiring a large number will be broken. The wire also helps to sustain the combs on a very hot day when there is danger of them falling from the frames. It is very risky to attempt the transportation of hives of bees if the combs are not wired. They are

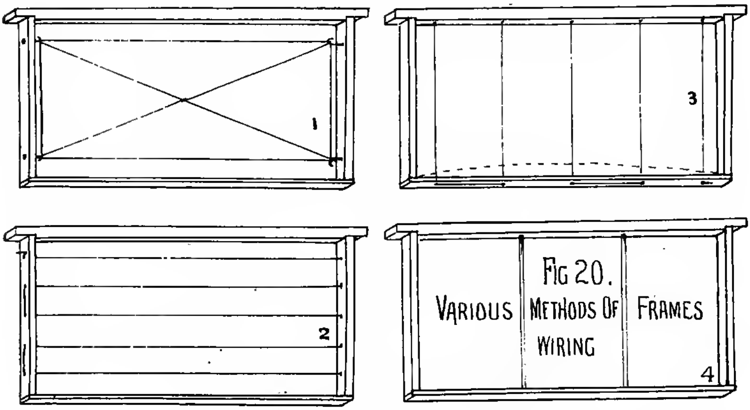


Fig. 20. Wired "Simplicity" Frames.

almost sure to break down during the journey and entail the loss of the colonies.

If it is determined to use full sheets of foundation one is committed to the use of wire also, as it is impracticable to use full sheets without bracing. Wiring (Fig. 20) keeps the sheets of wax plumb in the frame, and if this is neglected the resultant combs are very imperfectly built. A very good and quick method is to drive two one inch nails—points inward—through each end-bar about 1¼ inches from top and bottom, (No. 1, Fig. 20) and make hooks of the points with a pair of pincers. A loop is next made on the end of the wire—No. 30 tinned—and slipped over a hook. It is then threaded over the remaining nails in the manner indicated.

In No. 2 the end-bars are bored and the wire run through horizontally. This is slow work, and the wire is difficult to tighten once it gets slack. Too many holes weaken the end-bar, and also provide places for the wax-moth to hide her eggs.

No. 3 is even worse, it pulls the bottom-bar "out of true"—indicated by the dotted line—and the wires continually catch the knives when uncapping and scraping burr comb from top and bottom-bars.

No. 4 is an improvement on the two previous styles. It consists of two very fine strips of wood called splints, which before using are first tied up in bundles and immersed in boiling beeswax. This is necessary to entice the bees to build comb over the wood. Foundation is placed in the frames **after wiring**, but splints are pressed into the wax **after the foundation** is secured to the top-bar.

PRELIMINARY WORK.

USE OF FOUNDATION.

Foundation is a necessity on every modern bee-farm. Combs cannot be built regularly in a frame hive unless the bees have a "starter" or something to indicate where combs are required. Foundation supplies the requisite guide to the wax-workers. It is simply a sheet of wax passed through two embossed rollers. This process forms the midrib, (See Foundation Manufacture, page 213). It does not form the cell wall, as the bees draw out and add a little more wax to the foundation in making the walls. Bee-keepers in a large way of business make foundation during spare time. However, there is no time or equipment to make the foundation just now, so an order is placed with the manufacturer.

It is made in varying thicknesses, the lightest grade is "thin surplus." This grade covers 10 to 12 square feet per lb., "medium brood" (Fig. 21) measures about 7 square feet per lb., "light brood" covers 8 square feet per lb. If the objective is nice frames of brood-comb,—comb in which the bees rear their young—it is advisable to order "medium brood" foundation. This quality will also do for the combs the novice expects to extract; these latter are classed as super-combs. Should the apiarist desire to have the honey stored in the comb-super (*e.g.*, the little 1lb. sections) it will be necessary to order "thin surplus." The heavier grade "medium brood" is too thick, though the stouter foundation is more

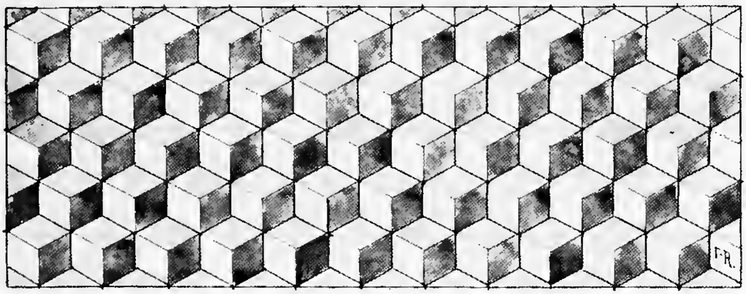


Fig. 21. Comb Foundation (slightly enlarged).

readily accepted and drawn out by the bees into comb.

Foundation not only secures beautifully even combs—and this is appreciated when uncapping them—but it also permits the apiarist to exercise some control over the number of drones produced in the apiary. Normally, drones are reared in cells measuring $\frac{1}{4}$ inch in diameter, $18\frac{178}{375}$ make a square inch, or one side of comb. Worker-comb is somewhat smaller, measuring one-fifth of an inch in diameter, and $28\frac{13}{15}$ cells (*Cheshire*) are required to equal the aforementioned area of comb. Owing to this difference in size, the intelligent apiculturist is able to restrict the production of drones to one or two selected colonies.

Foundation is made "worker" size only. Bees, permitted to build comb without man's interference, will have almost as much drone pattern as "worker." Drones are required only for mating with young queens. They gather no honey, but are heavy feeders on the stores of the hive, and it is waste of food and bee energy to rear a horde of lazy consumers. One or two selected colonies will produce all the drones needed in a yard of one hundred hives. A number of beginners prefer to use a narrow strip (about 1 inch wide) of foundation as a guide, but this is false economy, since it allows the insects to build too many drone cells. When this takes place, the object in supplying foundation is defeated.

HOW TO FASTEN FOUNDATION IN FRAMES.

To obtain the full benefit of this material whole sheets must be used. First it is necessary to have an inch thick board cut to fit easily the inside of the frames. It should also have two cleats nailed underneath to raise it an inch or so from the bench. This will permit frames to lie on the board supported by the wires. It will be noticed from the illustrations of the frames that the top-bar has a groove—in some frames two—on the underside.

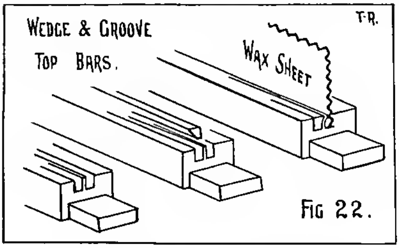


Fig. 22. Grooved Frames.

We are now ready to fasten the foundation. See that all wires are just right, not too tight, turn the frame upside down, and fit edge of foundation into the groove. A vessel of hot wax is required close at hand, also a spoon. Still holding the frame upside down, and tilted at a low grade, a little hot wax is poured along the angle formed by the top-bar and foundation. The wax when set will firmly cement the sheet to the top-bar. Special implements have been devised for this purpose but a tea-spoon is always at hand, and is convenient to use.

Frames that have two grooves (Fig. 22) do not require hot wax to fasten the foundation. A small wedge-shaped stick is supplied, the wax sheet is placed in the centre

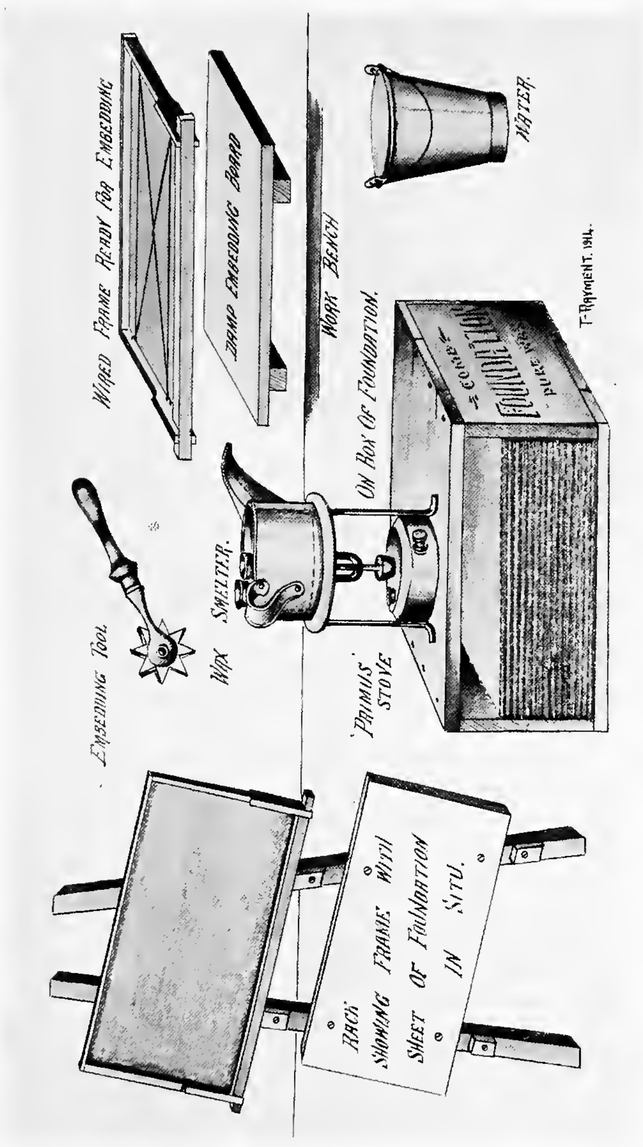


Fig. 23. How to fasten Foundation in Frames.

groove, and the wedged strip is then forced into the second slot, so that the thin intervening wood is jammed against the foundation, holding it securely in place.

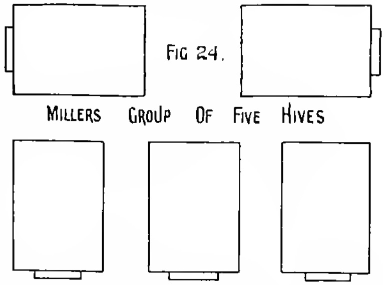
With the sheet of wax firmly attached to the top-bar, it is ready for the next operation. A word of caution is here necessary. Bees-wax, when heated, expands considerably. Now if a sheet of foundation is fastened into a frame in a cool temperature, it will certainly buckle and warp out of shape, when placed in the warm interior of the hive. To ensure nice, regular comb being built, foundation work should be performed in a heated room.

The frame—with the wax sheet down—is now laid on the board, and with a small serrated wheel (Fig. 23) the wire is embedded in the wax. To allow for stretching, the foundation should be trimmed ¼ of an inch short of the bottom bar. If the sheet of wax is **too hot** during the embedding process, it is liable to split between the wires when contracting in a cooler atmosphere. Where the foundation is handled in a temperature ranging between 90 and 95 degrees F., very little trouble is experienced. The completion of this operation renders the hive fit for occupancy by the bees.

ORDERLY ARRANGEMENT OF HIVES.

If we wish to make the arrangement of the apiary as orderly as possible, it is necessary to mark out the situations of the hives before the bees are housed therein. A hive, after the bees have accepted, and located it as their home, cannot be shifted or moved without causing a disturbance and loss of bees. A shift of one yard to right or left is sufficient to cause demoralisation. Hives of bees may, under certain conditions, be moved to fresh locations, but it requires experience and skill to do so without loss of bees and subsequent weakening of the colonies.

Circumstances surrounding the formation of the apiary, determine to a very large extent the plan or disposition of the hives. A study of the photographs reproduced in this work will show a predilection on the part of Australasian bee-keepers to lay out the hives in rows. The author prefers them in a straight line. It has been suggested that groups of 2, 3, or 5 colonies (Fig. 24) enable the bees to better locate the position of their home. Practical experience, however, shows the disadvantages of contiguous groups in dealing with an outbreak of disease. It is well known that disease among humans is more virulent in the congested areas, whereas the isolated residences of the rural provinces present less difficulty. This analogy may be applied to apiculture.



Where the hives are of the same colour and shape, with intervening spaces mathematically alike, more or less confusion will result. This is especially the case where the hives are crowded together. Reasoning from the above it will be seen that to have the greatest practicable distance between each hive is a very good rule to observe. With the position of each hive indicated by a peg or other mark, there is yet another matter to receive attention before the hive is placed on its site.

KEEPING WEEDS DOWN.

The practice of modern apiculture demands the entrance of the hive to be at the bottom, and it is in this position that it is most liable to become choked with weeds, grass, etc. It is a waste of bee life for the insects to crawl through a foot or so of long grass to reach the doorway. Sheep are splendid lawn mowers, but all apiarists are not sheep farmers. While sheep keep the grass down, they do not prevent the bottom of the hive from rotting where it comes in contact with the earth.

Salt overcomes the weeds, but it does not prevent decay. A good scheme is to mix a sufficient quantity of lime mortar and lay down an area of a yard square for each hive. This keeps down grass, and is dry, hard, and level for the hive to stand upon.

In the working of a bee-farm a large number of damaged tins accumulate, too dirty or rusty for use. Now these tins—kerosene tins will do—with the tops and bottoms removed, and the sides flattened out make very good hive stands. Use two of them to each hive, thus protecting them from damp, and choking of the entrance. Hives are now ready to receive the bees.

HOW TO STOCK UP.

There are as many ways of stocking a bee-farm as there are apiarists. Each one pursues a plan which he considers the best for his locality. The great majority of bee-farmers have grown into the business, and in a number of cases, the business has evolved from capturing a stray swarm hanging by the roadside. Some bee-keepers, located in good country, make a practice of hunting bees in the bush. The tree found is fallen, and a hole cut in to enable the brood-combs to be removed and transferred (See under that head) to frames which are then placed in a nucleus hive for the bees to cluster on. There are few bee-keepers that have not at one time or another secured an extra swarm by this means. This is all right if the bees are healthy.

Another plan—perhaps the most expensive one—is to simply order a few hives of Italian bees from some breeder, who will pack them as per diagram (Fig. 78) and guarantee safe arrival. All that is necessary is to remove the screens at the entrance and on top—after using a puff or so of smoke—and replace the ordinary cover.

Again, bees may be bought by the pound, delivered in a wire cloth cage. In this case the hive—containing frames of foundation—is placed on its site and a sheet of paper or other material is spread at the hive-front. The contents of the package are now dumped out on to the paper and the bees quickly enter the prepared hive.

If it is possible to catch the queen whilst the bees are marching in, it is a good opportunity to cut the royal mother's wings. If a honey flow is on, the bees in a short while will draw out the foundation into beautiful white comb, and after two or three days eggs will be found in the centre frames. This method of hiving should be selected when a stray swarm is brought home.

There is yet another way, and in the hands of a competent man is undoubtedly the cheapest one. Since the introduction of the Bee Diseases Act, a number of people prefer to dispose of their bees (in kerosene and other boxes) rather than incur the expense of a new frame-hive. When the buyer is capable of distinguishing disease, and possesses sufficient knowledge to transfer the bees to a patent hive, he should use this means to acquire a few stocks.

PACKING AND MOVING BOX HIVES.

This is perhaps a fitting place to describe the process of moving a stock in a box hive. After the bees are bought, they should be packed for removal. If the box is a sound one—very few are, about one per cent.—give a few puffs of smoke at the entrance after the bees have stopped flying at evening—or at any time if it is raining—and turn the open side upwards. If the journey is of short duration, a piece of cheese cloth over the (now) top secured to the edges of the box by four strips of wood will do very well. If the travelling is spread over a few days, wire gauze had better be substituted for the cloth. Make sure that the hives are carried with the cloth or gauze on top. The combs resting on their attachments instead of being suspended therefrom, will travel better in this position.

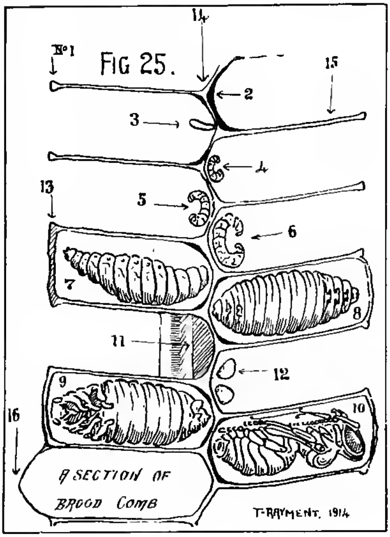
Should the box-hive have some crevices that permit bees to escape, adopt the old plan of putting the whole hive inside a sound chaff bag, and tying the mouth securely. Of course bees packed in this manner should be shifted in cool weather only. If the hives are to be carted in a horse drawn vehicle, see that the combs are **parallel with the axle**. If it is intended to transport them by railroad, the combs should be **parallel with the rails.** On arrival at the apiary, the box-hives should be placed on the selected sites, and opened up after sundown. They should be left undisturbed for a few days until the bees get accustomed to their new surroundings.

TRANSFERRING.

This little spell will also permit the aspiring apiarist to make preparations for the transferring operation. He will require a bucket containing water, and a cloth with which to keep his hands and tools free from honey; otherwise the poor bees will stick to everything and severely try the temper of the operator. Cleanliness and neatness are the secrets of successful transferring. A strong sharp table knife, hammer and chisel, also a few pieces of string, (long enough to reach twice from top to bottom bar of the Hoffman frames) and a case approximately the size of the box-hive should also be at hand. Of course the frames to which the combs are to be transferred should be wired and in readiness.

A board a little larger than the frames will be handy. If covered with a piece of hessian of double thickness it will make a rough cushion on which to lay the pieces of brood-comb. It is only brood—and worker-comb at that—which should be transferred. To begin, lift the box-hive to one side with the bottom up—this is best done during the middle of the day—and in its place set down the patent hive, the entrance of which should face the same direction as that of the box-hive. Place the spare inverted box over the colony and with two sticks drum quickly on the sides. This causes the bees to leave the combs and cluster at the top of the inverted box.

When this is accomplished, dump the cluster into the frame-hive, which should contain say five frames of foundation; the remainder of the frames should be simply wired to receive the transferred combs. With the bees out of the way, carry the box-hive into the honey-house, and proceed leisurely. With the hammer and chisel remove a portion of the box-hive, preferably at the side of the combs. This will reveal to the apiarist three varieties of comb, *i.e.*, worker (Fig. 25), drone, and storage-comb containing honey and some pollen. The honey-comb must be removed and treated at another time. The drone brood, which is easily recognisable because of the larger cells and high conical cappings (Fig. 25, No. 16), should be rejected.



This narrows down the material to be treated. The slabs of worker-comb should be lifted on to the hessian-covered board and a wired frame placed on the top. With a sharp knife mark out and cut the comb to make a tight fit inside the frame; it is also necessary to trace the wires with the knife and make an incision reaching to the midrib (Fig. 25, No. 14). The frame is now pressed down and the wires embedded in the comb with a spoon handle or chisel. Previous to laying the comb on the hessian, two or three pieces of string should have been laid across, and after the comb is squeezed into the frame the string should be brought together over the top and tied. The frames should then be given to the bees. The string is to support the combs until the bees fasten them, which they will do in a day or so, when the string may be removed. **Do not attempt to transfer combs containing honey.**

Under favourable conditions there is a less troublesome way. After the bees in the box-hive have settled down, select a hive-body containing frames of foundation and inverting the box-hive simply place the body over it. As the colony expands the bees will draw out the foundation and the queen will occupy the new combs. In three weeks all the brood will have hatched in the box-hive, which may now be removed. In many cases the bees remove the honey and store it in the new hive, and all that remains is some old dry comb, suitable only for rendering into wax. The foregoing are the plans for transferring most generally in use. The budding apiarist will be surprised at the celerity and neatness of the bees in effecting repairs to combs so transposed. The bees now housed in a workable hive and busily engaged on a flow of honey—bees should not be transferred unless there is honey enough gathered to enable them to build comb—require no further attention for a day or so.

MANIPULATING FRAMES.

OPENING HIVES.

Seven or eight days after the bees were hived on the frames it will be necessary to look over the colony and see that everything is progressing satisfactorily. The string used to support the combs during transfer may now be removed. But before this be accomplished, a word or two here regarding the proper method of opening a frame hive may not be out of place. Wait until the smoker is in a fit condition to discharge a good volume of smoke—not that it is necessary to use a large quantity, but it is advisable to have plenty in reserve in case of accident.

Approach the hive in a deliberate manner, give one or two puffs at the entrance, then raise the lid—without jerking or jarring it—and puff a little smoke over the tops of the frames. There is no occasion to overdo it; two or three puffs are quite sufficient under ordinary circumstances. Keep a sharp lookout, and when the bees show a disposition to "form line" along the top bars, it is time to give some more smoke. Too much demoralises the insects and renders all operations much more difficult.

There is a golden rule in regard to handling frames: always remember to keep the combs on edge, and handle them in that position. If combs are carried on the flat—*i.e.* like a tea tray—an accident is almost certain to occur; should the weather be at all warm, and the combs heavy with new honey, they will assuredly fall out of the frame. If this should happen once or twice, it will be perhaps the best reminder to the novice always to handle combs on edge. All work should be carried out with deliberation. The movements of the hands should be free and sure. Avoid all jerky movements.

To remove a particular frame, press the adjoining ones a little to each side, thus creating a space sufficient to withdraw the desired frame without killing bees, and perhaps fatally injuring the royal mother.

The apiarist is now in a position to study the formation of the comb and the development of the bee. The frames of foundation will, by this time, be drawn out into beautiful white comb of virgin purity, and some cells will contain a little honey, others small deposits of pollen (See Fig. 25, No. 12). Should the colony be both numerous and industrious, tiny eggs may be observed in some of the new combs. On account of the similarity in colour, the eggs (Fig. 25, No. 3) are harder to discern in new white comb than in the old black transferred ones. The colour of the comb—after the first hatching of brood—constantly darkens until the familiar blackish tint is acquired. Cheshire specifies the larval excrement (Fig. 25, No. 2) as the cause of the discoloration. A reference to the diagram will show the manner of comb structure and larval development. The architectural abilities of bees have attracted the attention of numerous scientists, Maraldi, Huber, Réaumur, and many others.

The body of the bee has, on the under side, six wax "pockets" or plates. Under certain conditions, *e.g.*, when the colony of bees is engaged upon a flow of honey, a minute quantity of translucent liquid exudes from the wax plates, and immediately "hardens to a scale." This then, is beeswax. It is white at first, but gradually assumes a darker tint. The little builders gather up the wax scales and "pinch" them into position on the growing comb. It is a strange thing this forming of the waxen cells. The conditions necessary for the formation of wax closely approximate those successfully used to fatten various kinds of domestic stock: plenitude of food, equable warmth, partial darkness, and quietness. The swarm of gorged insects clustered tightly together to conserve the heat, hang quietly from a twig elaborating in their peculiar manner the structure of their home. Fig. 76 depicts the manner in which bees alter the pattern of the comb. The transition from "worker" to drone cells is clearly shown.

BROOD COMB.

On examining a piece of black comb from a populous colony a close scrutiny of the cells will reveal a number of tiny eggs. They appear as white specks, something like a small piece of white cotton thread stuck on end in the bottom of the cell (Fig. 25, No. 3). A good prolific queen is capable of producing many hundreds, even thousands of eggs per day during the middle of the warm months.

If we inspect the comb in three days' time the eggs will have hatched, and in the bottom of the cells are small white grubs (Fig. 25, No. 4) or larvæ surrounded by a milky-looking food. The larvæ are curled in a fashion resembling the letter C (Fig. 25, No. 5). They retain this position whilst growing until the seventh day (in the case of the worker bee) when each grub extends itself the length of its cell (Fig. 25, No. 7). About this time the nurse bees seal it up (Fig. 25, No. 13). The larva then spins the cocoon, and enters upon the wonderful transition from larva to chrysalis (Fig. 25, Nos. 8, 9, 10). In twenty or twenty-one days from the time the egg was laid, the perfect insect worker will cut her way out through the capping of the cell. The development of the drone takes twenty-five days from the laying of the egg.

The queen, the only perfectly developed female in the hive, occupies a much shorter period in reaching maturity (See under head "Queen Rearing," page 109). The royal mother is ready to hatch from the cell on the 16th day.

COMB OR EXTRACTED HONEY.

If the supply of pollen and honey still continues plentiful, the queen will very soon fill the whole of the eight or ten frames with eggs and brood in varying stages of progress, and cells along the top-bar will be swelled out with new honey. This is the signal for the apiarist to supply more room.

The bee-keeper will now have to decide whether he intends to produce comb or extracted-honey. If he lives in a district capable of producing heavy flows with nice white wax, he may possibly find a ready market for all the comb he could harvest. He should demand a much better price for his comb-honey because it costs more to produce, and he is also disposing of the wax.

It undoubtedly requires more skill to produce a good sample of comb-honey, and the necessary plant is of a more costly nature. When produced, the frail nature of the comb renders it very subject to damage during transit over long distances to the metropolis. Comb-honey in 1lb. sections is sold in the cities of Australasia in limited quantities at 1/- per lb., but the producer can obtain only about 6/- or 7/- per dozen. At this price there is more money in working for extracted-honey, and the bee-farmers of Australasia mostly produce this class. However, we will describe both systems, giving extracted-honey pride of place.

EXTRACTED-HONEY.

WORKING FOR EXTRACTED-HONEY.

Extracted-honey is produced mostly in frames, similar in every respect to the brood-frames, with this exception, they **rarely** have brood reared in them. In some instances "Bolton" or half-bodies are used. But it is preferable to have only one size of frame in use.

It at times happens that among the hives purchased from other apiarists, some are not uniform with the equipment in use. The frames are sometimes the correct size, but the supers may be larger. A satisfactory way of using odd-sized bodies is shown in Fig. 26. The "overhang" of the super, of course, leaves an opening on each side. These should be closed with two slats ½ an inch thick as shown. When fitted thus the supers fit very snug on the brood-chambers. In fact some bee-farmers perfer these large supers and they form part of the ordinary plant. However, the sketch may suggest the use of bodies that would otherwise be idle.

When the bees begin to swell the brood-combs as already described, it is time to give the extracting-super, or extra hive-body. It is simply a body of frames exactly the same as the brood-chamber. Therefore, from now on, it will be distinguished from the brood-chamber by the term comb-super, or extracting-super, as circumstances require.

After providing a body of frames containing foundation, simply remove the lid of the hive, adjust the super, and replace the cover. Usually, the colony—if strong enough—will take possession of the upper storey at once, and start to draw out the foundation. There are odd times when the bees refuse to do this. In such case remove from the brood-nest a comb of brood and place it in the centre of the super; make room for this frame by removing one of foundation and placing same in the brood-chamber. This will overcome the difficulty.

The frames adjoining the brood-comb in the super will be the first drawn. By judiciously shifting the

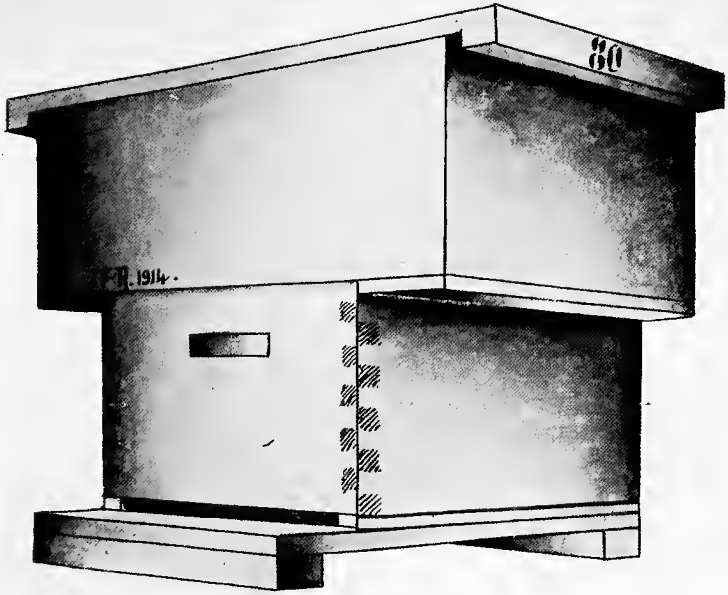


Fig. 26. An "odd size" Super.

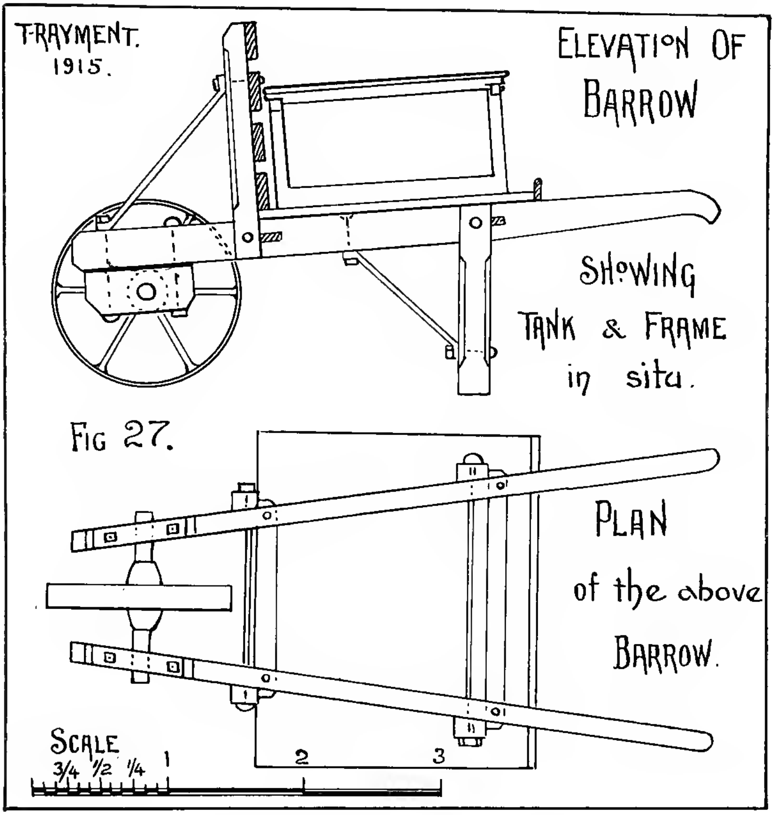
newly drawn combs to the sides of the super and placing the foundation close to the brood, the whole of the super will very soon contain all nice white comb fit to store the best of honey.

As the season advances, the super-combs will soon be filled; and with white capping showing along the top-bars of the frames. The apiarist will require to exercise some discretion as to when the honey is ripe enough to extract. Coastal districts, especially the areas carrying dense forest growth, are remarkable for the dampness of the atmosphere. Where the apiarist is so situated, he will find it a very safe plan to permit the capping of the honey to entend over the entire comb-face before removing it from the hives. Even then, the honey "in the wet districts" is of a rather thin character; in fact it is almost impossible to attain the density of honey gathered from inland and central districts.

The top of the hive is, of course, the warmest place, and so the honey placed there ripens first. Hence we see the cappings along the tops of the frames advancing slowly toward the bottom-bars. Nectar, when first gathered from the flowers is very thin, and requires the heat of the hive for some little time to thoroughly ripen it, so that it will keep without fermenting. In very dry and hot localities the nectar ripens quickly, and the combs are ready to extract when the capping covers approximately half the comb-face.

There are machines on the market for ripening honey, but the majority of bee-keepers leave the honey on the hives in preference to the artificial process. At times the honey-flow is so heavy that the super is soon filled with unsealed honey. If the bee-farmer now neglects to supply further storage room the bees will almost invariably store honey in the brood-combs and crowd the queen for egg room. (This is the prime cause of swarming at any season of the year). It also causes the bees to build a number of burr combs on the tops, sides, and bottoms of frames, making their removal a test of patience. Should the bees fill the super before any of the honey is ripe it is advisable to furnish yet another hive-body of foundation.

After opening the hive remove every second super-comb of honey, and substitute frames of foundation. The extra body, or super No. 2, is now placed on top, and the combs and frames of foundation alternated as in super No. 1. This makes the colony three stories high. By working on these lines, the bees are supplied with plenty of room and their energies are turned to comb-building instead of making wax-burrs and struts all over the frames. It permits natural ripening of the honey, and is also somewhat of a factor in controlling the swarming propensity. All the benefits enumerated above



will apply with double force when the apiarist has supers of drawn comb on hand to take the place of the foundation.

TOOLS FOR TAKING OFF HONEY.

When sufficient honey is ripened to justify its removal, select a bright, warm day, and get everything in readiness. The operator will require a brush, or possibly he may prefer to use a small twig of wattle leaves. A bunch of tea-tree, or even a handful of grass tied together may be pressed into service as a bee-brush. Where the number of colonies is limited to three or four, a small tin box (holding five frames of comb) called a comb-carrier is convenient to hold the honey as it is removed from the hives. Where the combs of a large bee-farm are to be extracted, the tin box is manifestly inadequate.

A tank, or box, on a wheel-barrow (See Fig. 27) will be required. One or two apiarists have tram lines traversing the apiary, and trucks containing a number of slides suitable for holding the frames are used for carrying the full combs to the extractor. The most popular way of working is with a wheel-barrow and a suitable box. Many bee-farmers take off the entire super, stand it in front of the hive for the bees to crawl back, and load up the barrow. Of course the combs may be taken from the hive per medium of the Bee-escape (See Fig. 10, also "Comb-honey"), but to be effective, the escape must be put on the hive overnight to give the bees time to go down out of the super. If by any chance there should be brood in the super-combs **the bees will not leave**, and the labour of placing the escapes is of no value.

In practical work on a bee-farm, it is almost the rule to find brood in the supers (at least on those bee-farms that permit the queen to range over the entire comb-face). Apiarists using Bolton hives, lift off the shallow super and dump it on the ground until all the bees are jarred out. The chief objection to this style is the damage to combs and frames. It is nevertheless a rapid way of taking off honey.

BARROW TANK.

Fig. 27 represents one method of working with a barrow and a galvanised iron tank 36 inches long by 20 inches wide by 12 inches deep. Two strap irons are passed under the tank. On the inside, ½ an inch from the top, two pieces of wood 36 inches by 3 inches by 1 inch are bolted to the irons to form a rabbet on which the frames rest. A small gate should be soldered near the bottom, to drain the tank as a certain amount of "drip" accumulates. It is better to have the drip in the tank than a sticky mess on the honey-house floor.

ROBBER-CLOTH.

To prevent unnecessary exposure of the combs, the top of the tank should be covered with a robber-cloth. This is easily made, and saves considerable inconvenience. Procure sufficient unbleached calico to cover top of the tank and to hang 5 or 6 inches over the sides; hand this over to the womenfolk to turn a hem all round. On two sides a smaller hem will do; on the other ends the turns should be sufficiently large to allow two sticks to be pushed through. Pour about ¼ of a lb. of shot into each of the narrow hems and the cloth is complete. Made according to the above directions, the cloth will hang over the tank very neatly even in a strong breeze, and prevent the bees getting a taste of forbidden sweets. The careful apiarist should regard all honey after removal from the hive as contraband. (See Box-hives, page 22, Robbers, page 135, and Bee Diseases, page 153).

WHEEL BARROW.

The structure of the barrow in the illustration is apparent. Many prefer the flat tray style. It carries the barrow tank whilst extracting; with a load of 4 tins it is easily wheeled, and will also carry 2 to 4 hives of bees when packed for travel. No other style of barrow is so adaptable to the needs of a bee-farm. With the smoker, hive tool, and brush conveniently to hand, the hive should be opened as already directed.

SHAKING BEES OFF COMBS.

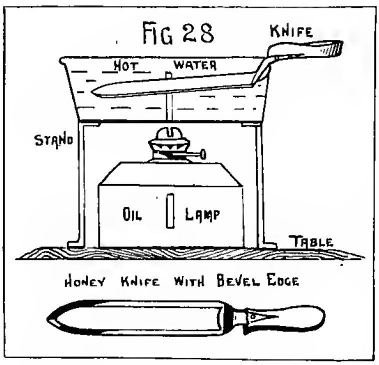
Select combs, capped sufficiently, and hold them with the palms of the hands on the side bars just below the lugs, the thumbs being passed over the top bar; this gives a very secure hold. Raise the frame 9 or 10 inches above the hive, and with a short sharp jerk downwards dislodge the bees into the super. Italians are harder to shake off the comb than any other bees; blacks are the easiest. A few bees may probably remain on the combs, but these are gently swept off with the brush or twig. Lift up the robber-cloth and place the comb in the tank. If some spare empty combs are on hand these should take the place of the full ones.

If the flow is very heavy, it is certainly an advantage to place a sheet of foundation in the centre of the super, when extracted combs are returned to the hive. The bees will be gorged with honey after cleaning up the wet combs, and the resultant wax will be used in drawing out the foundation. If no spare combs are available to replace the full ones, leave one or two hives without combs for the day, giving them back at night.

There is a rule that must on no account be broken. **If disease is present or suspected, each comb must infallibly be returned to the hive it came out of.** If this rule is not rigidly observed, the first step toward failure is already taken.

When the tank is full (it usually takes about 3 hives to provide sufficient ripe combs) it is wheeled into the honey-house ready for the extracting operator. The actual extracting of the combs necessitates the use of certain machinery adapted to that purpose.

UNCAPPING-KNIFE.



"Bingham" Uncapping Knife.

After the combs of honey are received into the honey-house and before they are placed in the extractor, it is essential that the cappings be removed. There is a special tool (Fig. 28) for this purpose known as the uncapping-knife; it is made on the heavy side to retain the heat, and the edges are bevelled to form a very keen cutting implement. To do nice work the knife should be very sharp, clean, and hot. Bee-keepers in a small way keep the knife heated in a shallow pan of water over a kerosene lamp. For more extensive operations there is a steam-heated knife. It is decidedly an advantage to work with two knives when relying on hot water to heat them; for one is getting hot while the other is in use. With the steam knife, the temperature is maintained and supplied to the blade—which is hollow—through a rubber tube connected with a small boiler.

UNCAPPING-CAN.

Until recently, all bee-keepers uncapped the combs over an uncapping-box or tank. A large number still use the uncapping-can illustrated in Fig. 29. It is really two cans, one fitting on top of the other. The upper part has wire cloth soldered over the bottom and a wooden bar fastened across the top. It has a sharp spike projecting upward, on which to rest the end-bars of the frames. The lower portion is cone-shaped on the bottom, with a honey-gate soldered in such a way that it drains off the honey from the cappings rather conveniently. The addition of handles renders it much easier to lift about. If the honey-house is of the one-floor type, it will be necessary to raise the can high enough to allow a vessel to stand under the gate. An alternative is to sink a "well" or hole in the floor, to accommodate the tin or bucket. If the extracting is conducted on the second floor of the honey-house, the uncapping-can is

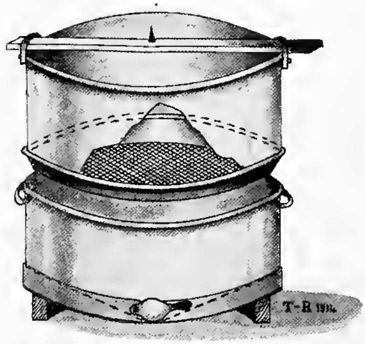


Fig. 29. Uncapping Can.

placed directly over a pipe, conducting the honey into the tanks on the ground floor.

UNCAPPING COMBS.

The comb should be lifted from the barrow and with the end-bar resting on the point—the left hand supporting the comb by the other end-bar—it is ready to uncap. The knife has two edges, and it is a good practice to get into the habit of using both. The majority of apiarists use but one edge. In using one side of the knife tilt the top of the comb forward and start cutting from the bottom; as the knife reaches the top the whole sheet of cappings will fall clear of the comb. When the combs are built in Bolton frames, the knife will go clear to the top in one sweep, but with the combs in Langstroth or Hoffman frames it is necessary to give the knife a zigzag motion.

When very old combs are to be uncapped, the "sawing" backward and forward of the knife becomes imperative in order to secure a "drawing" cut. The amount of comb to be removed at each uncapping is entirely within the control of the apiarist. Full, bulged combs are the easiest to handle, and it has been found a good practice to have a greater space between the super-combs than between those in the brood-nest. In the brood-chamber the Hoffman frames when touching one another are spaced exactly right to conserve the heat. The backs of the bees clustered over the faces of adjoining brood-combs just touch one another; this prevents any cold air circulating between the combs to the detriment of the brood.

In the extracting super there is no occasion to have the combs so spaced. In actual working close spacing of super-combs results in a number of depressed places difficult to uncap without gouging into the comb, destroying the even face, and wasting time. During extracting use seven frames in eight-frame supers; this gives nice "fat" combs, easily uncapped. While some remove considerable honey with the cappings, the combs are returned to the hives as flat as a board. A quantity of honey drains from the top compartment of the uncapping can, but a considerable amount remains in the cappings. After they have drained for a while, they should be removed and placed in the press illustrated in Fig. 73. Gentle pressure should be applied for a considerable space of time to secure reasonably dry wax.

In the busy season one cannot leave urgent and important work to press cappings and afterwards melt them into wax cakes, consequently the honey-house becomes choked with tins of cappings waiting treatment. In seasons when the honey candies quickly, the cappings and the honey remaining in them must be attended to at once, otherwise the honey and wax set into a hard mass from which it is next to impossible to separate them.

UNCAPPING MACHINES AND DEVICES.

To overcome the difficulties enumerated, a number of apiarists have contrived various ingenious methods for automatically separating the honey from the cappings. The author has used two of the machines invented in Australia, and after three years' use can give them the heartiest approval. The principle of the "Beuhne" Cappings Device is illustrated in Fig. 30. It is composed of a hollow tank on two sides and bottom. The "grid"—a series of angular pipes separated from each other by ⅛ of an inch—connects the sides at the top. The inside of the tank under the grid is fitted with a drawer, on the front of which are two tubes, one for honey and the other for wax. The wax outlet is at the top of the drawer, and that of the honey situated at the bottom.

The positions of the outlet tubes are determined by the difference in the specific gravity of honey, wax, and "slumgum" or refuse. The wax is lightest, honey heaviest, and the refuse strikes the happy mean. The tube at the bottom of the drawer has an extra pipe, shaped like an elbow, fitted rather tightly, yet capable of performing a complete circle. The three-cornered tubes, of course, present a large heating surface. To operate the machine, fill the tank with water which is kept heated to boiling point by a kerosene stove. A glance at the illustrations will show how the knives are heated.

The combs are rested over the grid in the same manner as when using the uncapping-can, and the cappings and honey fall from the knife on to the hot pipes; if the frames are not tilted at the top the cappings will cling

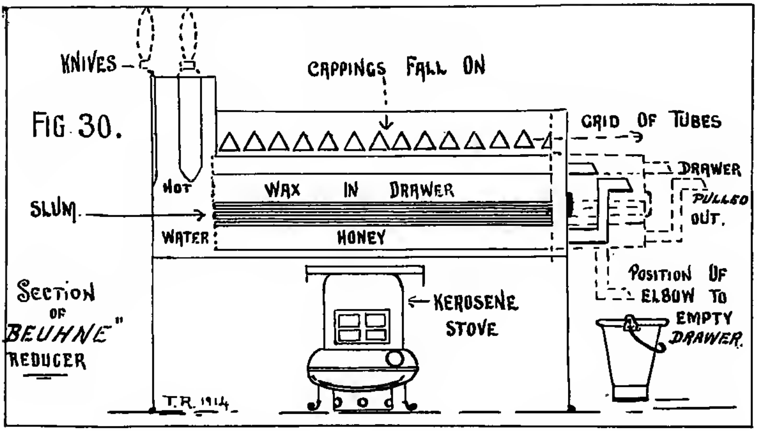


FIG. 30.

to the combs and severely try the patience. The wax is quickly melted, and with the honey falls through the interstices into the drawer. A little honey should previously be poured into the drawer to prevent the first wax from clogging the honey outlet.

The automatic separation of honey and wax is accomplished by manipulating the elbow. This, when in an upright position, almost reaches the level of the wax tube, and the height of the honey level in the drawer is governed by the position of the elbow, consequently since the wax is on top of the honey it is forced to flow out of the upper tube. When refuse begins to flow from the wax tube the elbow is lowered. To empty the drawer of honey the elbow is turned downwards, but it must be raised immediately the refuse starts to run. When

Fig. 31. Beuhne Device in Operation.

the machine is cold the drawer is pulled out and the cake of slumgum or refuse is removed.

The saving effected by the cappings-melters is so great that in a little while their use must become universal wherever extracted-honey is produced. It is the only way of saving **every drop** of honey in the cappings. It is more workmanlike to have the wax in nice marketable shape when evening arrives; look at the time saved in

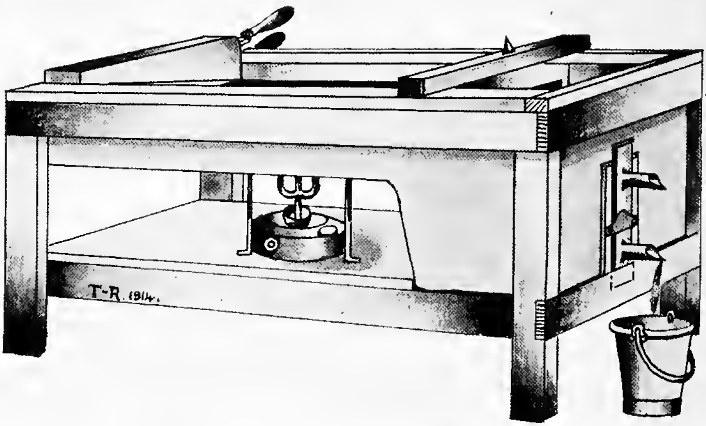
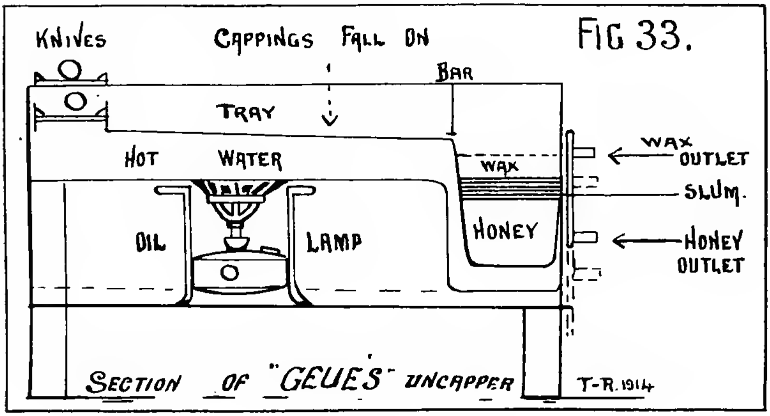


Fig. 32. "Geue's" Uncapper.

"grubbing" cappings out of the can, storing them in tins or boxes, and finally pressing and melting.

Fig 32 will explain "Geue's Uncapper." It is simply a hollow tray depressed at one end to form a "well"; the top of the tray on which the cappings fall is on a slight incline to the depression. A bar at the lowest end of the tray has a space under it to permit the passage of melted wax and heated honey, but also acts as a barrier to any large pieces of comb. The hollow tray is filled with water and heated with a primus stove. This apparatus, like the "Beuhne," also heats the honey-knives.

The separation of honey from the wax takes place in the well, to which is attached a metal slide fitted with two tubes; by raising this slide (Fig. 33) honey will flow, the reverse action permitting the egress of hot wax. Since both tubes are on a perpendicular line, it is inconvenient to have honey and wax running at one time, whereas the "Beuhne" device is very handy in this respect. A cappings-melter will handle all odd pieces of comb containing honey, and especially are they convenient for melting the honey-comb from box hives, or that taken from bee trees.



DRAINING TANK.

As the uncapping proceeds it is advisable to have some sort of a contrivance to hold the combs before placing them in the extractor. Very often the persons uncapping get away ahead of the extractor, and while the combs are waiting to be extracted the constant dripping makes a nasty sticky mess on the floor. To overcome this nuisance the author constructed a tank called a Drainer (Fig. 34). It is six feet in length, and the top is contracted to allow the frames to hang in nicely. It is made of galvanised iron, and the bottom sloped to the centre. A two-inch honey-gate is soldered in one end, and the whole tank is supported and reinforced by a strong wooden frame. The illustration makes its construction very clear.

Just above the honey-gate the reader will notice a dotted line. Before the cappings-melters came under the notice of the bee-keeping world, a wooden rack covered with strong wire mesh rested in the tank on a level with the dotted line, and when so fitted made a very fine uncapping-tank. Apart from the "melters" this is

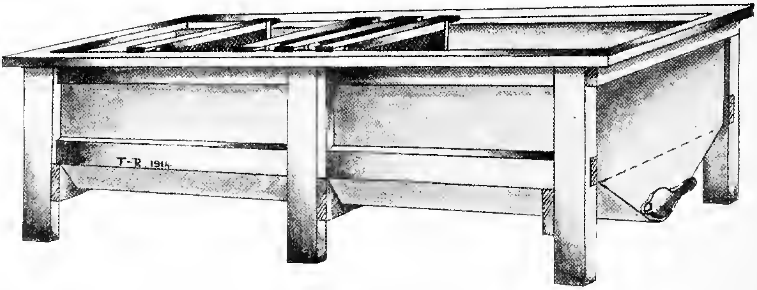


Fig. 34. Draining Tank.

the most convenient arrangement. Now having uncapped enough combs and learnt something about how to manage the knife, the next step is to the extractor.

HAND EXTRACTORS.

The honey-extractor, like the bicycle, having passed through a period of evolution, has reached a stage where it is extremely difficult to suggest any further reduction or addition to its structure. The extractors in general use vary somewhat in the details, but the principle of centrifugal force is adopted by all makers. The machines are constructed in various capacities from 2 to 8 frames, and even larger sizes than these are used in America.

For small apiaries—up to fifty colonies—the two-frame extractor (Fig. 35) will accomplish the work easily. These small machines are built on the same lines as the larger ones. A reel working on a pivot in the bottom of the can or tank, is attached at the top to a pair of bevelled cog wheels set up on a strong cross-arm of channelled steel. These gear wheels are operated by a handle situated on the end of the spindle at the side of the tank. Two wire cloth pockets or baskets are hung on the reel at the top and bottom; the hinge adjustment permits the baskets to swing with the action of a house door. With a convenient gate to permit all honey to be drawn off as extracted, the machine is very efficient.

When the uncapped combs are placed in the baskets—which are strongly stayed to withstand the strain—the reel is rotated until the honey ceases to splash out against the sides of the tank. Thin honey leaves the combs very readily, simply "raining" out; the denser honeys of the inland districts require much more turning to make a good dry job of the combs. The reel is then slowed down and the baskets reversed to allow the opposite side of the combs to face outwards, for only the outsides of the combs are extracted. If new combs are handled for the first time some extra care is required in turning. When the apiarist has broken a few combs he will see the urgency of having all frames well wired. Extracting is rather pleasant work if the weather is nice and warm, but if the temperature is too low the honey clogs the combs, and sometimes they adhere so tightly to the wire cloth as to prevent their easy removal. It is worse than useless to grip with both hands and pull, the frame simply comes away leaving a mashed-up lot of wax in the baskets. Should the combs stick in this manner, simply reverse the pockets and turn gently until the combs "let go." Very often combs are cracked in the process, but the bees very soon attend to the damage.

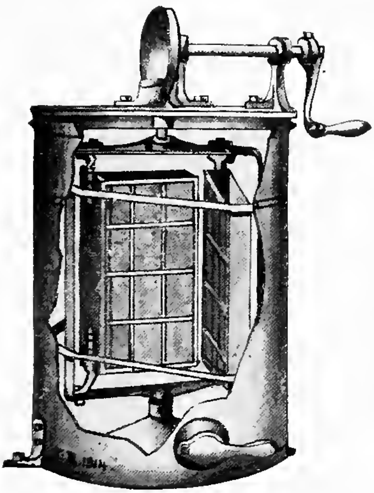


Fig. 35. Small Hand-extractor.

Heather-honey—gathered in Scotland and also on the Continent—will leave the comb retaining its cell-like form; this jelly-like consistency militates against its removal from the combs with the centrifugal extractor, and Scottish apiarists handle it with a specially constructed press. Australasian bee-keepers fortunately have little difficulty with the honey of the native plants, though some seasons the dark nectar secreted by the tea-tree (*L. lanigerum*) will refuse to leave the comb except for a few small pieces the size and shape of the cells. When the apiary is situated near considerable areas of tea-tree the trouble becomes acute. (See under head of "Honey.").

POWER EXTRACTORS.

Where the produce of the apiary runs into tons of honey per annum, the power-driven extractors become a necessity. The large machines are very strongly made, and the reel carrying the baskets is suspended from ball-bearings located just under the geared cogs. The band brake and slip gear are illustrated in Fig. 37. The extractors (Fig. 36) manufactured by the Root Co. of U.S.A., are remarkable for a unique and simple method of reversing instantaneously the four, six, or eight baskets of the various machines. As stated above, the reel is worked on a ball-race, and a band brake is attached to the top of the reel. Each of the baskets have what is practically half a cog wheel on the top of the hinge, and an arm connected to the centre of the reel extends over the hinge. The underside of this arm directly over the half-cog is in mesh with it. The arm is pivoted midway to the reel, and after speeding up, a pressure on the brake lever causes the arms to move to the right or left as the case may be, and so reverses the baskets without stopping the machine.

The slip gear is modelled after the free-wheel of the bicycle. When speeded up a lever is pulled down, which forces the bevelled driving cogs out of gear, permitting the reel to run "free-wheel" on the ball bearings. The large-sized honey-extractors are rather too heavy for hand-power, and the low cost of working an oil engine of ½ H.P. is the determinating factor in the popularity of this source of power.

In placing combs in the extractor the top-bar of the frame should be next to the hinge of the baskets. Some of the early machines were rather troublesome on account of the periphery of the reel running too close to the sides of the tank, so that when extracting very dense

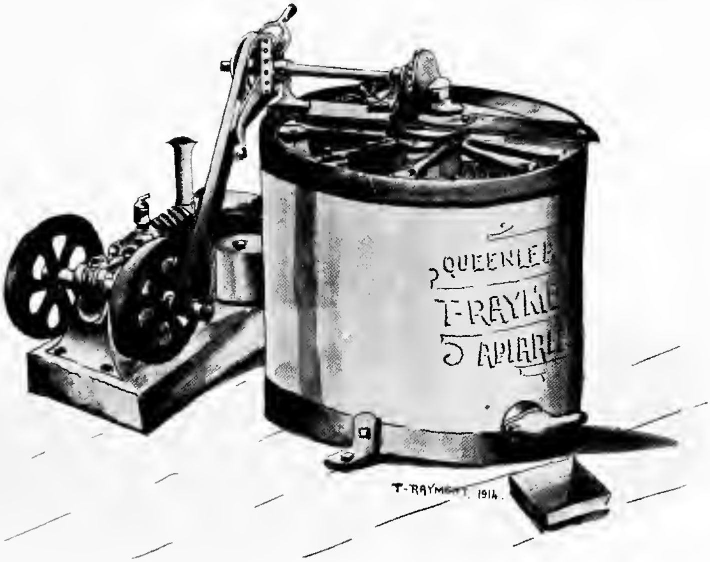
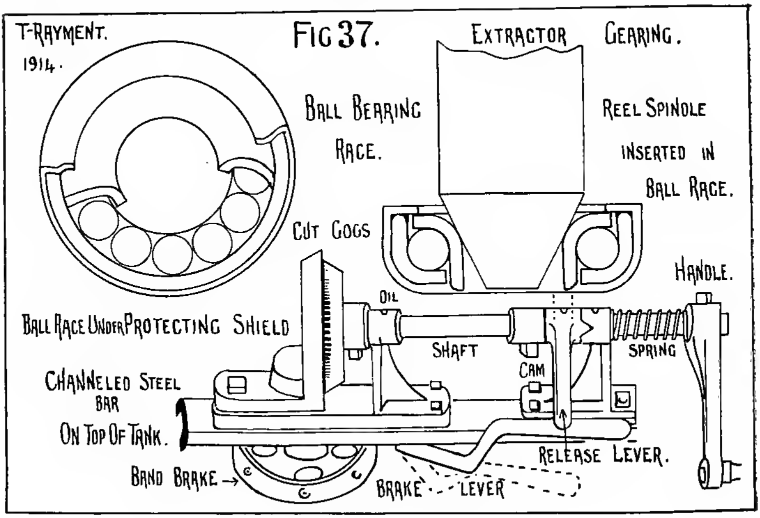


Fig. 36. Power Extractor.

honey the reel would "boggle" against the thick cords on the can. Some of the honey gathered from the Eucalypts is so dense that it stands out on the sides of the tank in ropes—perhaps an inch in thickness—which take a considerable time to reach the bottom.

All honey-extractors—hand or power—require to be very firmly bolted down. If the honey-tanks are on a lower level and the gate of the extractor is over a hole in the floor, there will be no difficulty. When all the work is performed on one level, a "well" or "box" must be under the gate to accommodate the bucket for drawing off the honey. The small two-frame extractors may be securely fastened to a solid block of wood sunk into the floor; in this case the block should be high enough to take a vessel of some sort under the gate.

To have the honey-tanks situated under the extractor saves a vast amount of manual labour. The physical effort required to lift a large crop from the honey-gate to the storage tanks per medium of a bucket becomes exhausting. Whenever practicable the tanks should be filled by some scheme of gravitation.



HONEY-TANKS.

Hardly two bee-farmers are alike in the matter of honey-tanks. A large number favour a pattern similar to the draining tank; others again, use a square tank, constructed of plate iron riveted at the corners. These latter before filling are brushed over the inside with hot beeswax. The tank generally preferred is illustrated in Fig. 38. It is made of heavy gauge tinned steel with a cone bottom and a 3 inch honey-gate. The large cover remains on during the progress of the extracting, but the smaller lid is taken off to allow the bucket to drain. When two buckets are in use, one is left thus while the other is filling. When the tanks are full, the small cover is replaced, and the honey left to clear.

This takes two or three days, at the end of which time lift off the main cover and remove the scum. This is comprised of small particles of wax, pollen, and also air bubbles that have been forced through the honey during extraction. After the froth is disposed of the honey

Fig. 38. Honey Tank.

should be run into 60lb. tins, and after branding to indicate the source of flavour, stored away until selling time comes round. (See "Preparing Honey for Sale," page 190). Before attempting to enter upon a detailed examination of how comb-honey is produced, it is necessary to point out that while occupied with the extracting, other important work has been going on.

WORKING TO INCREASE.

NATURAL AND ARTIFICIAL INCREASE.

As the hives breed up towards late spring, opportunities arise that make increase of colonies very desirable. In overhauling the combs signs of swarming are apparent. The colonies have built a number of queen-cells, and the royal mother begins to lay fewer eggs in order to gradually contract the ovaries sufficiently to enable her to fly with the swarm. Here is then a favourable chance to utilise the young queens that will soon hatch out of the peanut-shaped cells. If the colonies are permitted to cast natural swarms, these would, of course, make some extra colonies. Normally there are several queen-cells built and if only two queens are saved it is a serious economic waste to allow the surplus to be destroyed. Now do not imagine from this that **all** cells so built should, or could be saved, for they can not. If the colony has proved itself a good honey gathering strain, quiet, peaceable to handle, and free from disease, then an effort should be put forth to save all the cells if they are large and strong. A good plan is to get a queen-excluder (Fig. 57A), and an extra hive-body containing frames of foundation. Excluders are generally made from a sheet of zinc, with perforations just large enough to give worker-bees free passage through, but effectually debarring queens and drones. Some excluders are made of wire.

Lift gently from its bottom board the hive containing the queen-cells, which should never be jarred or shaken, and let the body of foundation take its place. Select from the brood-combs one containing unsealed larvæ and eggs, then catch the queen and put her on this comb. If queen-cells are built on this comb they must be removed with a warm penknife and carefully attached to the other frames; no cells should be placed in the body containing the foundation. The excluder is now placed on top and the supers tiered up, the brood-nest containing the cells surmounting the whole. Replace the cover and leave until the cells are almost ready to hatch. (See "Queen Rearing," page 109). If using eight-frame hives, there should be about seven frames in the super with 7 or 8 nice ripe queen-cells.

When larger increase is desired, start seven new colonies with these frames of brood. There will be required the requisite new hives or nuclei boxes (See Fig. 55), and have two "fat" combs of honey and pollen in each, spaced wide enough apart to receive—later on—the brood comb with its ripe queen-cell. Place these prepared hives or nuclei on the stands it is intended they should occupy, close the entrance with wire gauze so that no bees can escape and have the lid handy at the side.

Towards evening get the smoker and one of the brood-frames with queen-cell and adhering bees, and place it in hive or nucleus, close the lid securely and leave strictly alone for 2 or 3 days, at the expiration of which the entrance may be opened at nightfall. The queen will have hatched during the interval and there is nothing like a newly hatched queen to make bees stay in a new position. This plan requires fairly warm weather to make it entirely successful.

If only half the increase is desired use two frames of brood in each new colony or nucleus. Sometimes it becomes necessary to double the number of hives in a yard, and when this happens, all that is required is to lift off the treated brood-nest of seven combs, removing all queen-cells except one or two large ripe ones, and place it on a bottom board on a fresh site. If this is attended to during the heavy flight of the day very few bees will return to the old stand, because they are nearly all young bees who have never fixed the location. As an extra precaution stuff up the entrance tightly with grass to confine the bees for a day or so. The plan of increase mapped out above will work very well when the weather is warm and bright, with honey and pollen in abundance.

If these conditions are absent no increase of hives or any queen-rearing operations should be attempted. This question of increase is the cause of more failure than any other item in apiculture. There are as many ways of increasing as there are apiarists, and to the **seasoned** expert they are all safe and sure; to the novice there is no safe plan, and here is a word of advice to the beginner. For the first year or two make no more increase than what the bees compel; in a great many instances the natural gain will be more than the novice can well attend to. Go in for honey, and see how many bees you can get into one hive, not how many hives you can populate.

IMPORTANCE OF SPRING WORK.

That the work performed in the spring has a pronounced effect upon the earning power of the apiary is a fact that few would dispute. Of necessity the various manipulations must be modified to suit existing circumstances, but there is always certain routine work that must be carried out.

For instance, on a nice sunny day, look over the hives, and if any are damp change them for dry ones; examine the covers also: some may require repairs, and painting. Go over the underneath of the bottom boards with warm tar: it preserves the wood, and acts as a mild disinfectant. Hives that have fallen "out of square" should be levelled up. This will save ungainly combs. Avoid too much opening of the colonies in early spring. Clean up the supers, cut out all misshapen combs, and have them all ready for use in case of an early flow.

When the weather becomes more settled, it is time to overhaul the brood-nest and look out for the queen; note her age, and if too old, mark her for removal. Clip all queens' wings, and cut out drone comb early, otherwise it will only be rebuilt drone pattern. If queen-rearing is carried on, it is well to select the drones and give them a little extra attention. If any further hive supers or frames, etc., are likely to be in demand, do not wait for the swarming season to arrive before securing them.

Clean up the honey-house; do not leave it until the honey flow is upon you and "time is honey." Do all you can now and save yourself for the busiest time. Leave everything just right, so that the work may be accomplished in ease and comfort, with a maximum of profit and a minimum of labour.

Before leaving the spring work in the apiary do not forget the importance of the food supply. While comparatively small demands are made on the stores during the winter, it is astonishing how the honey will disappear when brood-rearing begins in spring-time. It is essential that at this time the hives should have ample stores so that no obstacle exists to curtail brood-rearing. The position and success of a bee-farmer are reckoned not by the number of hives, but by the amount of honey he produces.

In breeding queens avoid being influenced by fads. Colour is nothing to boast of, but a hive that can gather 600lbs. of honey in a season is a thing of beauty, and a treasure to be guarded zealously. Whenever queen-cells are found in a good colony they ought to be saved, and should any of the colonies possess a defective or old queen she should be killed, and these surplus cells used to replace the queens destroyed. As the reader progresses it will be shown how these cells may be used to produce the finest queens.

OUT-YARDS AND ITALIANIZING.

STOCKING OUT-YARDS.

About this time the extensive bee-farmer looks up various sites to establish new out-yards. The distance of an out-yard from the home apiary should be at least three or four miles; the greater the distance the better the results. A good location is a gently sloping hill facing the morning sun and protected by hills or trees from gusty, boisterous winds (Fig. 39).

Having selected the site and erected the fence—a hundred posts and a couple of coils of No. 8 wire will do very well—a honey-house of galvanised iron should be constructed at the lowest corner. The next thing to look after is a good solid block to carry the extractor. If the block is sunk into the ground twelve or fifteen inches

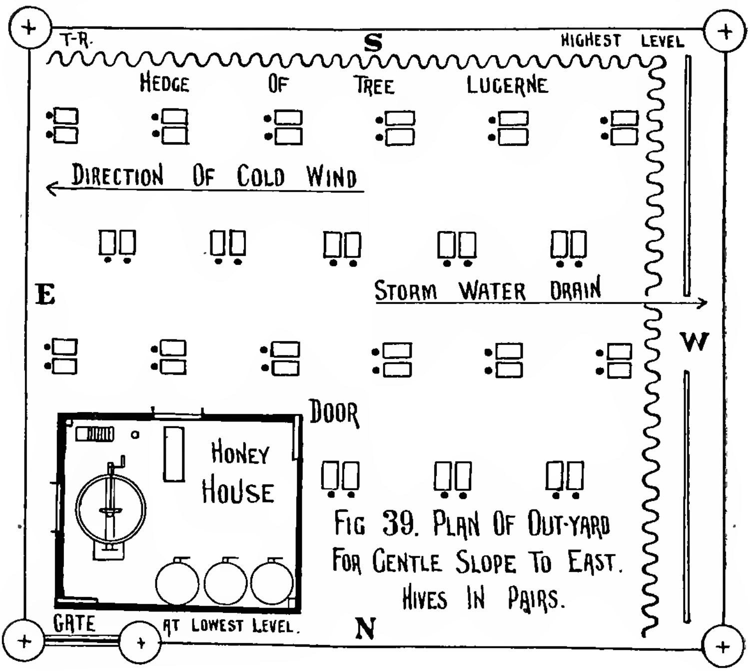


FIG 39. PLAN OF OUT-YARD FOR GENTLE SLOPE TO EAST. HIVES IN PAIRS.

it will make a very firm base. Sink a "well" or hole and line it with bricks or wood; when this is attended to the floor should be asphalted or laid down in concrete. This appears to be some little bother, but is well worth the extra trouble. If the slope favours the erection of a two-floor honey-house, it will be more economical for handling the crop.

To stock up an out-yard you will first need a number of extra hives or nuclei that require only a piece of perforated zinc slipped over the entrance to make them ready for removal. Take fifty or so of these nuclei and provide a nice tough comb of honey for each. Secondly, rear the required number of Italian queens, and the day before these are due to hatch get the nuclei—containing the honey-comb—into position.

Break up the requisite number of hives to furnish a frame of brood and bees to each nucleus; at the same time attach a ripe cell to the comb; close the entrance, making it impossible for one bee to escape. Leave them entirely alone for a couple of days until the queens have hatched. Pack the sixty nuclei—and one hive of bees containing a number of good drones—on the waggon, and in another hour they may be placed on the new site. Open the entrances at night, and the yard is established.

In a few days' time the young queens will be laying, and owing to the small number of bees, are easily found. All queens' wings should then be clipped. This is a cheap and good method; queens reared in spring rarely swarm the first season, and this is a distinct advantage; young queens also build up very quickly. The small size of the nuclei permits the removal of the entire yard at one operation, and there is no danger of the bees returning to the parent hives when liberated. The apiarist also has a better chance of getting the queens mated to selected drones. Of course, a certain percentage will lose their queens, but there is no difficulty in introducing to the nucleus a queen from the home yard. In actual practice these two-frame nuclei present the least difficulty to successful introduction. It is always the big strong rousing colonies that refuse to accept a mother.

It is during the late Spring and early Summer that the bee-farmer is most likely to have a number of queen-cells on hand, and if the stock from which they are raised has proved itself good enough to breed from, then the apiarist should set about getting rid of the "wasters." He should—like the successful dairy farmer—constantly weed out the "duffers" and try to fix a type suitable for his locality and management.

ITALIAN STOCK.

Undoubtedly the best bee in Australasia to-day is the leather-coloured Italian, and with good reason. If all the original stock in the apiary were black or hybrid, it is a step in the right direction to purchase one or two leather-coloured Italian queens from some reputable queen-breeder. These should be introduced to hives in the home yard to be under close observation for qualification as queen mothers of the future. In introducing queens received through the mails the beginner will probably just follow the directions on the card attached to the mailing card (Fig. 40), and this is the safest course until he gains further experience.

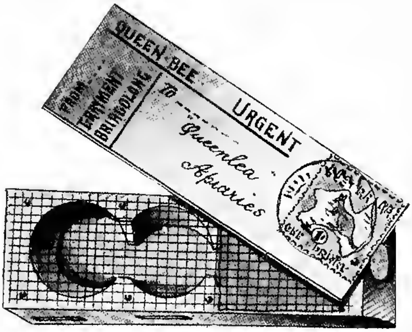


Fig. 40. Mailing Cage for Queen Bees.

When the apiarist decides upon the hives to be re-queened with Italian blood, he should mark them to avoid mistakes when the queens come to hand. The mail cages are small blocks of pine with three one inch holes bored almost through, to overlap each other; the end compartment is filled with special candy upon which the bees subsist during transit. The holes are covered on the front with wire cloth which in turn is covered with an address card, on the reverse side of which are directions for introducing. Upon receiving the queen, remove the card and place the cage in a coat pocket. Go to a marked hive, open as already directed, and keep a sharp look-out for the black queen.

TO REMOVE BLACK OR OLD QUEENS IN LANGSTROTH HIVES.

Every bee-keeper has experienced at one time or another the difficulty of finding the queen in a powerful colony. Usually a quick eye will locate a queen of the

Italian race with a minimum of trouble, but when the colony consists of black bees, the very keenest eye will sometimes fail to see "her majesty." Some authorities advise placing a strip of perforated zinc (queen-excluder) over the entrance, shaking the bees from the combs in front of the hive, and allowing them to run in. The queen, of course, is unable to pass and should be found struggling to get through the perforations.

This sounds nice in theory, but when put to a practical test it develops one or two very objectionable features. First, if the queen is very small, as black queens generally are, she may possibly wriggle through the zinc guard, and, in certain circumstances cause a deal of inconvenience. Secondly, bees will not, as a rule, enter the hive very quickly if the queen is outside, in consequence the insects hang out in great bunches on the hive and bottom board, among which it is almost impossible to see the desired object. Again, the disturbance of shaking the bees places them in an abnormal condition, and therefore out of order for the day. At swarming time a good way is to place a swarm-catcher on the colony, and when the swarm issues, the queen—that is a large one—will be detained in the trap and may be readily caught.

Bee-keepers often wish to remove a black queen outside of the swarming season, and the following plan has its advantages. Go to the colony at a time of day when the bees are flying strongest, and have on hand a hive containing frames with starters; lift out a comb of larvæ and place it with the frames in the new hive, after which brush the remaining bees on to the starters. You will now have all the bees in a new hive with seven empty frames and a comb of larvæ. This hive should be carried to a distance of one hundred yards or so from the old stand and allowed to remain until the bees have quietened down.

In a little while, if the apiarist lifts out the brood-comb, the queen or queens will be found on this frame. This is a good method if the removal of the queen has for its object the introduction of one of Italian blood. The apiarist is also confident of removing two queens, as sometimes happens. (This plan is also good where one has to contend with laying workers, *i.e.* worker-bees capable of laying only drone eggs,—a purely abnormal condition.) Of course the bees are a little confused at first upon discovering the loss of the regal head. After the black queen is removed the two lots are united, and the cage with the Italian queen is quietly placed between the brood-combs in the warmest portion of the hive.

It will take from two to four days for the queen and her attendants to eat their way out through the candy, but it is imperative that the hive should be undisturbed for eight or ten days. The queen has usually started to lay and is fairly safe after this lapse of time, but the hive should be opened only sufficiently to remove the cage. Queen introduction is treated under the head of "Queen-rearing."

FINDING QUEENS IN BOLTON HIVES.

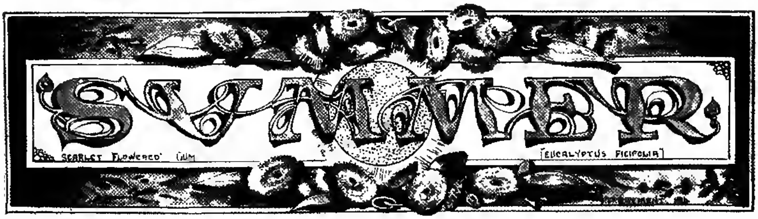
Should the apiary be equipped with Bolton hives there is yet another method to be employed. Here is the plan advocated for this hive. The author has never used it, so cannot speak from experience. "All you have to do is simply raise the front of the hive up from the bottom board with one hand, enough to allow of blowing a few puffs of smoke between the bottom bars of the frames. This drives the queen and most of the bees into the upper part of the hive. Quickly raise the top section of the brood-nest and place the excluder between it and the lower one. Now raise the cover and examine it, for you will often find the queen here or on the top bars. If you do not see her blow a little smoke between the frames and down go the bees through the excluder, and after removing the top section you cannot fail to find the queen trying to get below."

Having successfully introduced the Italian queens that are to form the foundation of a modern bee-farm, we will probably find that one or two hives by this time have made up their minds to swarm.

PREPARING FOR SWARMS.

This work requires urgent attention, so the apiarist abandons all other labour for the time being, to give the swarms a helping hand. It will be noticed that this question of swarming is left until early summer, not because **all** swarming takes place at that period, but because the **majority** of swarms issue during late spring or early summer. Under exceptional circumstances a swarm of bees has been known to leave its hive in early winter, but these cases cannot be classed as normal.

Previous to the swarming season, the apiarist should have a number of extra hives with frames of foundation, ready at hand. He will also require a few cages, which are simply wire gauze cubes plugged at the ends with two pine blocks. The introducing cages are very handy to catch and hold queens while swarms are receiving attention. To cage her majesty, remove the larger block and stand the mouth of the wire portion over the queen. Like the majority of insects she will run upwards; the wooden plug is then replaced. It is advisable to see that the hole in the opposite end—the candy or feed hole—is plugged with wax or a small piece of wood before imprisoning the queen.



SWARMS AND SWARMING.

SWARMING TIME.

There are few people in Australasia who have not at some time or another encountered a swarm of bees hanging by the roadside. Those so witnessed it is fairly safe to say are natural or normal swarms. Now before any surprise is expressed at the term "natural," it is only right to say that all swarms are not normal ones. In early spring, when the insects have just come out of a rigorous winter with little or no stores, and are faced with starvation, they sometimes leave the hive in search of better living. The remedy is obvious, supply them with the necessary food and all are contented. Again, someone may have been robbing bees in a tree in the forest. The removal or destruction of the combs leaves the bees without a home, so they cluster similarly to a normal swarm until the scouts find a new domicile. It has been proved that swarms so clustered despatch a number of home seekers who, on returning, lead them to the desired haven, perhaps a knot-hole in some forest giant.

From the bee-farmer's point of view the term "prime" swarm describes the first exodus of bees headed by the old queen—very rarely the first swarm is led by a young or virgin queen—bent on establishing a new community. It is really an expression of the bees' idea "to multiply and replenish the earth." Hives in a state of Nature often cast more than one swarm, but the second, third, and sometimes fourth, get respectively smaller and smaller until the last attempt has only enough adherents to fill a breakfast cup.

After the issue of the "prime" or first swarm, the succeeding ones are described as "after" swarms, and have invariably young virgin queens accompanying them. At times three or more virgins are found in the tiny cluster. Modern bee-farming methods have decided against allowing bees to swarm how and when they like. It is unworkable, to say nothing of the loss involved, to permit natural swarming. Of course it has to be recognised that the swarming propensity is an instinct of the *Apidæ*, and that considerable study is required to combat or control that instinct successfully. Reasoning from analogy, man has bred a constant type of non-sitting fowl, (The Mediterranean breeds) and why cannot he accomplish something the same with the honey bee?

That careful breeding can reduce the swarming fever to a minimum the author has demonstrated in the apiaries year after year. The congregation of large numbers of hives in small areas receiving skilled and constant attention to their wants, renders the swarming instinct valueless. In fact it becomes detrimental; if increase of colonies is desired, the apiarist should gain it at his most convenient time, which is not necessarily so for the bees. Looking at it from another standpoint, if increase is permitted per medium of natural swarms, it must of necessity continue to perpetuate this undesirable factor. This, then, forms the chief objection to using queen-cells raised during the swarming impulse.

When the season advances, with honey and pollen abundant, the hive quickly fills with brood, and a queen laying 4,000 eggs per day soon gets short of cells. If the bee-farmer supplies plenty of room for egg laying and honey storage, also an enlarged entrance for extra ventilation and shade if the sun is hot, he will greatly mitigate the colonising propensity. But in spite of all these precautions some hives will swarm.

The majority of swarms issue between the hours of 9.30 a.m., and 3.30 p.m. As the bees pour forth from the entrance in a thickening cloud, the apiarist, smoker in hand and queen cage in his pocket, should open the hive to ascertain the cause of the swarm. Nine times out of ten want of room is responsible. If any of the precautions mentioned have been neglected the remedy is obvious. The reader with a retentive memory will recall the spring instructions given under "Out-yards" to clip all queens' wings. This operation should be performed at the first overhaul of the apiary after the winter.

HIVING SWARMS.

When a swarm has issued, if the apiarist is on hand he should cage the queen, (she will usually be found vainly attempting to fly or else climbing up the grass stalks in front of the hive) and place her in his pocket or some shady place away from the ants. If left in the blazing sun she will very likely save her owner any further trouble. Look lively—because the swarm will soon miss their queen and hurry back to where they last heard her—and open the hive. The combs will be found crammed with brood in all stages. Leave one comb containing very young unsealed larvæ only—take care there is no queen-cell on this comb—look carefully, because the swarm would not have issued unless some queen-cells were under way, and fill the hive body with frames of foundation; put on a queen-excluder, and place empty supers on top, then close the hive.

By this time the bees will be returning to find the queen, and it is safe to lay the cage at the door, until evening, when she may be released. It is not advised to release her immediately, for the swarm will sometimes leave the second time, either because they have not noticed the altered interior of the hive, or are in some way dissatisfied with it. Swarms leaving the hives within a short period of each other show a tantalising disposition to unite. Keeping the queen locked up till evening often avoids this trouble. When one remembers that a swarm (Fig. 42) is just as likely to cluster on a

"White-gum" tree one hundred feet high as it is to hang on a wire fence, the saving of time in thus hiving them becomes apparent.

Clip all laying queens. But sometimes there will be swarms led by royal mothers proud of their full wings. How about hiving them? Very often the wings of the queen have not been used for some time, and the royal insect is rather heavy with eggs, so she does not fly very far before forming the cluster; this is almost the rule.

SWARMING BOX.

The swarming-box (Fig. 41) is then brought into

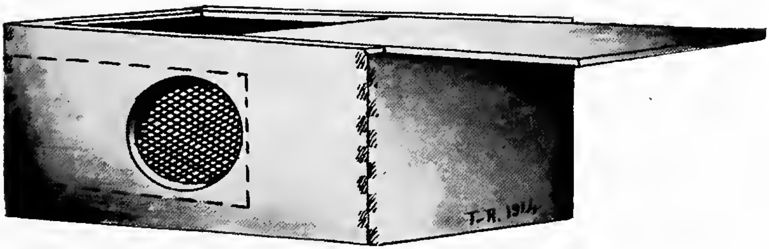


Fig. 41. Swarming Box.

requisition. This box is simply made, and is a great convenience. A 3 inch hole is bored through two sides and covered on the inside with wire cloth. The dotted line in the diagram represents a tin slide to cover the holes and darken the box. Go to the swarm, and with the sliding lid pulled open as illustrated, cut off the swarm from the twig or fence so that it falls into the box. Hold the box close up to the swarm (Fig. 43). Close the lid except for a small space of say, 1 inch, and stand the box down on end, with the entrance at the bottom so that the remaining bees can enter. This they will quickly do; the lid is then shut entirely. If the swarm is to be carried a lengthy distance remove the tin slides to permit air to circulate through the box. There is then no danger of the bees smothering even in the hottest Australasian summer.

Fig. 42. Swarm Clustered on Young Loquat Tree.

With the swarm secured, return to the hive from whence it came; here is a crowded brood-nest

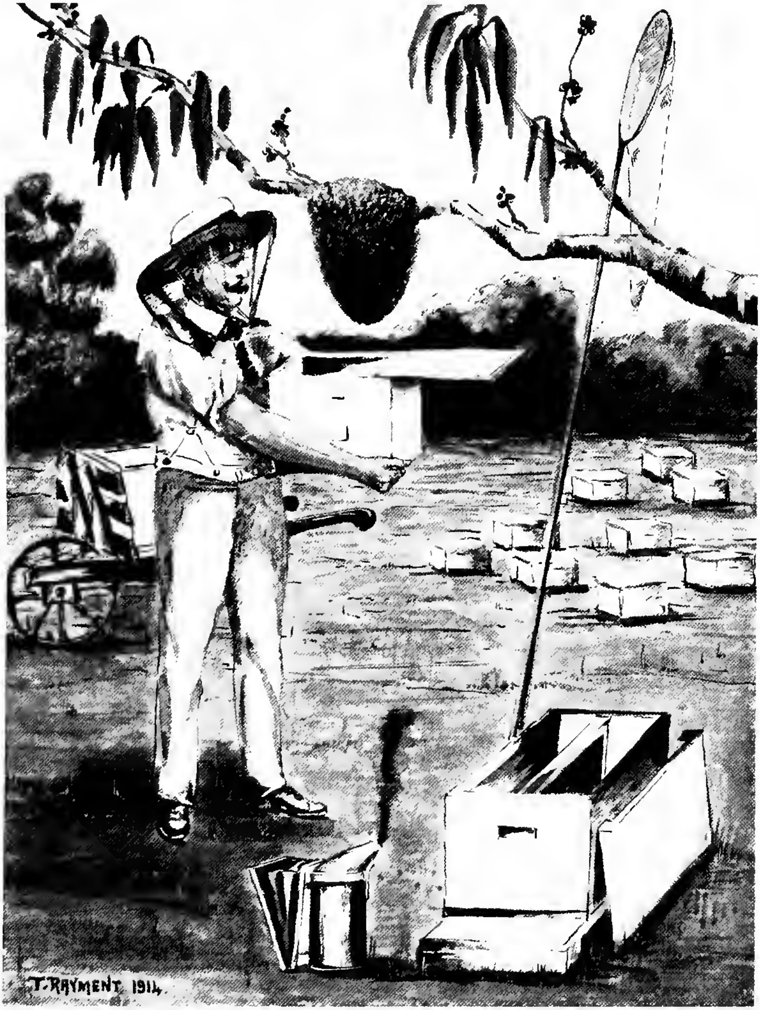


Fig. 43. Hiving a Swarm conveniently settled.

and queen-cells in varying stages of progress. Follow the procedure already advised and select a comb of young larvæ just hatched; make sure it has no queen-cell attached. Remove the remaining brood-combs, without jarring, and fill up with foundation, put on a queen-excluder and then the supers. If no excluder is used the queen simply goes up into the super to lay, and the bees refuse to build out the foundation. Honey is wanted in the supers, and it must go up there because, as soon as cells are built below, the queen deposits eggs in them.

We are now ready to put the bees into their house. Prop up the body—about an inch—and lay a piece of canvas or bag in front on a level with the entrance, give the swarm box one or two sharp jerks, open the lid and pour the bees out on to the bag. Place the box to one side and search for the queen; she will often be found running over the backs of the bees in her haste to get out of sight. Clip her wing when found, and cage her until evening for the reasons given above.

DISPOSAL OF SURPLUS BROOD.

The omission to state what becomes of the surplus brood-combs removed from the colony that swarmed had better now be rectified. The combs will have a number of queen-cells attached, and if it is desired to save them the combs are simply placed on top of the supers of the parent colony until the cells are "ripe." They are then used in the apiary. If there are any weak colonies in the yard this body of brood-combs should be given to one of them as a super, it will strengthen it wonderfully. If it cannot be used in this direction let it remain on top of the original colony until all the brood has hatched. If more bees are wanted follow the plan given under "Increase," page 68.

All the preceding is applicable when the swarms are within easy reach, but how to hive them when the cluster is up beyond arm-reach? If the queen is clipped and caged, don't worry, they will soon come down again. But suppose the queen is not clipped! Well, if the apiarist has had a chance to do this and neglected to grasp it, it would "serve him right, he went looking for trouble." But "the best laid plans of mice and men oft gang agley," and in spite of the best management a swarm will occasionally get away with a queen not clipped. This often occurs when the queen is a virgin, or with "after" swarms. The remarks on queen-rearing will make it plain why a virgin cannot have her wings clipped, and it is the frisky youngsters that go in for aerial records, clustering high among the tall eucalyptus trees.

To secure swarms that attach themselves to twigs say up to 14 feet high, a swarm-catcher made after the style illustrated in Fig. 43 will come in very nicely; it is light to carry and effective. It is simply a ring of ⅜ inch iron sewn into the top hem of some strong net and mounted on a long stick. Push it up among the leaves right under the swarm, dragging the ring underneath the bough—to cut the bees off, so to speak; a slight turn of the handle closes the mouth of the bag. Wait until the flying bees have clustered on the bag, then gently lower to the ground and hive as already directed.

There is one circumstance that requires special mention; under the heading of the insects' anatomy will be found a passing reference to the breathing-tubes of the body. They are small eyelet-like holes with tubes along the sides of the body to enable the bee to absorb oxygen. This fact must not be lost sight of when handling swarms. **Do not on any account** attempt to hive a swarm on frames wet with honey, or in a box washed out with sweet water, etc.; swarming-out is a foregone conclusion if either of the above are used. When the swarm leaves the parent hive, each worker carries in her bag or sac sufficient honey for a week's supply. Now it stands to reason that when the gorged insects are confined to sticky combs and get covered with honey they are unable to clean the spiracles that supply the air, so the insects surely suffocate. Fortunately the bee is well aware of this danger, and unless confined to the hive will quickly leave.

When a swarm has hung out exposed to the elements during a spell of boisterous weather, the honey sacs become depleted, and the bees are in a hungry and weary condition. When hived upon wet combs they are then very glad to obtain a little food, aye even licking each other dry. This is about the only time wet combs can be successfully used for swarms. If the hive becomes sun-heated it is a predisposing factor.

VENTILATION AND SHADE.

During hot weather supply plenty of ventilation by raising the hive from the bottom-board with blocks 1 inch thick. Shade-boards (Fig. 44) made of old cases provide very acceptable shade. When running for extracted-honey extra ventilation supplied by one or more entrances to the various supers is undoubtedly of assistance in relieving the congested passages of the brood-chamber. It is something to be avoided, this crowding of the brood-nest; when all the field bees must of necessity push their way and climb over the brood-combs it must create a certain amount of delay and confusion. Where an extra entrance will provide a short cut to the super it is a wise plan to furnish it.

Some go so far as to erect a shed large enough to house the entire apiary. While shelter for bees—and incidentally for the apiarist—has much to recommend it for the hot summers of Australasia, it is not very popular among Antipodean bee-farmers. In Arizona, U.S.A., bee-keepers use long sheds roughly made with uprights of bush timber and a number of fencing wires rove along the "roof" to form a support for the grass and bushes that finally cover all. Probably the fear of bush fires implanted in the breasts of most apiarists of this sunny land militates against their use. A number of bee-farmers prefer to get along by allowing the bees to swarm with the queen's wings not clipped, but this entails the purchase of a force pump and a supply of water—the latter is fairly scarce in some Australasian forests. When the swarm issues the apiarist must be on hand to direct a spray upon the bees, thus dampening their wings and impeding flight. Possibly the insects are deluded into thinking it is a fall of rain and so decide to cluster. The amount of water "turned" by the overlapping wings of bees in a swarm is astonishing. However, clipping wings is considerably cheaper, and the presence of the proprietor is not essential. (See "Working of Out-yards," page 129).

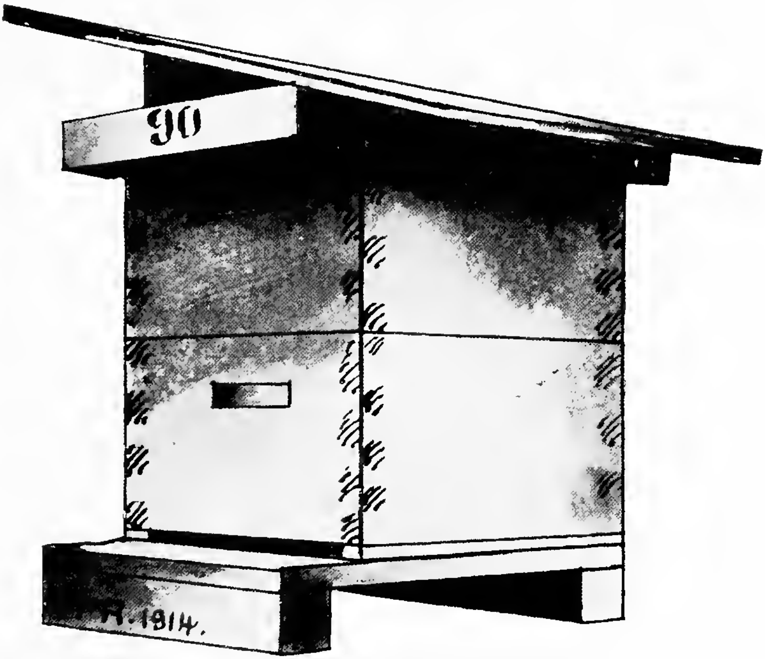


Fig. 44. Shade Board for Summer.

Water lightly sprayed over a swarm before hiving helps to prevent a large number of bees taking wing. No two years are alike in regard to swarming, so the vagaries of the season usually determine the method to be employed. Old queens are more liable to swarm than young ones. Some years (usually considered a bad sign) there are very few swarms; other years it is almost impossible to prevent a surplus of them. The chief thing to know is the primal cause. When this is determined the line of treatment is plain. The mighty rousing exodus of insect colonists seldom fails to move the bee-farmer in more ways than one.

Should a newly hived swarm desert the home do not give them a second opportunity. Once in the swarming box, open the slides to allow plenty of air, give them a comb containing some water, then place in a dark cellar for 24 hours to permit them to cool off and to turn their thoughts to wax production. If the queen is aged better not bother with her, but get a young Italian queen and then hive. A swarm will accept almost any queen, and without the employment of the usual methods of introduction. However there are rare times when no written formula is of service: the apiarist has simply to fall back on his experience to solve the difficulty.

COMB-HONEY.

EQUIPMENT.

Experienced apiarists will no doubt be surprised to find "Swarming" taking precedence of "Comb-honey," but when they remember the difficulties presented by the swarming fever whilst engaged in comb production, they will see the advisability of thus presenting it to the novice. While the problem of swarm control is, to the extracted-honey producer, of no great moment, it becomes a serious question when comb-honey in sections is the chief objective.

The first requisite is a locality free from propolis, and one that is capable of producing high-grade honey in considerable quantity over a fairly long period. The wax produced should be of virgin whiteness. If these conditions do not exist it is unprofitable to run for comb-honey. Extra skill is also required in the manipulation of the hives. The brood-chamber is, of course, the same as that of the extracted hive; the difference is in the supering arrangements. A glance at Fig. 45 will show the distinction of a super fitted for the small 1lb. sections; it is, of course, of the same outside dimensions as the hive, and is almost identical with a Bolton body (Fig. 14).

The internal fitments are composed of 24 1lb. sections and seven separators or divisions. When plain pieces of soft pine $\frac{1}{16}$ of an inch thick are used in conjunction with the bee-way section (Fig. 46), only five separators are used. The bee-way section—as the name implies—has an opening scalloped out at the top and bottom to allow the bees to enter. The socialistic nature of bees makes them averse to working in small detached groups

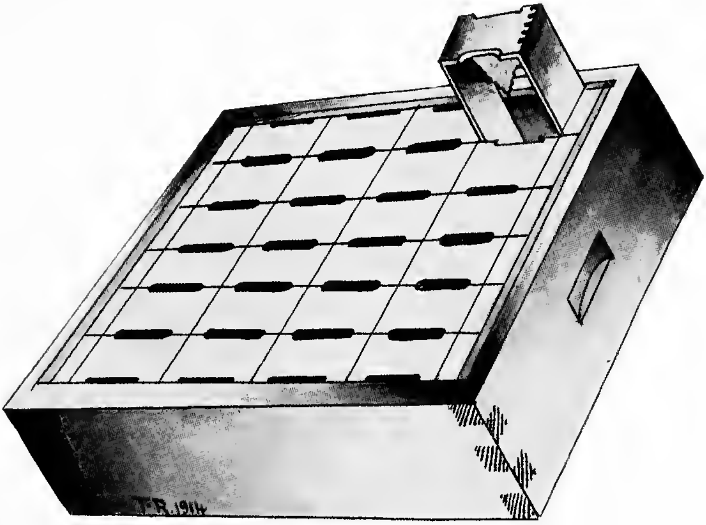


Fig. 45. Comb-honey Super.

such as a comb-super entails. To overcome this aversion a number of schemes have been put forward. The chief one is the fence or slatted separator.

From the remarks on hive construction it will be seen that a bee-space of ¼ inch throughout the various portions of the hive is essential. If the space is more than ¼ inch the bees will build comb in it; if less than this measurement it is found that the bees, unable to use it as a gang-way, regard it as a crack to be filled up with propolis. So a comb-honey super should conform to this vital principle to be successful.

The plain (Fig. 46, No. 2) or "no-bee-way" section more nearly approximates to this ideal. The bee-way is taken off the section, which is thus made of one uniform width, and the space is added to the separator, a diagram of which is shown over the comb-hive in Fig. 17. This fence separator allows of freer ingress and egress to the sections, and overcomes to a certain extent the bee's feeling of isolation. On account of the plain equal sides of the "no-bee-way" or plain section, it is necessary to have a fence separator on the outside rows to provide a passage way. Otherwise the sections flush against the sides of the super are closed to the bees.

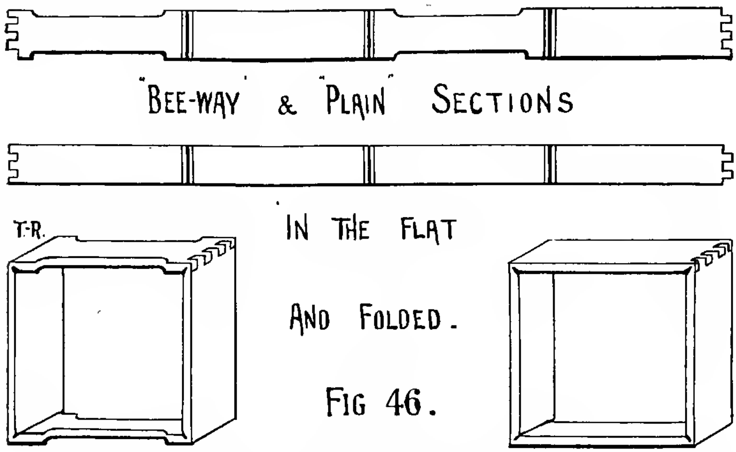


FIG 46.

To keep the wood of the sections clean, and to have a nice marketable appearance when filled with honey, they should be crowded up tightly together to prevent daubing with propolis. (A resinous, sticky substance—dark brown in colour, gathered from the buds of the sunflower, oak, and various other plants and trees—used by bees as putty for closing cracks, etc.). This is best carried out by slipping a follower, shown over the hive at Fig. 16, in the super side against the separator, and applying pressure by two thumb screws similar to those used with the Bolton hive.

Years ago, a number of bee-keepers attempted to get along without separators. While bees were easier started in supers without separators, this disregard of the essential bee-space over the face of the combs resulted in having sections built of uneven weight; a large proportion being unfit for marketing on account of the damage to the combs that projected beyond the wood.

When the bee-way sections 4¼ inches by 4¼ inches first came under notice, they were supported in the super by a number of strips of tin across the bottom. Plain sections 5 inches by 4 inches hold about the same weight of honey as the 4¼ inch square bee-way section. Latterly, the approved method is to have what are termed section-holders resting on two tin strips—one at each end of the super. The section-holder resembles a shallow frame without top-bar, and the same width as the sections. Fig. 45 shows the section-holders, also one of the sections raised to display the small piece of foundation fastened at the top. Both patterns of section are made in America, from basswood ⅛ of an inch in thickness (a soft white timber very suitable for the purpose). They arrive in this country in boxes containing "1,000 in the flat," *i.e.* not folded up (Fig. 46. Nos. 3 and 4). The ends are dovetailed, and at proper distances the wood of the section is almost severed with a V cut.

FOLDING SECTIONS.

To fold up the sections take a bundle and pour hot water over the V cuts in such a way that all are damped. This toughens the fibres of the wood and prevents breakage when folding. When only a few are required no mechanical help is needed, but there is a special machine made for this purpose. After the section is folded square—if not folded true but a little diamond-shaped, you will have trouble in the super, and the section will probably break in the marketing-case—it is necessary to fasten a strip or sheet of foundation along the top as a guide to the bees.

The sections in Fig. 17 depict foundation cut into various shapes: the first section on the left has a half diamond piece, the next a narrow strip at the top, No. 3 a piece top and bottom, and the last one a full sheet short of the bottom $\frac{1}{4}$ of an inch to allow for stretching. When using a full sheet of foundation the advice to fold the section square will be appreciated. The two starters, one top and bottom are easily best, providing the lower starter is not more than $\frac{3}{8}$ of an inch high; if too high it will fall over. The advantages of this style are: no bulging of the foundation should it stretch unduly and it ensures all worker cells.

Two starters are easier to fix than one full sheet. The bottom starter secures attachment to the wood, and this, of course, makes the combs better fitted for transportation. When only narrow strips are used at the top the bees will often finish out the comb by building it drone pattern, and this is something to be avoided in producing a first-class article. Where top and bottom starters are used, the risk of having drone-comb is reduced to a minimum. Compared with the full sheet there is a slight saving of foundation.

WORKING FOR COMB-HONEY.

FIXING FOUNDATION.

To get the foundation fixed into the section is the next work. For a small number, secure a pivoted wooden block fitting easily in the inside of the section. The face of the block should come a fraction less than half-way through the box. The top of the block should stand at an angle of about 40 degrees from the operator. Lay the section over the block and drop in the strip of foundation. With a spoon or wax-smelter pour a small quantity of hot beeswax along the edge of the foundation, thus cementing it firmly in the centre of the box. Reverse the block and repeat the process with the second strip.

Where the production of comb-honey runs into tons the above plan is altogether inadequate. Extensive producers use a machine that folds the section and fastens two starters in one operation. It is a very compact and ingenious contrivance, the invention of The A. G. Woodman Co., Michigan, U.S.A., and is illustrated in Fig. 47. A hinged arrangement folds the section, and a series of steel plates heated by a lamp melt the edges of the starters, fastening them to the wood on all sides. The section-fixer is made of pressed steel.

The foundation used should be the lightest grade, catalogued as "thin surplus." If a heavier quality is

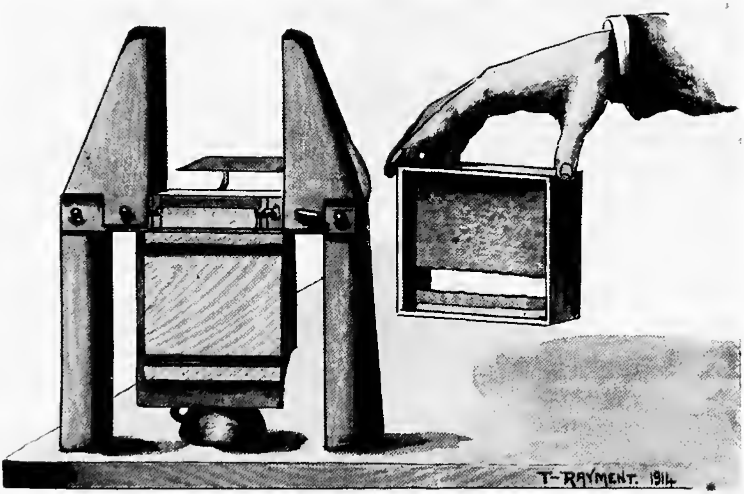


Fig. 47. "Woodburn" Section Fastener.

used the bees sometimes neglect to thin it, and this fault is objected to by people who eat comb-honey as a regular thing. The delicate crispness of wax in the natural comb is absent in foundation, and the thinner this is used the more pronounced is the friable character of the resultant comb. With the super thus prepared, we are ready to hand it over to the bees for completion.

TO GET BEES TO WORK IN SUPERS.

The first thing the novice will discover after giving the super is the decided disinclination of the insects to accept the prepared sections. To save him any undue worry is the objective of the author. In the first place unless there is a fairly heavy flow of honey, and nice warm weather (day and night), it is useless to give a super. The days may be fine enough but if the nights are chilly the bees will not be able to maintain warmth sufficiently to go on uninterruptedly building comb. The result is sections of various widths and colours.

Should the honey flow be in quantity and the bees still loth to occupy the sections, an examination of the brood-chamber will disclose one or more combs glutted with honey. As long as there is room in the brood-nest

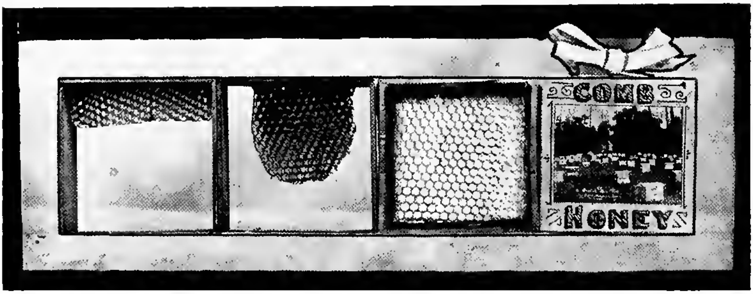


Fig. 48. Evolution of Comb-honey.

for honey it is vain to expect it to be stored above. The remedy is to leave no comb room for honey storage down below. Many colonies will, if unattended to, fill all the available brood-cells and so prevent the queen performing her oviparous duties. Needless to say when this happens the colony very soon dwindles down to a mere handful of bees, incapable of storing a surplus of honey, or else the queen, tiring of her vain searching for egg room, finally leads off a swarm.

The apiarist alive to this danger will lose no time in effecting an alteration. Two or more of the outside brood-combs will probably be solid honey. These must be removed, and sheets of foundation alternated with the brood-combs. There are, then, no empty cells below to hold honey, consequently it is forced above. As the foundation is built out the queen occupies it with eggs, that is if she is a prolific one, and no others should be kept. Where the bee-keeper has surplus brood-combs it is no better to substitute these for the honey combs. At any rate, the hive **must be strong** to do satisfactory work.

Should the queen be unequal to keeping the brood-nest filled, she should be replaced by a better one. Some strains require little inducement to enter comb-supers, others again work under protest as it were. Should a colony swarm in preference to storing honey, they should be hived on frames of foundation, and a queen-excluder placed over the brood-chamber, afterwards giving the comb-super.

BOLTON HIVES FOR COMB-HONEY.

The Bolton hive is capable of special handling for forcing honey into the super. In hives fitted with Hoffman or Langstroth frames 9⅛ inches deep, the bees very often have a strip of honey perhaps 2 inches wide along the top of each brood-frame, and it is rather a difficult matter to get them to remove it. This is especially the case with black bees. Where the queens are young and of a prolific Italian strain, the problem is less complex. The Bolton hive claims to overcome this trouble.

As already noted, the brood-nest of this hive is composed of two shallow portions, and the honey referred to above is stored along the top-bars of the frames in the upper portion. This is so because the natural position of honey is over the brood, in the warmest place, and, since this is away from the entrance, the safest position from attacking robbers. Now this fact is made use of with the Bolton hive. If the top portion of the brood-nest is replaced by the bottom one and *vice versâ*, the band of honey now separates the two lots of brood. This position of the honey is so distasteful and unnatural to the colony that they immediately remove it, and the only vacant cells are in the comb-super. The queen, of course, then lays eggs in the emptied cells. The hive is reversible—that is, after the thumb screws are tightened to prevent the frames falling down—though the above object may be gained by simply inverting the top portion.

Besides the foregoing schemes, practical apiarists alter the super fitments in various ways to overcome the "passive resistance" to comb-supers. Some go so far as to place Bolton extracting-frames on the outside of the sections; some produce comb and extracted honey in the same super by alternating combs with rows of sections. Since all are divided by fence separators, the evenness of the section face is nowise impaired. American comb-honey producers save all the unfinished sections of the previous year, and when getting the new season's supers ready place one in each corner as bait. Others claim better results by putting the bait sections in the centre of the super over the middle of the brood-nest.

DRAWN COMB.

Latterly a practice of fitting fully-drawn comb in the sections has gained a number of enthusiastic supporters. The bees are given a super of shallow or Bolton frames containing foundation, and when this is drawn out into nice white comb, it is cut and fitted into sections. They are then given to the bees in regulation comb-supers. That this super of drawn comb is more readily accepted by the bees for honey storage is not questioned, but it can be conclusively shown that the finished comb in sections so prepared is not fastened to the wood as effectively as comb **built** therein by the bees. This insufficient attachment is the bugbear.

One or two apiarists have allowed the bees to fill the shallow frames with honey and to seal it up. This full comb is then fitted to sections and given to the bees to clean up and fasten, but the combs are only fixed superficially, so the bugbear of insecurity is not demolished. It is, however, comforting to know that once the bees get the habit of storing above, any style or number of supers may be given; in fact the last given may be rendered more acceptable than any previous one.

This is apparent when a comb-super almost completed is raised from the brood-nest and another set of empty sections interposed. The bees are tricked into energetic efforts to fill the space and thus connect the honey with the brood.

As explained in a previous subject, want of room is a prime cause of swarms, and to supply the necessary amount of section room without landing too large a percentage unfinished at the close of the season, is a nice point that continually engages the attention. Failure in either of the above makes a decided difference in the amount of marketable honey produced. In accordance with the instructions to keep bees in as few hives as possible, get all your comb honey in as few sections as is consistent with fair average weight. Do not pile on supers until every section is but half finished. As the season advances crowd the bees to fewer sections so as to have them all ship-shape when finally taken off.

TAKING OFF COMB-HONEY.

The removal of comb from the hive without damage is attended with more risk than is the case with extracted honey. When a hive of bees is disturbed, the insects, fearful of being deprived of their stores, make haste to fill their honey sacs to enable them to make a new start in case of emergency. This trait furnishes a difficulty in the production of section-honey, for instantly the smoker "whiffs" and the lid is opened, the ever ready insects puncture the cappings of the comb in their hurry to secure provisions. This damage to the cappings is unsightly, and often causes the comb to "bleed" after removal from the hive.

To overcome this a Porter bee-escape is fitted to a thin board, say ½ an inch in thickness by the dimensions of the hive in use. On one side of the board slats are nailed to raise the super from the brood-chamber; these are ⅞ of an inch wide, and fastened similarly to the slats on the bottom board. A hole, corresponding to the one on the escape, is now bored through the centre of the board and the escape tacked over it. To use: gently pry up the super from the brood-chamber—do this at the rear—allow the super to rest on its front edge; give a puff with the smoker, and slide the escape board in between the two divisions of the hive, let the super down on to the board and bring the whole into alignment.

The bees in the super will pass through the escape to the brood-nest below and are unable to return. If the escapes are placed on the hives at evening, the supers may be removed, practically free of bees, next morning. The objections to the use of escapes with extracting-supers do not apply when used with comb-supers, as no harm is done by the comb honey getting cold. When bees leave the supers in this gradual way they make no attempt to carry any honey down, so sections are rarely disfigured.

BLACK BEES BEST FOR COMB.

Comb-honey, when first capped, has a beautiful powdery whiteness—Black bees are noted for the purity of their cappings (Fig. 48)—but when allowed to remain on the hive for any length of time the cappings become yellower in colour. The constant trampling of the insects' feet soon mars the original delicacy of colour, and the quick removal of sections after sealing will better secure the appearance. Where one or two hives only require the attention of the apiarist it is an easy matter to take off the finished sections, but when there are many hundreds of colonies the whole super is removed, and the unfinished sections used as baits in the supers returned to the bees.

The Italian race generally do not make such a nice finish to the cappings. The colour is very often of a golden-yellow tint and the "powdery" effect is not present. This "powdery" appearance is not unlike the "bloom" on fruit such as plums, grapes, and several others. The comb-honey from Italian stocks often has a greasy, water-soaked look. This is due to the cappings resting directly upon the honey itself. Black bees leave a tiny air space between honey and cappings, which accounts for the dry "powdery" effect produced by this variety of *apis*.

When taking out the sections invert the whole super and loosen the thumb screws at the side. The empty body is then lifted clear leaving the sections, holders and separators on the work bench. The unfinished and partly-filled sections are returned to the supers to be given to the bees later on

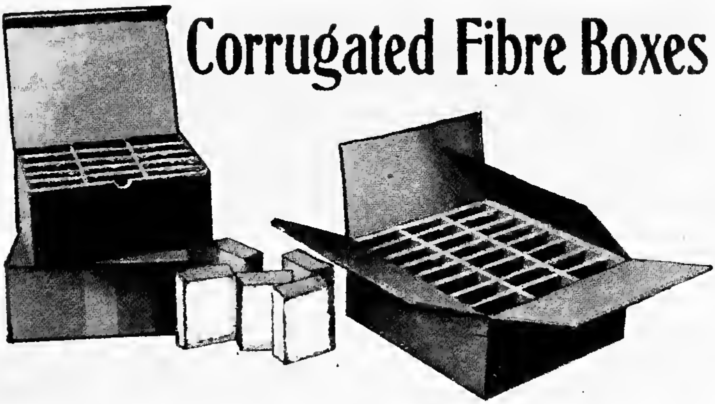


Fig. 49. Cardboard Boxes for Comb-honey.

for finishing. The fully-capped sections are now scraped free of propolis and wrapped in paper preparatory to packing in a corrugated cardboard box (Fig. 49). The corrugations act as buffers and absorb all shock. They are splendidly constructed for the carriage of comb-honey.

PACKING CASES.

Where tons of comb are handled these cardboard boxes should be tightly packed in a strong wooden case fitted with handles for lifting. The case should hold say 1½ cwt. Comb-honey will carry fairly well when packed in this manner.

CATERING FOR A SPECIAL CLASS OF CONSUMER.

Mr. Garrett, one of the pioneers of the frame-hive in Australasia, one time produced tiny comb-honey sections made of wooden shavings, which, when filled with honey, weighed but 2 ozs. While Mr. Garrett is a past master at producing comb, and his locality eminently adapted for it, his experience was, that the luxurious hotels of the metropolis would not pay a remunerative price, so he abandoned comb (of which he produced a great many tons) in favour of extracted.

The Americans, notably the great A.I. Root Co., of Ohio, cater for this select trade by putting up tiny squares of **cut comb** in special wrappers decorated with gold, etc., and make a success of it. In Texas, comb-honey is cut from the frames, then put into tins, and a large trade has been built up with "chunk" or bulk-comb as it is named.

Should comb-honey be kept in stock for any length of time, it is essential that the temperature of the store-room be fairly steady. If it fluctuates each evening the honey will most likely "candy" or assume a solid form, (localities producing honey that candies quickly are not suitable for comb-honey); the cappings will also crack and the honey sweat from the fissures. Wax is more susceptible to heat than honey; consequently the expansion and contraction of the cappings, unaccompanied by similar phenomena on the part of the honey, are responsible for cracked surfaces and sticky non-saleable sections.

If the apiarist can obtain even 9/- per dozen for sections, he should be able to make comb-honey production a payable business. While sections are retailed in the capital cities at 1/- each, the prices offered to producers are not sufficient to induce them to go in extensively for this class. Possibly a trade could be built up by following the Texans' lead with "chunk" honey.

BEES HANGING OUT.

When the temperature mounts steadily from sunrise as the precursor of a hot day, it will be noticed that some of the colonies show a disposition to cluster on the hive front. As the day progresses there will be more bees hanging on the outside than there are inside (Fig. 50). Old-time bee-keepers looked upon this as an infallible sign of swarming; it is now recognised as a symptom of insufficient ventilation. Bees do not hang outside during chilly weather. When the safety of the brood and the stability of the combs are jeopardised, instinct

Fig. 50. Bees hanging out in hot weather.

warns the bees to seek a cooler spot. It has been the author's experience year after year that want of cool, fresh air is the primary cause of bees hanging out.

If, during the summer months, some bees should attempt to cluster outside, raise the lid perhaps an inch at the back. Ninety-nine times this is sufficient; if the hundredth time it is unsuccessful, raise the body from the bottom-board with two 1 inch pine blocks. This gets over the difficulty cheaply and effectively.

The disposition of combs in the super has some influence. The author has always approved of super combs crossing those of the brood-chamber at right angles; this plan is much favoured in Great Britain. To do this conveniently the hives should be square, but the plea of standardisation militates against this form in Australasia. "Criss-crossing" prevents "burr" to a certain extent and is somewhat of a queen-excluder. It also allows one air current passing upward between two brood-combs to circulate between all those in the super.

Bee-keepers (generally British) accustomed to using frames parallel with the entrance dub those other than the centre, "back" and "front" combs. The Langstroth man invariably designates them "side" combs. Undoubtedly the best position for winter is parallel with the entrance. The apiarist should always overcome clustering out, as it blocks up the "gangway" preventing ingress and egress. The passages "choked up" tend to make the insects dissatisfied, and often breed the inclination to swarm. No matter how thickly the insects cluster out, should a cool change come along they will quickly retire within.

Bees, after confinement by bad weather for a day or so, will surprise the budding apiarist with their noisy flight or "playspell." An extra large number of bees will be observed flying from each entrance, and the beginner will perhaps imagine that a swarm is at hand. However, after a "corroboree" they will settle down to steady work again.

QUEENS.

PERFECTLY DEVELOPED FEMALE.

Having accompanied the bees thus far through the season, the apiarist will no doubt be subject to the curiosity so often exhibited when the queen bee is mentioned. That the royal mother is worthy of the interest displayed goes without contradiction. That the virgin queen—*i.e.* a queen who **has not** mated with a drone or male bee—can lay eggs, aye, and drones hatch from them are truths demonstrated daily by the scientific bee-farmer in the pursuit of his daily occupation. These and many other curious phenomena will be placed before the reader in the following pages.

The queen is the only perfectly developed female in the hive, and the egg producing a worker-bee is apparently in no wise different from one that will finally develop a queen. The monarch then, it may be said, owes her existence as the perfect female, to the food fed to her during the larval growth. Queens in a normal state lay 2 kinds of eggs. They present no differences outwardly,

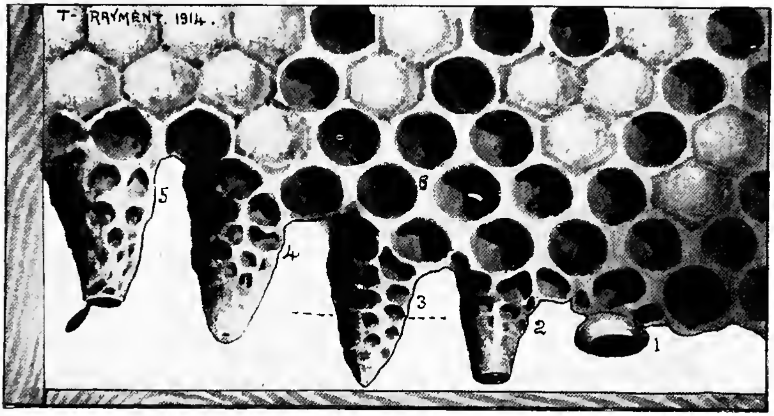


Fig. 51. Portion of Brood-comb with Queen-cells.

even to the searching eye of the microscope, but when the contained fluid is exposed to view, it reveals the fact that the egg intended to hatch a drone is without any trace of the fertilising medium. This fluid (or semen) is always associated with the egg that is intended to develop into a worker or a queen. It is surely an anomaly to say that the drone hatches from an unfertile egg, yet if we regard the presence of spermatozoa as fertility, it is undoubtedly true. However, let us examine a comb and study the queen from egg to imago.

EGGS.

At swarming time there will be no difficulty in observing a number of small cups (Fig. 51, No. 1)—

very similar in shape and size to the caps of acorn seeds—built along the bottom of the combs, mouth downwards. These are embryo queen-cells. A close search will reveal eggs stuck end on, or suspended as it were, from the dome of the cell—similar to the worker egg shown in No. 3, Fig. 25—and when placed in the cell by the queen, it is coated with an agglutinative substance that makes it adhere in the manner described. After a day or so the eggs lay over and rest in the cells. With everything just right the larva will hatch from the egg on the third day, (if the temperature is below normal this period is extended) and is similar to the larva in Fig. 25, No. 4.

At this stage the eye will detect a huge difference in the amount of food given to the queen larvæ and that found in cells of worker brood.

QUEEN FOOD OR ROYAL JELLY.

The queen larvæ fairly float in a tiny sea of milky food. It tastes something like cream turned slightly acid, and is very rich; bee-keepers always refer to this queen food as "royal jelly." The amount of food continues to increase together with the growth of the larvæ for five days. Just before the cell is sealed (No. 2, Fig. 51)—which, by the way is not made air-tight—usually on the ninth day, the food is so plentiful as to half fill the cell. That there is more food than the larva can possibly eat is proved by looking into a cell after the queen has hatched. There is left, invariably, a piece of dried brown jelly about the size of a pea.

The wonderful metamorphosis that takes place between the sealing of the cell and the hatching of the perfect insect on the sixteenth day, has been observed by scientific men of high attainments. The ordinary apiarist, however, must be content to witness the queen cutting her way through the end of the cell with her powerful *mandibulæ* (jaws). It is a very neat cut too. As she presses against the inside the circular piece

(No. 5, Fig. 51) springs open before she has completed the cut, and this gives the cell a hinged-lid appearance.

When a number of queens are about to hatch simultaneously, the apiarist may hear them emitting a peculiar sound (z-e-e-p z-e-e-p). Many writers assume these notes to be a challenge to combat. However, the first one to hatch will kill all the other queens that are nearing maturity. Cells not too far forward (Fig. 57, No. 3) are passed over unnoticed. Very often the bees do not wish the death of the extra queens (this is noticeable at swarming time); so they allow the imprisoned insects to make a puncture in the ends of the cells sufficiently large to permit their tongues to come through for food (No. 4, Fig. 51). During inclement weather young queens are often detained prisoners in the royal cells for days after the normal period has elapsed. Should the apiarist open the hive at this juncture, the ensuing upset distracts the bees' attention from the cells and several queens hatch simultaneously.

QUEENS FLY ON OR ABOUT 21ST DAY.

There is a point here worth remembering. Normally a young queen will leave the hive to fly on the fifth day after her exit from the cell, but queens detained as shown above are capable of flight as soon as they nibble out of their cradles. This often leads to misunderstanding. Ordinarily, the young queen on emerging from the cell presents a downy, "groggy" appearance, as she crawls over the combs seeking a cell of unsealed honey. (It is only during the egg laying period that the queen is so carefully fed by the workers). After crawling about for 5 or 6 days the queen walks out to the front of the hive and takes wing. With her head towards home she circles in graceful flight, taking great care to make a note of the surroundings. In a short while her peculiar flight is no longer heard. She does not remain away very long, but soon returns. She repeats this performance for several days until fertilised by the drone.

QUEENS FERTILISED DURING FLIGHT.

The act of copulation takes place on the wing, and the whole of the genital organs of the drone are expelled from his body with a distinct sound, and are absorbed by the queen. The whole act has been witnessed, and fully described in that fine journal *Gleanings in Bee Culture*. This rupture invariably kills the drone. The author has often witnessed the return of the queen from her mating trip, with the fine white thread, already partially dried, still protruding from her abdomen. The worker bees appear very excited and follow the queen about stroking her with their antennæ and generally making a fuss. The apiarist will now discern a great change within the next 48 hours.

DIFFICULTY IN FINDING VIRGIN QUEENS.

Previous to her wedding journey the virgin queen was of a restless, nervous disposition, running hither and thither whenever the hive was opened. Her body was very little larger than that of a worker bee, and her quick movements made it difficult to find her. In fact, practical queen breeders make no effort to find virgins: they rely on the surroundings and temper of the bees to determine whether the hive is queenless or not.

After her marital flight the queen's abdomen fills out in a most astonishing manner. The next day she walks over the combs with her shapely body held high up from the comb (a sure sign of age in a queen is a dragging gait as if the legs were no longer strong enough) in a slow dignified way. Her whole attitude is that of attending strictly to the business of egg-laying. Very often when removing a comb one may notice the queen investigate a cell with her head, then insert her abdomen in a curved manner and when she withdraws it the tiny egg, like a speck of white cotton, is plainly visible attached to the bottom of the cell. This usually takes place about the tenth or twelfth day after she hatched from the cell.

QUEEN DESTROYS CELLS.

As mentioned elsewhere, the first queen hatched will—unless prevented by the bees—destroy all the mature cells. To prevent this it is well for the apiarist to make himself familiar with the signs that denote the age and condition of queen-cells.

The day before the queens are due to leave the cells the bees remove the wax tip (No. 3, Fig. 51) and leave the end of the cell quite smooth. Actually the larva when spinning the cocoon inside the sealed cell is unable to reach right into the sharp tip, and the moving of the head from side to side during the process of weaving determines the distance reached by the cocoon, so when the bees remove the pointed tip it exposes the cocoon, which is smooth (No. 4, Fig. 51).

The cocoon is very tough indeed, and if a "ripe" queen-cell is held up to the ear the sound made by the insect's jaws is quite audible. It is always safe to take care of the cells when the sharp tip is removed in this way: it is really the stage referred to as "ripe." On odd occasions, queenless bees will remove the tip several days before the due time, perhaps in eagerness to see their prospective mother. The strong aversion queens have for one another prompts the first queen out of the cells to look around for rivals to the monarchy. The cells are hardly safe even for a very short while. The free queen looks for a little refreshment from some unsealed cells of honey before she starts out as a royal executioner. Thus strengthened she make a savage attack upon the other cells.

Now it is a strange thing to record, but it so happens, that when the royal larva spins a cocoon, unlike many other insects, it weaves it in such a way that it covers but half of the insect—the head and thorax. The abdomen in the base of the cell is not protected by the silken covering, but only by the successively cast skins of the larva. The cocoon, woven of bee-silk, is extremely tough; it will resist a strong pull with the fingers, and only reaches up to the dotted line on No. 3, Fig. 51.

When the executioner arrives, she wastes no time attacking the portion of the cell reinforced by the cocoon, but starts at once to tear a hole in the side of the cell just above the dotted line. While the base of the cell is made very thick with wax and bits of refuse, the point is protected by the cocoon. The position indicated by the dotted line is therefore the weakest point, and it is here that queen-cells are always destroyed whether by worker-bees or queen. After the queen has effected a breach she inserts her sting and administers the *coup de la mort.* (The slightest prick of the sting proves fatal to bees). The worker bees now enlarge the hole, drag out the body, and to make a good clean finish eat up any royal food that remains. The cells soon disappear as they are never again used for royal cradles.

Should a queen be killed accidentally, or removed from the hive, the bees will at once select larvæ to receive an extra supply of royal jelly. Such is their haste to supply the missing mother that they do not make queen cells similar to the ones described, but simply build out one or two—perhaps more—worker cells and amalgamate them into a queen-cup on the face of the comb. Cells so built are poor, miserable things, hardly any dimpling on them, and the queens that hatch are little better than half workers. The circumstances under which such queens are reared are so entirely at variance with the conditions existing at swarming time, that a well-developed mother could not possibly be produced this way. Whenever the apiarist comes across a queen reared in this fashion he should destroy her and re-queen with one of better development.

YOUNG QUEENS LAY DRONE EGGS.

Rarely, a beautiful well-developed mother will start off laying drone eggs, but after a while she appears to get the "machinery" under better control, and worker eggs are laid almost without exception for the whole of the first season. A virgin queen delayed unduly from mating with the male bee starts to lay **drone** eggs and is never of any service. Once in a while the eggs of certain queens will not hatch and the reason is difficult to discover.

When all the food supplies are right, a good Italian queen is capable of laying 4,000 or more eggs per day in the height of the season. Queens incapable of this should not be tolerated; also those that lay little patches of eggs here and there (instead of starting at the centre of the comb and spreading eggs in widening circles until the wood of the frame is encountered), are of no use. The most up-to-date methods for breeding fine, large, perfect mothers will now be described.

QUEEN-REARING.

GENERAL METHODS.

The most popular breed of bees in Australasia is the Italian race. The queens are extra large, gentle, and of pretty tan colour; the workers are good honey gatherers, hardy—when not inbred for colour—and practically immune to the wax moth. Now if we wish to introduce this breed we will require to purchase a pure breeding queen from some reputable apiarist. When she is safely introduced to a stock, and laying, we are prepared to start rearing queens of Italian blood. If swarming is at hand, Italianising will be comparatively easy. Watch the black and hybrid stocks closely and whenever embryonic queen-cells are started and well supplied with royal food, select a warm bright day, not lower than 88 degrees F.,—the warmer the better—and lift out the combs with the rudimentary cells and carry them to the hive that has the Italian queen. With the transferring tool (Fig. 57) lift out from the queen-cells on the brood-comb, all the larvæ occupying them and substitute some of the **smallest** grubs from the Italian stock.

The larvæ transposed should not be more than 36 hours old—the very young ones are the safest for the novice. The cells so handled, marked by pushing a 1 inch nail into the comb, should then be returned to their respective stocks. In due time they will be completed, and when the hybrid and black swarms issue, there will be a fine batch of young Italian queens ready to hatch in 7 or 8 days. As already stated, inclement weather will sometimes delay a swarm until the young queens are ready to bite out of the cells.

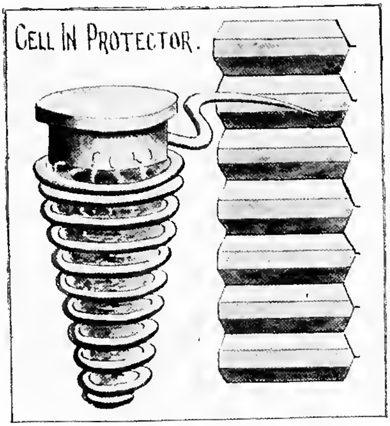


Fig. 52. "West" Cell-protector.

These cells when mature or "ripe" may be placed inside a cell-protector (Fig. 52) and given to queenless stocks, or the swarm may be deprived of its black queen and given a ripe Italian cell. Cells may also be disposed of as directed under the heading of "Increase" (p. 68) which it is well to look up at this time. Queens may, by this plan, be reared with a minimum of trouble where only a few hives are kept; these queens are first class too.

SUPERSEDURE—ANOTHER NATURAL PLAN.

Should the apiarist desire to raise a few queens outside of the swarming period the desired object is rather harder to accomplish. He may happen to have a hive with a very old queen and fortunate enough to find them building, in a leisurely way, two or three queen-cells. This is to rear a young queen to assist the old mother to keep up the egg supply, and to finally reign over the hive when the old one dies. (Probably this is the only time two queens are tolerated in a hive under natural conditions). Now a hive engaged in the superseding of its old queen is about the very best to build cells, and to secure the maximum benefit the novice should closely follow the directions here given.

PREPARING CELLS.

Secure a piece of nice white drone-comb and cut it down ⅛ of an inch from the midrib on one side. A sharp hot razor will do the work. Slice off a strip say 10 inches long and wide enough to show one clear row of cells (Fig. 53). Fasten an extra bar in a frame, and on the underside cement the strip of comb with the shaved side facing the bottom-board. The prepared frame is then given to any strong colony at sundown.

During the night the bees will build the shallow drone-cells into rudimentary queen-cups, and when taken

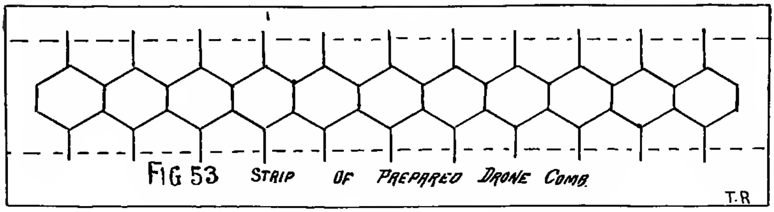


FIG 53 STRIP OF PREPARED DRONE COMB

out during the warm hours of the following day, the frame and cups are warmed to the proper temperature. There is thus no chilling of the larvæ as when cold cells are used. Before attempting the transfer of the tiny grubs, make a space to hold the cell-frame in the hive superseding its queen. This precaution is to prevent unnecessary exposure of the grafted cells.

With the prepared frame go to the Italian stock and select a comb containing larvæ of suitable age, up to 30 hours old, and leave it close at hand. If the supersedure colony has queen-cells with royal jelly, remove one of them, and with a stick or jelly-spoon place in the cells a piece of jelly about the size of the head of a match. Put it neatly in the centre without daubing the sides of the cup. This makes a nice soft place whereon to lay the larvæ which should now be lifted from the Italian comb with the transferring-needle. This little food supply helps to sustain the larvæ until the bees begin to feed them.

Do not put a grub in every contiguous cell, because when completed, there will not be sufficient room to separate them. Leave a space of 2 or more empty cells. The frame of "grafts" is now handed over to the supersedure colony for completion.

The business of building queen-cells is a severe strain on the colony, and no more than a dozen or fifteen prepared cells should be given at one time. Only young bees up to a fortnight old are provided with the glands that manufacture, with the chyle stomach, the milky food termed "royal jelly." When a supersedure colony has plenty of hatching brood, it will probably accept and draw out half-a-dozen batches of cells. To get them to do this, however, the queen-cells should be removed before they are sealed. A fresh batch may then be given. Cells built by these colonies produce some of the finest queens, and since they are disassociated from the swarming impulse, this must be a step in the right direction.

WHAT TO DO WITH THE CELLS UNTIL WANTED.

The novice will perhaps wonder what to do with the cells after sealing until they are "ripe" enough to dispose of. Well, a queenless colony will take care of them, or they may be removed with a warm knife, placed in cell-protectors, and given to the upper storey of any hive separated from the brood-chamber by a queen-excluder.

TO GET CELLS ACCEPTED.

Go to a strong stock and cage the queen; remove the brood-combs and take off the supers. The best way is to shake off all the bees from the combs on to the ground in front of the hive, allowing them to run back. Place in the hive a comb containing some water and pollen, and another one of honey; the two combs should be just far enough apart to permit a third frame to hang easily between. Cover the hive and leave it thus for eight or ten hours with the queen still caged.

At the end of the time specified go to the hive of the best Italian queen and cut out a strip of worker comb containing eggs. The strip should be cut in the way illustrated in Fig. 53. With a tooth-pick or match destroy every alternate egg. It is better to destroy the eggs in three consecutive cells as this leaves a greater space between when finished. The piece of comb should now be fastened to the underside of the middle-bar of the frame, with the eggs facing downwards; it is then given to the expectant colony. Remove cells when sealed, and return to the colony its supers and brood-combs.

THE DOOLITTLE SYSTEM.

Get a small piece of pine about the size of a rake tooth, and with sand-paper shape it to fit an embryonic queen-cell. A small flat tin of hot wax should be at hand in which to dip the pieces of previously wetted pine. Doolittle recommends dipping the sticks to a depth of nine-sixteenths of an inch the first time, and each successive dip a little shallower. This makes the edges of the cups very thin and the bases very thick, which is similar to a naturally built cell. The wax should not be too hot, just above melting point; three or four dippings will be all that is required. After the final dip plunge the sticks into cold water. The little cups may then be taken off by gently pressing with the thumb and forefinger.

When a sufficient number are moulded they should be fastened with hot wax to the underside of the middle-bar (See bottom frame Fig. 54). It is a good plan to stand the cell-cups in the super of a strong colony over-night to prime and warm them. Next day procure a queen-cell almost ready to seal, lift out the grub, and stir the royal jelly to make it even in quality. (It will be found that the fresh thin jelly is much preferred to the thick stuff). An amount equal to the size of a pin-head should be placed in each cup, which is then grafted with Italian larvæ in the way already described.

During the swarming season the cells may be placed in the super of any strong colony if it is separated from the queen by an excluder. Two frames of young unsealed larvæ should previously be placed in the super, one on each side of the wax cups. This entices the nurse bees upstairs so that the queen-cells are not deprived of food.

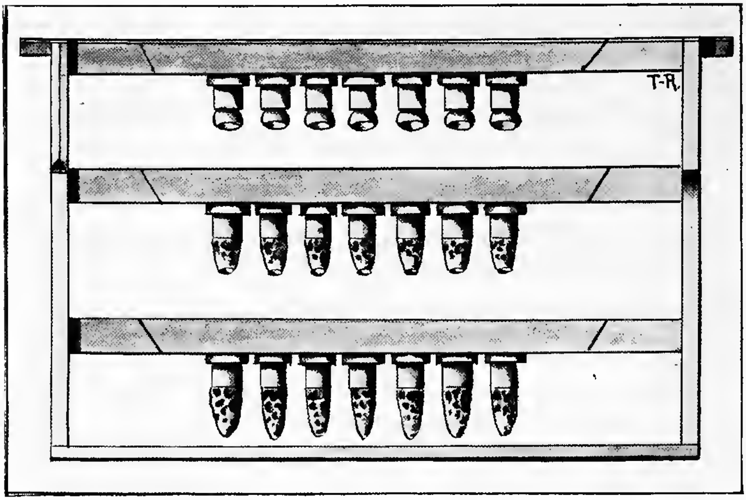


Fig. 54. Queen-cups, and sealed Queen-cells.

SUPERSEDURE CONDITIONS.

Any portion of a hive with a little brood, shut off from the queen, gives the nurse bees the impression that the brood must be getting less, and since no fresh eggs are deposited, the queen must be failing. They then decide to rear a young queen to supplant the failing mother. It is a good thing to bear this in mind whilst engaged in any queen-rearing operations.

THE LATEST OR PRATT SCHEME.

Latterly, a high-pressure system of queen-rearing has been given to the apicultural world by an American named Pratt, widely known among bee-keepers as "Swathmore." To get queen-cells built he "borrows" a quantity of bees, not necessarily all from the same hive—of course no queen is taken with them—and confines them in a box, similar to the large nucleus in Fig. 55, holding five Hoffman frames. It has a special lid, with a slot in it fitted with a dummy bar (Fig. 56). This "dummy" is interchangeable with the bar from the cell-frame.

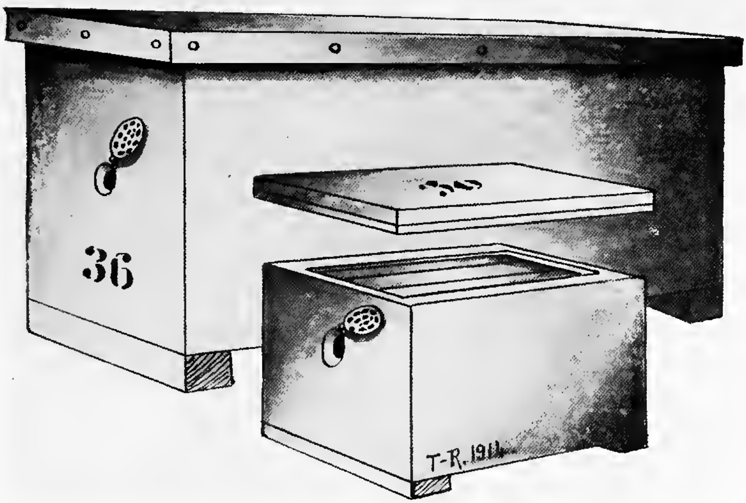


Fig. 55. Comparative view of Nucleus-boxes.

Before confining the bees he provides them with water, pollen, and honey in a comb, after which they are placed in a dark quiet cellar. When sufficient time (about 3 hours) has elapsed for the bees to realise the helplessness of their position, he prepares a number of little wooden cell-holders by pressing into the hollow a wax cup. The cell-holders are attached to the bar of the frame (Fig. 56) by sharp spikes pressed into the soft pine. They are then given to the colony to prime. After this the cups are provisioned with royal jelly, and grafted with larvæ from the best breeding queen. (Fig. 57).

The dummy bar is now removed with a drawing action—after giving the box a sharp dump to throw the bees to the floor—and the bar of prepared cells takes its place. This sudden appearance of larvæ when everything appeared so hopeless, acts in a wonderful way. The cells are accepted and carefully attended to at once, without waste of time.

STRONG COLONIES TO COMPLETE CELLS.

It is a recognised fact that whilst a colony with a queen will not, generally, accept queen-cells to build,

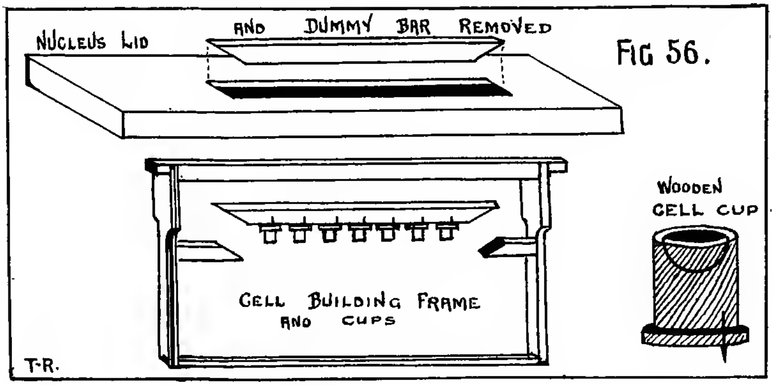


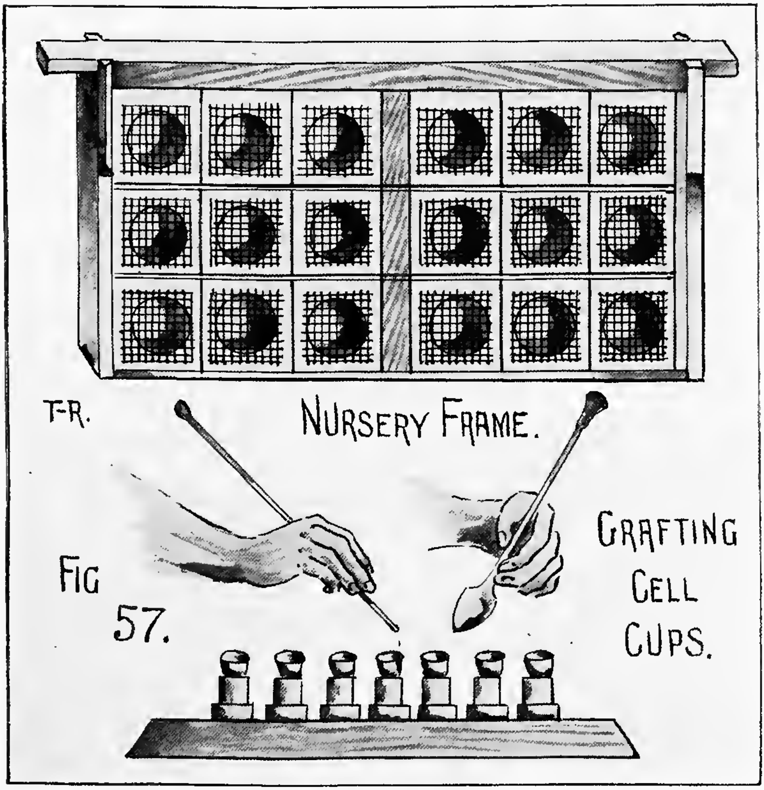
FIG 56.

almost any strong colony will **complete** queen-cells once started. Therefore as soon as the cells are accepted, E. L. Pratt removes them from the box in a careful manner, and after replacing them in the cell-frame (2 Frame Fig. 54) gives them to a strong colony to complete.

A super, divided from the brood-nest by a queen-excluder, containing 2 frames of unsealed larvæ is chosen to hold the cells during completion (first frame in Fig. 54). Strong colonies have more nurse bees, therefore a greater supply of royal jelly is available. The temperature of the hive is more easily maintained when it is "boiling over" with bees. This question is a vital one to the queen; should the cells get even a slight chill the occupants often die. It prevents perfect development at any rate; such queens are small, dark in colour, never prolific, and are unprofitable to keep.

QUEEN-NURSERY.

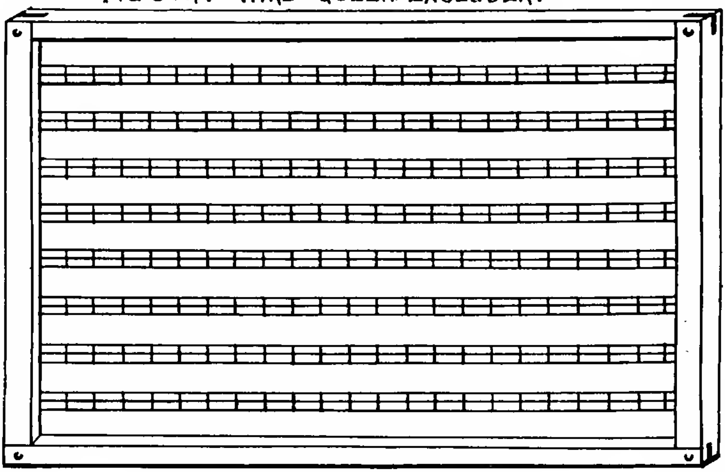
When plenty of cells are coming on it often happens



that the apiarist is not in a position to use them immediately. The nuclei may already be taxed to the uttermost; under these circumstances he has therefore to fall back on the queen-nursery to hold the cells until room is provided.

The nursery (Fig. 57) is the most popular method of holding cells until they are placed in hives or nuclei. It consists of cages fitted to a Hoffman frame. They are constructed of wire gauze, and to allow the queen-cell to be inserted in such a way that the slight projection on the cell-holder prevents it dropping inside. The cages are also supplied with prepared food for the queen, should she hatch and the bees refuse to feed her. The frame of cages, each containing a queen-cell, is then placed in the top storey of any strong colony.

FIG 57A. WIRE QUEEN-EXCLUDER.



The bees of such a colony are inclined to feed the young virgin queens. Before the queen-cells are placed in the nursery cages a little honey should be placed on the tip of the cell; this permits the queen to obtain a little food, fortifying her for the exertion of cutting her way out. Neglect to tip the cell with honey often causes the death of a queen.

INTRODUCING QUEEN-CELLS TO NUCLEI.

By far the best way to have cells attended to under natural conditions is to introduce them when "ripe" to nuclei. That most favoured for the purpose of a temporary home for a virgin queen or cell is the large one illustrated in Fig. 55. It is the regular standard size holding 3 Hoffman frames, two containing honey and pollen, the centre one with brood in all stages. The brood-frames are taken from any strong hive during the heaviest flight of the day, so that the bees adhering to them will be young ones who have not yet located their home, and therefore are more likely to remain where placed. However, when the brood-frame and bees are ready, gently cover the queen-cell with a protector and attach it to the side of the comb. See that the cell is up in the warmest part of the hive so that it will not chill. The perforated piece is then turned to cover the nucleus entrance.

The bees are closed up in this manner for a couple of days. When opened at dusk on the evening of the second day, very few of the young bees will return to the original stand. If the queen has hatched, they will be quite content in their new home. Perhaps it is well to point out that "ripe" cells only should be given to nuclei, so that the lilliputian colony is not too long queenless. There is nothing like a young virgin queen to hold the bees together.

QUEEN MATING.

BABY NUCLEI.

The Pratt method made use of the nuclei system, but instead of using the standard size he constructed a smaller box shown for comparative purposes in Fig. 55. In connection with these small hives he used what are termed "baby nuclei frames" (Fig. 58). These tiny frames (3 in number) were made to fit the standard frame. (The illustration is the author's method of fitting them. The Americans use a metal slide to form the lug whereby the frames rest on the rabbet). A frame so fitted is hung in the centre of the brood-nest of a strong colony.

If the baby frames contain foundation they are quickly drawn out and filled with brood. The author makes a point of saving small pieces of worker-comb when transferring bees from box-hives. A number of pieces too small to handle in standard frames can thus be utilised profitably.

STOCKING BABY NUCLEI WITH BEES.

When using baby nuclei care must be observed in peopling the tiny hives. Do not have these small colonies in the immediate vicinity of strong stocks on account of

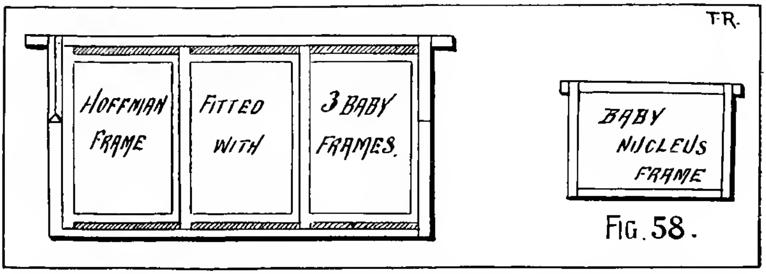


FIG. 58.

the danger of getting them robbed out. Also it is much better to stock baby nuclei with bees from an out-yard some distance away.

To do this, prepare, say, 30 nuclei. Get a like number of standard frames each holding 3 baby combs, which placed in the brood-nest of a strong stock will soon be filled with eggs. When a few bees begin to hatch from these frames the apiarist had better take two or three swarming boxes to an out-yard. Into these shake off the bees from 30 brood-frames; dump the box on the ground first before shaking each frame, to prevent the bees taking wing when the lid is opened. Of course the operator must be careful to take no queen.

When sufficient bees are obtained they are taken to the home yard, and as fast as the nuclei are given 3 baby frames and a ripe queen-cell, the swarming-boxes are dumped on the ground and sufficient bees—about enough to cover thickly a Hoffman frame—are poured into each nuclei. The lid is then replaced and the entrance securely closed with the perforated metal until darkness sets in, when the entrance is again opened.

The queen when out of the cell will behave in this miniature hive precisely the same as when hatched in a stronger colony. In due time she will be mated and eggs laid as usual. The apiarist, however, must be careful to remove her soon after she begins to lay, otherwise she will quickly fill the small comb space and lead off a lilliputian swarm. By using baby nuclei in this manner only a very small number of bees are taken from the daily work of honey gathering, and queens are mated with a minimum of expense. It is unwise to make use of baby nuclei in variable or inclement weather, as they are suitable only for the summer months.

UPPER STOREYS FOR QUEEN MATING.

Some bee-keepers do not care to have separate nuclei for queen mating, preferring the upper storey or super. In full depth bodies, there are divisions to hold two or three frames. Prepared thus, they are set over a wire gauze screen covering a strong brood-nest. Entrances are made on each side, and the centre compartment has an outlet at the back. This is an excellent plan for inclement weather, but it has the defect of having too many virgins flying from the same hive. This means loss of queens under certain circumstances.

Apiarists with Bolton hives can very easily adopt this plan, or use a single body on a separate stand as a nucleus-box. This has one great advantage; it does away with odd-sized hives, and uniformity of working plant is well worthy of more attention than it usually receives. A bee-farmer ought not to have to use odd-sized supers and frames during a rush of honey, before being able to appreciate uniformity of pattern.

QUEEN INTRODUCTION.

With the queens reared, and laying, a word or two here on the introduction cage may not be out of place.

Queens as sent out from the breeder's yards in mailing-cages, are usually accompanied by a sufficient number of worker-bees to maintain an equable temperature, and to act, as it were, like a series of live springs. When in transit the bees cling to the sides of the cage and so minimise the effects of a jar. One of the compartments is filled with queen-food.

QUEEN-CANDY.

This candy is prepared with honey and powdered sugar, kneaded until it is of the same malleable consistency as putty. The object is to work it very thoroughly so that a fairly high temperature will not thin it enough to run, at the same time care must be exercised not to make it too hard. Some badly made candy becomes so hard that it is impossible for bees to eat it.

A good practical way, is to heat some honey until it is very thin. **Great care must be taken to make sure the honey is not diseased,** for foul brood may be disseminated in this way. Only the best should be used for this purpose. Stir in as much powdered sugar as it will take up, afterwards adding more when working it with the hands, until it assumes a putty-like consistency.

CAGING QUEENS.

When the end compartment of the cage is filled with candy, a piece of oiled paper or vegetable parchment is covered over it. Wire gauze is then partially nailed on. The end of the gauze can thus be raised sufficiently for the apiarist to run in the queen and from 15 to 30 worker bees. To do this is a simple matter; the opening of the gauze must be at the lowest point, because most insects run upwards, and bees are no exception to this rule. Keep the thumb of the left hand pressing down the wire; lift out the comb holding the queen, and pick her up by the wings with the index finger and thumb of the right hand and release the wire-cloth sufficiently to permit the queen to enter.

The apiarist will now observe a number of bees with heads buried in the cells, taking in a supply of honey, so it is an easy matter for him to pick them up by the wings and place them in the cage to accompany the queen. Young bees—distinguished by their hairy appearance and lighter colour—should be selected for mailing cages, as they are better able to withstand the rigours of a journey in the P.O. bags. Most breeders place on the back of the address card full instructions how to introduce. Generally, it is pretty safe for the novice to observe carefully the directions so furnished.

Until the novice has gained some experience, he will lose fewer queens by the use of the cage: the veteran will very probably have developed a scheme of his own. It is advisable, however, to detail a few of the methods now generally in use. There is one rule that underlies all systems of queen-introduction, and that is to make sure that the hive is queenless before attempting to give it a new mother.

SIMMINS PLAN.

The Simmins plan is very simple, and very successful. To introduce by this method the hive should be queenless at least 8 hours, and not more than 1½ days. If longer than two days, the bees will have queen-cells well under way; they are then inclined to favour rearing a queen for themselves in preference to accepting a change. To proceed, cage the queen by herself and keep her alone and hungry for 30 minutes. Just at dusk, raise the hive lid in a deliberate and extremely careful manner, so that the bees are almost unaware of the act, give a puff of smoke, run in the queen, another puff, and leave the hive severely alone for 5 to 7 days.

MILLER PLAN.

During the last few months, an apiarist in the United States of America has brought forward smoke introduction, and great claims are made for it. He simply smokes a colony and runs in a queen. If the colony contains an old mother the introduced queen supersedes her. Virgins are introduced with the same facility. With the Simmins method, the queen is hungry, and desires company, so she protrudes her tongue and runs to the bees asking for food in a way similar to what their own mother would do. Thus they are cheated into a kindly reception of the stranger.

Virgins are easily introduced to any queenless stock, when not more than a few hours old; in fact, a colony with a laying queen will accept them until they attain a little age. They are then balled and stung. The introduction of old virgins is so risky, that it is not worth practising. Therefore the basis of the success of the "Miller" system is not easy to define. Supersedure will sometimes take place when a young queen is reared above a queen-excluder. When the excluder is removed, the young queen goes down to the brood-nest, and sometimes deposes the old mother. That this invariably happens is not the experience of the author.

A SAFE WAY.

When a large sum has been paid for a good queen—perhaps an imported one—the novice has no wish to take any chances with her. A good plan, and what is really the only certain way, is to place a wire screen (Fig. 77) over the brood-nest of a strong colony, and set an empty body on the screen. Look over some brood-nests, and select 3 or 4 combs where young bees are just batching out. Shake off **every live bee**, and place the frames in an empty body; do not forget to give a comb containing honey and pollen. The queen is then released on the combs, and the hive closed.

In a day or so, enough young bees will have hatched to keep the queen company; no brood will be chilled because the heat from the colony below will keep it warm. When a little cluster has formed the body may be removed to a new site, without loss, as the bees are too young to have any idea of location. The stock may be built up by judiciously adding a frame of hatching brood now and then.

INTRODUCTION BY ANÆSTHETIC.

European apiarists sometimes introduce a queen after having first stupefied the bees by the use of some anæsthetic. This plan is now never practised in Australasia.

POLLEN AND POLLEN SUBSTITUTES.

POLLEN SHORTAGE.

Queen-rearing in most places in Australasia is usually held up by a dearth of honey and pollen for a week or so in midsummer. This scarcity happens sometimes in the spring and autumn, but the midsummer spell is usually characterised by dry weather, and is considered a critical period in Australasian beekeeping.

This naturally brings us to a consideration of pollen shortages and how to minimise the effects on the brood, etc., etc. From the remarks made on swarming, it will be seen that the best queens can be reared only while honey and pollen are to be obtained in abundance. Honey is the heat-forming portion of the bees' diet, and if the protein-forming element (*i.e.,* pollen) is missing or deficient the young larvæ must suffer. Pollen, under analysis, contains ingredients similar in a great measure to pea-flour. Owing to a great many of the Eucalypts failing to yield pollen some seasons, and a number, (mostly the "box") that **never** yield any quantity, this shortage is of periodical occurrence.

This is very marked when the bee-farm is located on a "pure" forest, *e.g.*, where the only timber is "Yellow box" or "Red box"—although the latter yield a fair quantity some seasons—or some other single variety. On this account it is better to locate on a mixed forest if possible. The "pure" forests, while yielding large crops, are often deficient in some elements, so that strong colonies of bees dwindle down to mere nuclei, and consequently their removal to scrub country—with pollen-yielding plants—becomes imperative.

Numerous endeavours have been made to supply some efficient pollen substitute. A perfect substitute is yet to be found, but a number of mixtures have been furnished to the bees with gratifying results. During the winter months when brood rearing is at a standstill, little or no pollen is required. It is the author's experience, however, that a certain amount stored and carried over the winter, is put to very valuable service in early spring, when the fresh supply is rather tardy in making its appearance.

As elsewhere explained, the nurse bees—two or three weeks of age—are provided with a special gland very active indeed at the age specified. In the case of older bees this gland is almost dormant, hence the advisability of having a huge force of young bees when rearing queens. It is the secretion of this gland that is fed to the larvæ until weaned, when a mixture of honey, pollen, and water is substituted. In the case of queen larvæ this secretion is fed continuously until sealing. With drones, the weaning takes place much earlier. Laying queens appear to be constantly fed with this secretion whilst engaged in their oviparous duties, and this probably accounts for the phenomenal ability to lay enough eggs in twenty-four hours, the total weight of which is twice that of the queen herself.

It is difficult to decide, but it would appear, that the bees control the number of eggs deposited by the amount of food fed to the queen. Cheshire states that the pollen grains found in the stomachs of the weaned larvæ are in a **growing condition** (*i.e.*, live food similar to the diet of nuts, etc., prescribed for humans). When this is fully realised, the difficulty of providing an efficient and satisfying substitute is apparent. Since pea-flour more nearly approximates natural pollen, the author prefers to feed this meal, though the fact must be faced that the food is inert.

SUBSTITUTES.

Bees, when pushed, will accept a number of substances, such as flour (wheaten and rye); oatmeal, and cheese makers report bees carrying off the "dust" that accumulates on the maturing shelves. This "dust" is nothing more or less than living animalculæ, and is, perhaps, the best and most valuable substitute for natural pollen. Wheaten flour is carried into the hives all right, but it dries into a paste-like condition, that takes considerable work to remove it from the cells when it has become too hard for use. Bee-keepers place a number of flat trays containing flour about the apiary and the bees carry it packed in pellets, similar to the genuine article. They waste considerably in this way and it entails a deal of wear and tear on bees already impoverished.

The author has had better success by mixing pea-meal —with a pinch of salt added—into a thick paste with honey, and after plastering it into an empty comb, giving it directly to the brood-nest. Last autumn a fair colony cleaned out a ¼ lb. of this mixture in one night, and, on examination of the brood-nest next morning, not a trace of pea-meal could be found. That the brood benefited is quite apparent, for it is the strongest colony in a yard of one hundred.

Most hives in winter have no brood or eggs, and this is to be preferred, when no natural pollen is available in late autumn. Recently a recommendation has been made to cook the meal or flour, but this is not advisable since it renders the substitute more inert than ever.* Milk in

* Professor Osborne, D.Sc., has stated that the 'Vitamines'—the absence of which in polished rice causes Beri Beri—are present in some form or another in all fresh food, but many forms of preservation entirely destroy the substance.

dried form may possibly be utilised, but in the natural condition will soon sour and disgust the bees. White of egg is open to the objection of not keeping, but considerable success has been reported with it in combination with pea-flour. The apiarist discovering plenty of eggs all failing to hatch after the normal 3 days has expired had better prepare a pollen substitute on the lines indicated, even if the article supplied is not quite as good as natural pollen. Half a loaf, it should be recognised, is better than no bread.

There are rare cases (encountered at long intervals) when the eggs of certain queens fail to hatch. No amount of food, however rich, will overcome the phenomenon. The queen is defective in some way and should be destroyed, for it is impossible to remedy it. It is not this class that the author has in mind. There are times when the absence of pollen is so acute that the bees are unable to prepare the necessary milky food, and consequently there is no larval development.

The following food has been tried in a small way, with great success, but at present it is rather premature to advise its wholesale use. The author intends to give this food an exhaustive trial, and will then be in a better position to judge of its effectiveness when handled in a large commercial way. Recipe—Take two cups of sugar (1.A. crystal) with enough water to moisten it, add half a pinch of cream of tartar, and boil for ten minutes. Prepare the white of two eggs beaten to a froth, pour in the syrup, and stir until cold. It will then have a fine white grained appearance similar to the fondant inside chocolate-cream confectionery. The grub must have flesh-forming food (proteid-albumen) and heat-producing food. The life of the bee is a constant search after nitrogen, and since the grub must store up enough "vitality" to carry out its life's work the quality of the food constitutes the preponderating influence.

ANALYSIS OF POLLEN.

Appended is a table of analysis prepared by Dr. Cherry, late Director of Agriculture, Victoria.

Sample Number.	ANALYSIS OF POLLEN.	Nitrogen in water free pollen.
14423	Yellow box collected from Taradale, January, 1905	3·70%
14424	Bastard box collected from Heathcote, March, 1905	3·80%
14425	Bastard box collected from Tooborac, April, 1905	3·49%
14426	(1) Messmate or swamp gum ...	3·55%
14427	(2) Yellow box	2·90%
14475	Unnamed	4·00%

The outstanding feature is the variation in the nitrogenous content of the pollen from various indigenous trees. (For further information regarding pollen yielding plants look up Eucalypts, etc., under "Honey Plants," page 226.)

GENERAL SUMMER WORK.

WORKING OUT-YARDS.

Many apiarists find the practice of having bees distributed through a number of yards is one that can be successful only in the hands of a "born bee-keeper." If one cannot manage say, from 50 to 100 colonies in the home yard, it is wanton folly to attempt the working of out-yards miles distant from home. Out-yards should not be closer than four miles, the further apart the better the returns. In setting out bee-yards, it must be borne in mind that bees in the home yard will be able to work a two-mile radius. To have a yard situated four miles distant, would very probably lead to overlapping.

Closer distances are all right, when a honey flow is on and the season is a good one. Under these circumstances, a good location in a Eucalyptus forest, would probably support a thousand colonies, and still the average amount of honey gathered per colony would show no diminution. Like a chain, the strength of which is gauged by the weakest link, the location should be judged by the number of hives supported in the droughty spells.

Thousands of acres will not at times yield sufficient sustenance to support 100 colonies. Recently, reports have come to hand clearly demonstrating that bees will store from a distance of four miles. It is well to keep this in view when setting up and planning out-yards. However, when the apiarist decides to have out-yards, it is well to have a general outline of how to manage them. With the apiary set up—as shown under the head of "Out-yards," (page 71)—the apiarist should determine to handle it with a minimum of labour. When a system is evolved, that produces the maximum amount of crop with a minimum expenditure of labour, the apiarist is on the high road to success.

Whatever happens, have all hives and frames uniform, because there will be periods when it is necessary to exchange with another yard, to secure some special object. In working an out-yard, the number of working days will depend upon the season. Sometimes the flow is so poor that a trip to the out-apiaries once a month will be all that is necessary. However, one does not want this to happen very often.

Taking a normal season in early spring, say about the end of August, all colonies should be overhauled to see that they are not short of food. Food in this case means honey and pollen. On this trip, should there be a deficiency of proteid-forming food,—*i.e.*, pollen—the apiarist had better supply pea-meal, mixed with honey into a stiff batter and add 5% white of egg. Take a table knife and press the batter into an empty comb, which should then be given to the bees on the outside of the brood-nest. This is preferable to feeding meal out in the open, while the weather is still sufficiently cool to chill a number of bees.

On the next visit, say in eight or ten days' time, the apiarist should keep a careful watch for the queen, and if not clipped, this matter should then be attended to. He should also make sure that the amount of store is sufficient,—this is an important point. It is astonishing how the honey will disappear when brood-rearing is under way; should the colony be short of stores, the nursing part of the bees' duties must suffer. This is a critical time, for if the hives are not pushed on in the spring they rarely recover in time to be of any service. American and English bee-keepers believe in letting the colonies have "millions" of honey in early spring, as this sense of bee-richness is a determining factor in brood-rearing.

Scan the frames to see if the queen is doing her share by laying well enough to keep her place. Have a record of every hive in a pocket book, and if the queen fails to enlarge the brood-nest in a satisfactory manner, make a note thus: "23 (if that should be the hive number) remove Q." When cells are available, all queens recorded thus should be destroyed, and a "ripe" cell given to the colony.

At this time of the year, three weeks may elapse before the next visit to the out-yard. On the next trip, should there be any new honey about, and the queens at all crowded for room, remove the **outside** combs of honey, and substitute empty ones. (A word here: the previous autumn in shutting the bees down for the winter make a special point of placing the defective combs, if any, on the **outside** of the brood-nest. Subsequently, if unfit for further use extract the honey and render them into wax.) These combs are placed in boxes, awaiting the formation of early nuclei for queen-rearing.

About this time, new white wax will begin to show along the top bars. The honey-flow is, perhaps, just strong enough to enable the bees to build a little comb, but to give a super would double the size of the hive at a time when the bees would be unable to keep it warm. When this happens, it is a good practice to give a frame of foundation in the centre of the brood-nest.

The yard may not be visited again for a fortnight; this is a matter of judgment. On the next trip the frames of foundation will have become frames of brood. Perhaps the whole eight frames will contain larvæ in various stages, so the colonies at this time will probably be able to stand a super of extracting-combs. In a normal season the queen may be laying so freely that the centre combs in the super are a card of solid brood. Should it happen that some of the colonies are inclined to be backward, take these combs containing brood, and place them in the supers of the weaker hives; this had better be deferred until the brood begins to hatch.

Some of the hives at this time may show signs of swarming, in which case, substitute a body of foundation for the brood-nest; place a queen-excluder over the foundation, on this a super of empty combs and on top of all the brood-nest. Make sure the queen is down on the foundation. The point to secure is **plenty of room.** To control swarming at an out-yard, give the bees heaps of it. Young queens, bred from non-swarming strains, should be the principal objective, and clipped queens the invariable rule. The top storey of brood may be profitably used to raise young queens, and to make nuclei. The conditions existing in a hive treated in this way nearly approximate those of a supersedure colony, and the queens reared are very good indeed.

A WASTE OF TIME TO HUNT FOR QUEEN-CELLS.

Of course it is practically impossible to go through the season without swarms, and this, in spite of the best management. However, make no effort to go through all the brood-combs, seeking embryo queen-cells; (at the best, their destruction is not a cure for swarming; it only postpones it for a day or two) just look at two or three super combs, the centre ones. They will usually have some brood in them, and it is from these, that the condition of the colony is gauged. If the hive has really decided to swarm, these brood-combs in the super show the first indications. The author has repeatedly proved this season after season. By thus judging the conditions, one man can accomplish the work of an out-yard in a day comfortably. Except during extracting, one day in every twelve should be sufficient to do the work of the yard.

When extracting comes round, it is better to take a crew of workers, and concentrate on the job. An apiarist owning, or working, a series of out-yards, should certainly invest a few pounds in an uncapping device. These machines are very portable, so their carriage from yard to yard is a mere item. They are great time savers, doing the work of melting the cappings automatically while the extracting is in progress. Cappings stored away in kerosene tins, or barrels, soon block up the honey house. At any rate, after digging out a few tins of cappings, and candied honey, the apiarist will not require much urging to purchase a cappings-melter. As it is rather risky to leave much honey at out-yards the extracting crew should be taken out on a waggon, so that a load of honey may be carted home in the evening.

CLIPPING THE QUEEN.

The operation of clipping the queen's wing is not a very formidable proposition. Should the apiarist be at all nervous over the work he should practise on drones until he gains confidence. However, to help him in the matter, here is a detailed account of how it is done. Do not use too much smoke when opening a hive to find its queen, especially if the bees are of the black variety. Lift out the frames carefully, and remember that the queen will most likely be on the frame containing most eggs, and not much brood. The keen observer will very soon be able to tell where her majesty is engaged. In a great many cases Italian queens are found about the centre of the brood-nest and hardly ever on combs of honey. Black queens, on the contrary, run pell mell over the combs whenever disturbed, and the apiarist may very likely find her on the wall of the hive. However, when found, the frame should be leaned up against the hive, standing on the end-bar.

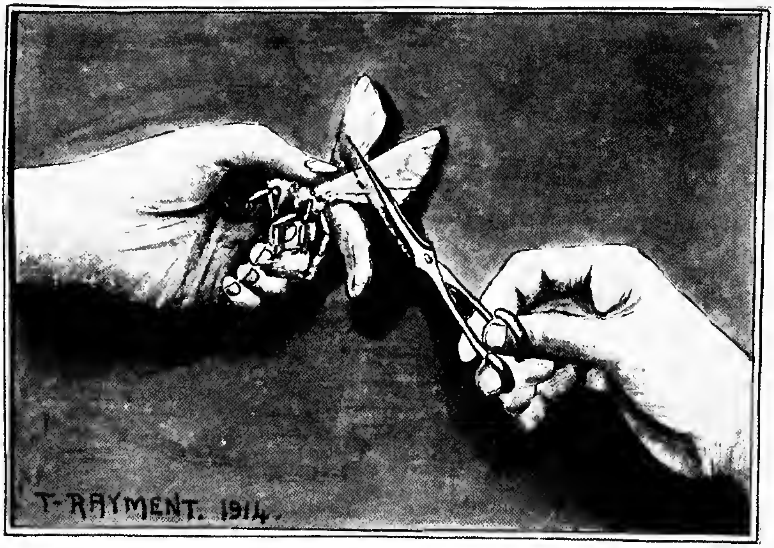


Fig. 59. How to clip the Queen's wings.

Have a pair of fine-pointed scissors close at hand. Follow the queen over the comb with the thumb and index finger of the right hand, ready to pick her up gently **by the wings** when she remains still a moment. When caught in this manner, it leaves the queen's head clear, so that the operator will have no trouble in holding her by the head and thorax, with the first finger and thumb of the **left** hand. The other hand is then free to use the scissors in the way illustrated in Fig. 59. Do not be afraid of hurting the queen's head or thorax. These portions of the queen's body are extremely hard, but the abdomen, containing the egg-producing organs or ovaries, is very sensitive to the slightest injury. **Always handle the queen by the head or wings.**

The stump of the wings should be about ⅛ inch long after cutting. By wings, it is meant that **both** wings on **one** side should be clipped. Remember, that the bee is a four-winged insect. After clipping, let the queen run on to the comb, don't drop her any distance as she is liable to be injured and turn to laying drone eggs (similar to an old queen when the supply of fertilising spermatozoa is exhausted). The thickened rib on the outside of the queen's wing, known as the wing nervure, should be left as long as possible, strip off the "feather" of the wing so to speak. If the nervure of the wing is cut too close to the body, it may "bleed" a little, causing a temporary weakness in the queen. If both anterior wings are cut, the result is not so satisfactory as when the anterior and posterior wings on one side are clipped. A queen can make a very fair effort to fly if the anterior wings are cut level, but when **both** wings on **one side** only are clipped it upsets her balance. When both small wings are removed the insect can fly down but not up.

ROBBER BEES.

ROBBING.

Any of the foregoing operations, with hives or queens, must be modified if there are any robber bees about the apiary. If robbers are very numerous, it is impracticable to do **any** work without causing serious demoralization and consequent stinging. Now, the novice will be pleased to learn that robbing is mostly the result of carelessness in leaving honey, or sugar syrup, exposed to the bees during a drought of natural nectariferous supplies.

In some localities, where the flow of honey is constant throughout the working season, the apiarist will experience little or no trouble with robbers. In forests where the honey flow is heavy for a month or six weeks (viz., when some of the "Box" trees are in bloom and yielding well) and is then suddenly cut off, the bees will require most careful handling, or the whole yard will be in an uproar in a few minutes.

DANGER FROM ROBBING.

There is a golden rule, **never leave honey or sugar syrup, or in fact anything that bees will rob, exposed about the apiary.** It not only induces robbing, but if disease is present the risk of spreading it to other hives is intensified. When once the bees obtain a taste of "ill-gotten goods" it is a matter of great difficulty to get them quiet again. Should the honey-house door, for instance, be left open and the bees gain admittance to the honey tank, an open tin of honey, or even "wet" extracting combs the merest tyro will soon notice something out of the ordinary. The shrill high note of bees on the rampage will first call his attention to the spoilers, who will be noticed flying in "clouds" about the honey-house. Should the careless proprietor then attempt to close the honey-house door, he will very probably receive a sting or two for his interference. (Bees are much more inclined to sting when on a robbing expedition.) The first action on his part will be to close the honey-house door; this is not to be recommended. Far better, go inside and cut off the supply: see that all tanks, super-bodies, and tins are closed **absolutely bee-proof.** A piece of paper or cheese cloth "stuffed" into a hole is not sufficient, robber bees will persistently tease paper and cheese cloth until an entrance is again effected. Another point to remember: robber-bees confined with wire cloth screen, will pass out the "stolen goods"—per medium of the tongue—to their free confederates, so that robbing still continues.

When quite sure that all honey, or other sweets, is safe, leave the honey-house door open until every bee is satisfied that there is nothing to gain by going in. It takes a day for them to realise this, so that when darkness falls the honey-house should be closed. If the door were closed first, the bees would recognise that "things are not what they seem," and they would diligently continue the search, until the apiarist will be astounded at the number of entrances to the honey-house available to the bees. Nail, and even knot-holes, are eagerly sought after. If a breach has been effected there will be quite a deposit of sticky dirt, etc., about the hole, formed by the passing of so many "trampling feet." This is noticeable also when a hive is assailed by robbers, the entrance or even a crack in the hive, will be quite discoloured in the manner described. Robber-bees, when let to pursue their own sweet inclinations will try every hive in the yard.

STRONG COLONIES SAFE.

If the bees are populous, headed by a queen, and with brood in all stages, the robbers will get a warm reception; and if persistent—as they generally are—will finally get stung by one of the guards. Weak and queenless stocks do not, as a rule, make a vigorous defence, consequently they fall easy victims; but give them some brood, a queen to defend, and they will fight valiantly in repelling the onslaught. Queenless colonies relax the guard at the entrance, and often join with the robbers in carrying off stores to the new home. Robbing appears to bring out other bad traits in the bees; sometimes baffled robbers will follow the apiarist about hour after hour in a most annoying manner. Buzzing (with a treble note) about six or seven inches from the face, they make spasmodic dashes for the eyes and hands, until the irate apiarist is at last forced to kill the tormentors.

When one or two bees develop this habit, it is advisable to kill them at the start. A good way to do this is to have a frame of wood—like a tennis racket—covered with wire cloth to allow the air to pass through, when making "a stroke" at the bees. A flat plain piece of wood blows the bee to one side, and before the "guard" is again raised, the apiarist is served with a sting in the face. Needless to say this "service" is not appreciated.

When taking off honey during a temporary cessation of the flow, great care must be observed that not one bee gets a taste of honey outside of her own hive. Should this happen, she will immediately repair homeward to tell the sisters of her "find." By this time the bee-farmer has moved on to another colony and he will be well advised to keep his eyes on the one last opened. Should a number of bees be observed trying to force their way through any cracks, etc., or even the entrance, he must take steps to stop it. This may easily be accomplished by brushing a little carbolic acid solution about the points attacked. See that the entrance is contracted somewhat, and that the covers are tight.

HOW TO HELP A ROBBED COLONY.

If the robbers appear too strong for a colony, and likely to overcome it, dust some flour over the robbers and then trace them home. Transpose the hives, place the "robber-hive" on the stand of the robbed and note the discomfiture of the "rascals" on returning to rob their own kindred. However, practical apiarists recognise that "prevention is better than cure" and there is always plenty of other work awaiting attention, so that nothing is gained by working bees when circumstances are unfavourable.

ROBBER TENT.

Queen breeders often have work to attend to that admits of no delay, so they have a light wire cloth "tent" made large enough to stand over a hive and leave room for the operator to work inside. Of course, robbing makes all bee work more troublesome, but when absolutely necessary, work may be made more agreeable by providing a supply of sugar syrup for the bees to work on. It should be so regulated, that the bees obtain it no quicker than they would a natural flow and do not have the syrup within 500 yards of the apiary.

The last extracting for the season is usually marked by more or less robbing; however, take care that no honey is left about for the bees to develop bad habits. When a hive is about "cleaned out" by robbers it is better to let them finish the "job" when they will probably settle down again. If the hive is removed, the robbers will concentrate on the next hive and the area of trouble is increased. This is especially the case where all hives are alike in shape and colour. Feeding bees and robbing are, in the hands of a careless apiarist, concomitant to each other.

FEEDING BEES.

WHEN NECESSARY.

Bees require to be fed only when natural supplies fail. When this occurs they are ready to rob on the slightest provocation, so the urgent necessity of exercising the greatest care is clearly apparent. To begin with, bees must sometimes be fed to enable the apiarist to maintain them in good order, to harvest a crop later on. Under the head of "Pollen Shortage" (page 125), it was remarked that during midsummer, most localities suffer a period of drought.

From letters received by the author from apiarists throughout Australasia, January appears to be a sterile month in many places. If the flow of honey in the spring is followed by a shortage for a month or so, about January bees look very poorly indeed. It is quite probable that the flow will again come on in the autumn, and, unless the bees receive some help during the summer, they will be too weak to gather any surplus. That is, if they were fortunate enough to survive the dry spell.

This matter could be easily disposed of if the bee-farmer had a premonition of the cessation of honey. He would simply leave off extracting in time to allow the bees to fill up the hives, thus obviating all danger. Unfortunately this does not occur. The flow is heavy and the apiarist keeps extracting to relieve the combs and provide storage room. In a few hours the flow of honey ceases from some unknown atmospherical change, and the hives may have sufficient stores to carry them safely over a month or six weeks. The flow of honey will probably not come on again for two months.

As the stores dwindle down, the queen contracts the egg-laying, and the old bees constantly dying off, the hive becomes weak unless aid is at once rendered. This is a matter upon which every bee-keeper has his own opinion. The author admits that no artificial food is quite equal to a flow of honey; still it is the best thing under the circumstances. Only the first quality of sugar should be used; some of the cheaper grades upset the digestive organs of the bee and should be avoided. For summer feeding, half sugar and half water by measure will do very well. This should be fed to the colonies at the rate of half a pint per day, to keep brood-rearing going along.

The greater the scarcity of natural supplies, the more vigorous the commotion when given artificial food. The bees rush out and make quite a fuss, upsetting the whole yard. To avoid this, always feed at night-fall so that all food is taken up before morning. The wisdom of this is clear after reading the remarks on robbing.

HOW TO MAKE SUGAR SYRUP.

For feeding a small amount, put equal quantities of sugar and warm water into a tub, and stir until all the crystals are dissolved. When large quantities require to be fed, place the requisite amount of water in a honey-tank or extractor, and allow the sugar to trickle slowly into the agitated water until the proper quantity is added. Always feed the syrup warm. If honey is substituted for the sugar, it should be boiled at least fifteen minutes to make sure that no disease germs are present. Remember that syrup made from sugar or honey will quickly ferment if allowed to remain; therefore do not make up too much at a time.

With the syrup made, the novice will want to know how to feed it. Of course it could be placed out in the open some distance away, and the bees allowed to carry it home, but this plan incites robbing and the weaker hives gain very little; neighbouring bees would also get a share.

BEE-FEEDERS.

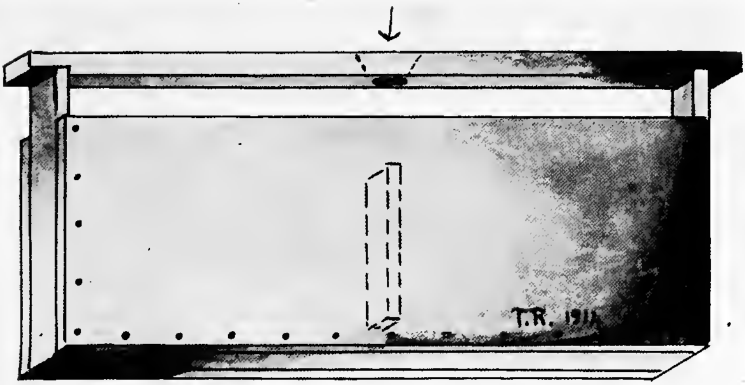


Fig. 60. Doolittle Bee-feeder.

There are numerous bee-feeders on the market, some very complicated, and a short description may not be out of place. The Alexander (Fig. 62) feeder is simply a block of pine hollowed out to form a wooden trough. The Doolittle (Fig. 60) is made of the same dimensions as a frame: in fact it is really a frame with a thin board nailed on each side. To feed a colony, hang a Doolittle feeder in the hive, and fill it with syrup from a watering can. The Boardman is an "entrance feeder." It is a wooden box—with "ears" to project into the hive—and has a hole cut to receive a Mason's jar, inverted. A special cap is provided, which allows the syrup to flow as it is used by the bees. The Thale (Fig. 61) Vacuum Bee-Feeder is more complicated. The amount of food is regulated by a wire on the outside of the hive, but the principle of the inverted bottle is not unlike that of a Boardman feeder. Any of these will give good results.

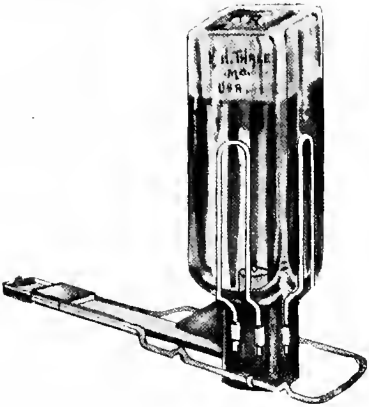


Fig. 61. "Thale" Vacuum Feeder.

Now, there is another class of feeding that the bee-keeper is occasionally called upon to perform. It is feeding up stocks that will have sufficient stores for winter use. In this case it is usually performed in the autumn, but while on the subject of feeding it is not out of place to describe it here. Feeding up stocks for winter is usually left too late in the year: cold weather comes on and the upset of feeding is not good for the bees. Do all feeding while the weather is still warm. There is sure to be a certain number of young bees reared under this stimulus, and there is nothing like young bees to carry a hive through a rigorous winter. Should it happen that

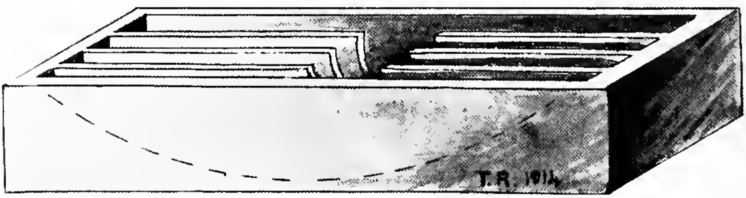


Fig. 62. "Alexander" Feeder.

the apiarist has sealed combs of honey on hand, these form the best stores, and feeding is simplified.

HOW TO MAKE CANDY.

Bees left until late in the year to be fed had better be treated to a cake of candy, made by mixing sugar and water flavoured with honey. How to do it is described by a correspondent in *The Canadian Bee Journal*—the leading bee-paper published in the Dominion. This is how the author states his instructions. Into an enamelled saucepan put 7½ lbs. of the best white sugar, add 3 pints of rain water, and stir only until all dissolved. Boil the syrup vigorously on the stove for one hour and twenty minutes, or until it forms into a tough ball when tested with a spoon; 2½ lbs. of honey should now be added and the whole again boiled for three minutes. Remove from the fire and when nearly cold stir until it becomes stiff and mealy. To mould into cakes, place the pot of candy in a vessel of boiling water, and stir until it assumes a thin creamy consistency; line a box or dish with brown wrapping paper and pour in the hot mass. (The paper is easily removed when the candy sets hard).

It is, however, more convenient to feed when moulded into wired Hoffman frames. Simply get the board that is used for putting in foundation and cover it with paper; lay the frame on this and pour in the hot candy. As winter stores this cannot be beaten. It is also a splendid queen-cage candy, and is unaffected by climatic changes, keeping its mealy condition for years. The recipe originated from the monastic apiarist in charge of the apiary at Buckfast Abbey, England. The author has experimented with many varieties of candy and the recipe given above produces the most satisfactory article. It is really a splendid candy for all purposes on a bee-farm.

British bee-keepers have always urged the use of the "cane" product in preference to "beet" sugar. They argue it is difficult to purify beet sugar so as to get rid of all the potash salts. These salts, they say, cause fermentation and on that account should be avoided. The author has fed beet sugar to bees, but no evil effects resulted as far as could be seen. The candy method outlined above would do away with the danger of spilling syrup about the apiary and so starting robbing.

There is a point about feeding bees that must not be overlooked. If there is no natural pollen about during summer feeding, the apiarist must make good this deficiency. Honey, it must be recognised, is purely the heat-producing portion of the bees' diet, and if the farinaceous element is lacking the bees surely suffer. For winter feeding, this shortage of nitrogenous food is not so detrimental, because brood-rearing has almost finished. In this case, it would do no good to add pea-flour to the candy blocks. While the demand for pollen is not so keen during winter months, the author has always found that those hives that went into winter with abundance of pollen in the combs usually came out in the best condition, to breed up quickly in the spring.

WATER FOR BEES.

During the hot days of the Australasian summer, bees require a supply of good clean water. In most of the indigenous forests there is usually a gully, spring, soak, or waterhole to furnish drink, but these are sometimes so far away that it is advisable to make a drinking place nearer the apiary. The prime thing to consider—when making a drinking fountain or watering place for bees—is safety from drowning. Bees, unlike flies, are not adapted for drinking at a body of liquid. Flies are accustomed—and adapted—to alight at the edge of a liquid to drink, and they rarely drown. Bees, on the contrary, alight on limited quantities, and should the supply be very large, there is danger of their losing their lives. Therefore, bees prefer to take a drink from some porous material, such as sand, or the trunk of a tree-fern that has fallen into a waterhole.

A simple plan is to have a tight wooden box, filled with sand, standing under the tap of the tank. The wet sand forms a safe water scheme. If no tank is available —at an out-yard for instance—cart two or three tins of water and allow a constant drip on to the sand. It pays well to provide water close at hand; it saves considerable wear and tear on the wings of the insects, and not much time is lost journeying to and fro.

ENEMIES OF HONEY-BEES.

BEE-EATING BIRDS.

The Australian apiarist often experiences considerable trouble from various bird visitors. The author places the Sordid Wood Swallow (Fig. 63) (*Artamus tenebrosus*) at the top of the class for bee-eating. These birds, erroneously known as Summer birds, Martins, etc., frequent the dead timber on the edge of the forests and about the apiary. They are partly migratory and, during summer and autumn—sometimes into winter—their peculiarly graceful flight is a common spectacle. If closely observed, they will be noticed making sudden "swoops" and immediately after alighting, to knock off on a tree limb, the abdominal segment of the bee containing the sting.

The author has often shot Wood Swallows flying about the apiaries, and opened them to search for traces of bees; in every instance the hard chitinous "shells" were present. In fact no remains of other insects were found in the "crops" of a dozen or more examined. Wood Swallows, when once they discover the fine supplies afforded by the apiary, seldom if ever, fare forth in search of other insects. In Fig. 63 the author has depicted the Wood Swallow and its carelessly constructed nest of fine twigs, horse hair, etc. The nest contains two or three spotted eggs about Christmas time.

Mr. Beuhne—of the Victorian Government service—mentions the Masked Wood Swallow (*Artamus personatus*) as destructive to bee life, but the majority of bee-keepers regard the "Sordid Wood Swallow" as the more common pest. The latter is smoky grey on the

Fig. 63. The Bee-eating Wood Swallow.

head and underneath the breast, tail feathers black with white tips, except the two central feathers which are black throughout and a little longer than the rest. The top of the wings is a subdued bluey-grey with a white flash on the two outside flight feathers. The beak is light blue tipped with black, and the eye dull blue-black in colour. The Sordid Wood Swallow is very daring: no amount of noise disturbs it.

The best way to rid an apiary of these pests is to shoot a few birds and hang them on the wires of the fence. It is certainly effective for frightening the marauders. Should one happen to make an attempt to rest on the fence and a dead bird suddenly move with the breeze the Wood Swallow will dart back in a state of great excitement. One season the author lost fully 50% of all young queens reared owing to the ravages of these birds. Other birds come and go and possibly eat a few bees when short of food, but the wood swallow makes a regular practice of it.

The Australian Bee-Eater (*Merops ornatus*) is sometimes responsible for eating the young queens whilst out on a mating flight, but as the birds are rather scarce and are migratory in habit, they are not so destructive as the Wood Swallows. The Bee-Eater is also pictured in Fig. 63 (the small bird with the distinctive long tail feathers in the top corner of the picture).

Young ducks cultivate a taste for bees and occasionally a sting will penetrate the throat and cause death. At the author's "Sawpit Creek" apiary the "Welcome" or House Swallows (*Hirundo neoxena*) built a mud nest in the honey house and the bees constantly followed the swallows when flying about the apiary. The little birds appeared to be very much afraid, darting hither and thither in excited efforts to dodge the annoying insects. As far as could be observed the bees were unable to overtake the birds. Of course the swiftness of the flight rendered close observation impossible, but the bees always appeared a foot or eighteen inches behind the birds. The "Wood Swallows" by the way, are not true swallows.

COCKROACHES, ANTS, AND SPIDERS.

Cockroaches are sometimes seen about bee-hives but they are never a pest; probably the warmth of the hive attracts them. Ants are rarely troublesome to good strong colonies of bees. It is amusing to see the bees pick up the little black ants and fly away, finally dropping them after long sustained effort. White ants are very destructive to pine bee-hives and bottom-boards; for this reason it is always advisable to stand the bottom-boards on two "Red gum" or "Jarrah" blocks. Both of these timbers have remained sound after resting on the ground for forty or fifty years, and they also resist the attacks of the Termites.

When the small black ants become troublesome in the apiary or honey-house they can usually be traced to the home of the colony, which should be destroyed by formalin. Push a crow-bar down into the nest and on withdrawing it put in about a tablespoonful of Condy's crystals or permanganate, then pour in about two fluid ounces of formalin (**take care not to inhale the fumes**) and plug up the hole with clay at once. This treatment produces gaseous formaldehyde which penetrates all the ant chambers and is very destructive to any form of life.

When supers are stored away it is rather an advantage to allow the ants to range over the combs, as they carry off the eggs of the wax moth which is so destructive to unoccupied comb. The tiny black ants will even carry away the young larvae of the moths. In some States the ants cause immense damage, and bee-keepers are forced to adopt special means to overcome the trouble. Some use a small trough containing liquid objectionable to the ants. A ridge is formed in the centre of the trough, and it is on this "island" that the bottom-board rests.

There is another pest that destroys the bees. It is a black spider that makes a home for itself under the hive and about the lids. It has peculiar red markings on the back and is reported as poisonous; it devours any bees unfortunate enough to be caught in its web.

WAX-MOTHS.

All the pests already enumerated sink into insignificance when compared with the wax-moths. There are two varieties found in Australasia and the larger wax-moth is by far the more destructive of the two varieties. Specifically known as *Galleria mellonella* (Fig. 63A) the larger wax-moth is troublesome only during the warm months of the year. During the winter, the caterpillars spend their time crawling about the galleries constructed during the previous autumn. They do not appear to grow very fast in the cold weather.

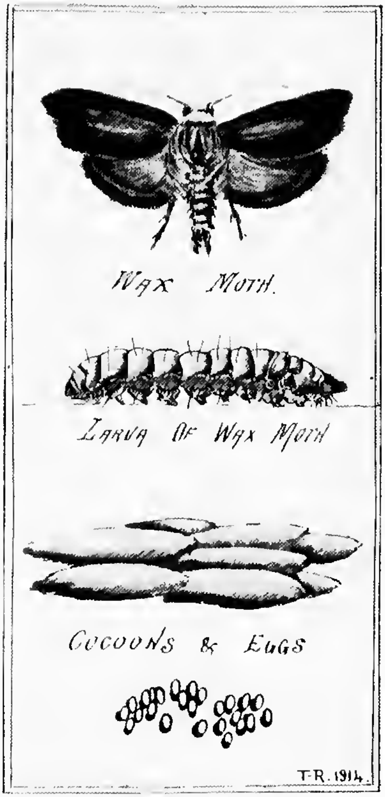


Fig. 63A.

With the advent of warm spring weather, the caterpillars spin a cocoon. It is a strange thing that the grubs, after wandering over the combs in search of food, repeat the arrangement of the eggs in the disposition of the "cradles." These "cases" are spun of some white silky sort of material, very tough indeed. From the completion of the cocoon, to the hatching of the perfect insect, occupies about a fortnight. The moth is then ready to fly about the hives, stored combs, or any wax refuse (indeed the author noticed in an apiary—visited some years ago—a pile of foundation just matted together with larval cases of the wax-moth), seeking a place to shelter the eggs, to carry on the particular cycle of insect life.

In June 1910 the author paid considerable attention to the wax-moths, and here is a note on the egg laying. "The wax-moth on entering the hive quickly ran up the end bar of the frames close to the lug; here it paused for a fraction of time, and after one or two nervous movements of the antennæ it spread its wings a little, and immediately a small ovipositor was protruded from the abdomen to the extent of one-eighth of an inch (it was not unlike a bee's tongue at first glance, and about the same colour). It moved rapidly, much the same as a minute paintbrush. Presently a slight distension occurred, and simultaneously a small white egg was seen to pass along the ovipositor, and become attached to the frame end."

When the grubs are able to move about, they usually seek out combs that have been used for brood-rearing. They very often refuse to touch clean white super-combs. Probably the farinaceous pollen in the brood combs is the chief attraction. The larvæ grow much larger when "farina" is obtainable, for pollenless super-combs usually contain very small, shrivelled grubs. The larvæ tunnel through the combs, and line the sides of the "walk" with silk. If a comb be held between the observer and the sun, the movements of the larvæ are plainly visible. They should be removed with the blade of a pen-knife.

When a large number are infected, the frames should be piled up in supers on a tight bottom-board. A cupful of bisulphide of carbon, placed in an empty super at the **top** will effectively fumigate the pile. The fumes of the bisulphide are heavier than air, consequently it should be placed high up. It will also be found advisable to paste paper over the joints of the supers, to render them air-tight.

Strange to say, Italian and Cyprian bees are rarely molested by the wax-moth, though the combs of black bees are frequently tunnelled—sometimes right through the brood—by the larvæ of the larger wax-moth. Amateur bee-keepers often wonder why certain patches of brood have the sealing caps removed; this sometimes happens as the result of the bees attempting to dislodge the intruders.

There is also a smaller wax-moth (*Achrœa grissella*), dull-gray in colour, with a yellow head. It is often found in conjunction with the first-mentioned variety, but it is not so destructive. Another method of killing the moths and also the larvæ, is to have the combs in an air-tight box or tank, and fumigate as directed for ants. **Take care not to inhale the fumes as they are very poisonous.** This last fumigation is very destructive to all forms of life, even bacteria succumb when exposed to the deadly vapour. The chief thing is to have only Italian bees, (or even hybrids); gather up all comb scraps, etc., and leave no wax *débris* about to furnish breeding places. The photograph illustrating "foul brood" clearly shows the ravages of the wax-moth.

MICE.

These pests will occasionally nibble combs, especially if they contain a few dead bees, but the careful man will rarely be troubled. It is an easy matter to keep the combs in tight super-bodies covered with wire cloth screens.

PARASITES AND INSECT PESTS.

Parasites are sometimes found on the queen. They are noticed, however, only on those imported from Italy. The queens are never seriously injured by the Braula as they are called. Probably the worker bees remove the lice from the royal mother.

The bee-hawk is said to be a serious enemy to bees, but there are no damaging reports to hand from Australasian apiarists. Mr. Froggatt, F.L.S., New South Wales Government Entomologist, at a meeting of the Naturalists' Club exhibited a fly, which he described as an inveterate enemy of the hive bee. The fly, under the guise of a harmless wasp, enters the hive, deposits eggs, and the fly pupæ subsequently fatten on the young larval bees. Mr. Froggatt also showed a piece of honey-comb containing pupal cases of the fly. The comb came from Condobolin, New South Wales. Practical apiarists up to the present time, however, have never observed any danger to the prosperity of their colonies from this insect.

POISONOUS SPRAYS.

Bee-keepers sometimes experience trouble when poisonous compounds are sprayed upon fruit trees in bloom. Not all sprays are troublesome, but there are a few that kill the young brood. Fruit-growers of to-day, however, are well versed in the use of the various sprays, and it is exceptional to meet one ignorant of the bee's value to the orchard. While bees return considerable profit to the apiarist, the orchardist is almost as well favoured. It has been conclusively demonstrated that the presence of the honey-bee exercises a marked influence for good on the pollination of the blossoms.

There are now few fruit-growers who wilfully spray during full bloom, or in fact, at any period injurious to bees. The use of arsenites of sufficient strength to kill insects will most certainly devitalise the pollen. There is also danger of people eating the honey gathered from sprayed blossoms with perhaps fatal results. Some States in America have legislation dealing with full bloom spraying.

BEE DISEASES.

FOUL BROOD.

(*Bacillus larvæ*).

After the rush and bustle of the summer is over and the flow of honey gradually slackens, the novice will be in a better position to locate any brood disease that may be present in the hives. It is well known that most bee diseases appear to improve during a heavy flow; this is due to the bees covering the diseased material with fresh honey, and the novice is deceived. When the flow slackens, the affected honey, etc., is again made use of and the diseased portions of the brood-comb assume the characteristic appearance. Now, what is the characteristic appearance? The novice should be well posted with the indications of normal health to enable him to better diagnose the characteristic symptoms of this the most prevalent brood disease. (Fig. 64.)

A comb of healthy brood has a sweet odour that is not unpleasant.

A "foul broody" comb in the advanced stages has a penetrating characteristic odour, well described as that of a "stinking" glue pot. An experienced apiarist can distinguish this offensive smell yards distant from the infected colonies.

In health the cappings of the brood are slightly convex and of a raw sienna-coloured brown.	The cappings of cells containing affected larvæ are sunken a little, and are darker in colour—more of an umber shade.
Normally bees **very rarely indeed** perforate the capping of healthy brood.	In the diseased condition a jagged pinhole is frequently torn in the covering, as if the bees knew something was not right inside and had made a peep hole.
If one displaces the capping of healthy larvæ he will at once receive an impression of sparkling white grubs, plump and full against the dark cells.	Uncap one of the sunken cells and the larval skin is flaccid and shrunken out of shape, of a dirty drab colour, and instead of filling the cell lies on the bottom side.
Take a fine piece of wood or dry grass stalk, insert it into a healthy grub and slowly withdraw it; the contained thin juices will **not draw out one fraction.**	Repeat this performance with a fresh stick on one of the diseased grubs and it will be found that a **thick** glutinous thread will follow the stick perhaps to half an inch in length. This latter peculiarity has given the malady the distinctive name of "ropy" foul brood. Take care to burn the stick in a fierce fire and to wash the hands in carbolic acid solution.

This stringy characteristic is not found in any other disease, and it is therefore considered a conclusive test for malignant foul brood. The glutinous strings are caused by the "breaking down" of the substance (*e.g.*, chitine) that would go to forming the hard shell structure of the imago. The final stage is just a black scale on the lower side of the cell. With this meagre description, the novice will be far from satisfied. He will want to know more about the why and the wherefore.

A short account of how bees may develop this dread malady will not be out of place. In the beginning, the disease is caused by a specific bacillus, visible only with the aid of high microscopical power. Like many diseases of the human race, the specific bacillus that produces foul brood has been isolated and given the name of *Bacillus larvæ*, and latterly the Americans (Dr. Phillips and staff of Washington, U.S.A.) have isolated a new one.

A Victorian microscopist states that spores may be obtained from the earth. These spores are the "seeds"

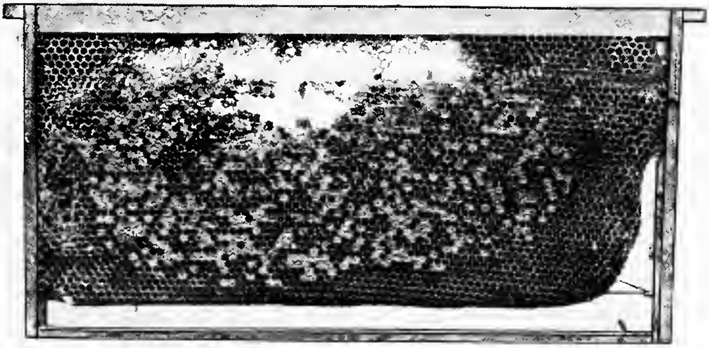


Fig. 64. A Comb of Diseased Brood. (Foul Brood).

—if one may use the expression—that placed in suitable "soil," *e.g.* the juices of the larval bee, develop into **Bacilli.**

These grow **lengthways**—like a bamboo stick constantly breaking off into short lengths each of which continues to expand in a like manner; scientifically known as fissuration—until the "soil" *e.g.* the fat globules of the larval juices is exhausted. Thereupon they again assume the spore condition. In the form of bacillus it is easily killed by boiling water, dry heat, 160° F., sunlight, or contact with various chemicals. In the form of "seeds" or spores the difficulty is not so easily overcome; they are coated with an extremely tough skin that requires long sustained heat to penetrate it effectively.

Bear in mind all the time that strong microscopic power is necessary to see either spore or bacillus. The spores are not affected by freezing, and have survived the high temperature of 210° for a lengthy period. They retain their vitality in the spore stage for a number of years, simply awaiting the opportunity of favourable media to go through the cycle again.

HOW BEES CONTRACT FOUL BROOD.

How do bees become infected with this specific bacillus? In the vast majority of cases from honey that has contained a "seed" or spore of the disease. Perhaps from some diseased bee tree; or the box hive, now happily prohibited in Victoria and New Zealand, of some negligent owner. In a few instances possibly from blossoms infected by spores carried on the body of a visitor from some distant colony. When the disease has once gained admittance to the apiary, it is extremely probable that other hives will be infected from spores carried on the fingers of the apiarist, unless precautions are taken to disinfect the hands before opening healthy hives. It is within the bounds of possibility that the constitution of the bees is so weakened by improper food, etc., that a spore adventitiously picked up, finds suitable media and develops into a bacillus.

HOW TO CURE FOUL BROOD.

Now that the main features of this disease have been outlined, the question of curing it will receive attention. There is only one way practised by professional apiarists to combat this plague successfully; it is called the starvation cure. To describe treatment by drugs is superfluous; the author has tried carbolic acid, salicylic acid, lysol, formalin and various other drugs, but they are waste of time and money. After successfully treating many hundreds of diseased colonies (some of them on a Government farm) by the starvation method, the author feels that he is quite safe in limiting the curative agents to this one formula. The application is not difficult, and is here given as simply as possible.

When the case is discovered, at once replace the cover, and mark the colony in some way so that it can easily be found again without opening others. When the bees have ceased flying for the day, get a boiler ready—large enough to take all the frames at once—with a fierce fire underneath to boil the water vigorously. (Of course steam would be better). Get a clean hive and some new frames of foundation placed near to the colony to be treated. Remove the diseased stock from its stand, and lay down two large sheets of newspaper, substituting the new hive. A bucket of carbolic acid solution should be available for washing the hands and smoker, etc.

Open the diseased colony, lift out the frames separately, shake the bees on to the paper before the clean hive, and at once immerse the combs in the boiling water. Keep them submerged for 15 minutes. The free wax on top of the water may then be skimmed off and 1 lb. of washing soda added to the water which is allowed to boil for a further period. The frames should now be lifted from the boiler and the hive-body, lid, and bottom-board plunged in for a few minutes; all are then hung out in the weather for a few days. While the boiling has been receiving attention, the bees will have taken possession of their new home. When they are all in, fasten a piece of wire cloth over the entrance so that no bees can escape, and carry them into the honey-house leaving them until dusk of the third day. They may then be returned to the original stand, which has previously been treated by spraying with carbolic acid solution. The ground afterwards should be turned over with a spade. If the colonies are not removed indoors the swarm will sometimes desert the hive next morning and unite with one of its neighbours. There is thus a danger of transmitting the disease, although up to the present the author has not had a case from this source.

Occasionally after this treatment the foul brood will again appear should the queen be diseased. A cure is then impossible until her removal. Although the name specifies "brood" the adult bees also suffer, but it is chiefly noticeable in the brood because the larval condition is more favourable for the growth of the bacillus. Before using the hive again it should be well sand-papered all over and carefully coated inside and out—lid and bottom—with white lead and raw linseed oil. Leave no spot unpainted. Before painting the author uses a brazing-lamp for running over the inside of the hive with a hot flame, but this is not essential.

Now there are at times nice dry super-combs in a diseased colony that have never contained brood, and these should be fumigated with gaseous formaldehyde as described for wax-moths, ants, etc. These should then be given to the original colony. If there are only one or two hives to be treated it would not pay to save the honey with consequent possible contamination of the extractor and honey-tanks, etc. In fact, if the hive is old and dilapidated, better make a large fire of brush wood and after shaking the bees, consign hive, frames and combs to the flames. If the colony is very weak, burn bees and all. It is impracticable to treat foul brood successfully unless the colony is strong, the weather warm, and honey abundant. When a whole apiary is diseased, better call in an experienced bee-farmer for advice. A professional apiarist would never permit the entire yard to become diseased before taking steps to eradicate the malady. Should the colonies have a large amount of honey on hand (too much to waste) it should be extracted, thinned with water and boiled for fifteen minutes. Be very careful to scald and disinfect everything in contact with the disease, and leave nothing about for healthy colonies to rob.

"BLACK BROOD."

(*Bacillus Alvei*).

There is another form of disease in some respects not unlike the preceding one. The Americans call it "black brood" or "European foul brood"; but this is not accepted by British authorities who regard it as a stage of "ropy foul brood." This form sometimes disappears without treatment and is thus quite distinct from the "ropy" type, which, once a colony is infected never leaves it, unless treated as described, until all the bees are dead. With "black brood" the affected larvæ are usually in the ends of the cells (whether sealed or unsealed) and are dirty grey to black in colour, also the juices of the unsealed brood are never "ropy." The dead matter will not stretch out like the first mentioned, and the offensive odour is not pronounced.

An experienced apiarist, quite sure of his case, would effect a cure by re-queening, but the novice had better not take any chances; treat for "ropy" foul brood to be on the safe side. To get a good idea of the general appearance of "black brood" take a few unsealed larvæ and leave them out of the hive three or four days. The dead larvæ will then closely resemble those killed by "black brood."

Brood destroyed by extreme cold and sometimes by heat was at one time counfounded with disease, and referred to as "pickled brood." The brood was simply dead, not from disease, however. One may as truthfully refer to the dead brood found in a strong colony moved during hot weather as "diseased." After treating for "ropy foul brood" there are sometimes a few dead larvæ found in the new cells; the misshapen grubs lie in the ends like a drop of milk. The bees clean them out and after the first hatching this trouble disappears.

DYSENTERY.

This disease is occasionally due to the presence of certain fungoid growths, *i.e.*, yeast cells, in the bowels. There is another less virulent form, easily overcome by the bees themselves when the weather is bright enough for the insects to have a cleansing flight. This latter form is nothing more or less than overloading of the bowels. When bad weather prevents bees going out the bowels are overtaxed—for the insects void the *faeces* only when on the wing. The symptoms are easily recognised, but the most apparent sign is the spotting and soiling of the hive, especially about the entrance. The bloated-looking bees crawl up the hive-front attempting to fly, until a dirty-brown discharge takes place; the bees then quickly recover. Warm weather is about the only effective cure.

The food supply undoubtedly exercises a great influence on the health of the honey-bee during winter. Honey that contains a large percentage of albumen is invaluable for breeding purposes in the warm months, but this very feature makes it unsuitable as winter food. Grey box and "Stringybark" honey have relatively large amounts, and "Yellow box," "Red box" and "Red gum" give very small precipitates. So that if unsuitable stores were gathered in the autumn better extract the lot and give a cake of candy as described elsewhere. Scientific investigation will sooner or later discover the effects of different honeys on the health of the bee.

At the present time little is known of the relation of tannic acid to the albuminous content of some Australasian honey. The "Grey box" product, rich in albumen, may have a strong affinity for tannin with consequent disaster when used as winter food. Appended is an analysis of honey showing absence of tannin in European samples.

	Yellow box Honey.	Bastard box Honey.	European Heather Honey.	Crystallised Comb Honey from Italy.
Water	22·0	27·57	29·1	18·07
Ash	0·096	0·094	0·123	0·25
Free Acid (as Formic) ...	0·03	0·05	0·18	0·17
Tannin	small trace	small trace	nil	nil
Nitrogen	0·041	0·11	0·225	0·365
Invert Sugar	—	—	—	—
Colour	Light	Light	Dark	Dark

Apiarists are well aware of honey-tins turning black when in contact with certain honey. This is especially true of that from the Narrow leaved Bitter-Pea commonly called "Wild Hop." After tasting the leaves of this plant one is of the opinion that it has a large percentage of tannin. Of the form of the disease termed "Dysentery," due to the presence of certain growths in the bowels of the insects, little is known.

"D.T."

Like another disease that has recently occupied the attention of scientists, considerable doubt exists as to the specific cause. Grampian bee-keepers have experienced great loss by what is known as "D.T." or "disappearing trick"; no investigation has taken place simply because no bees were available for examination. A prominent apiarist, who unfortunately lost some hundreds of colonies in five or six days, described it thus: "The bees were working on a flow from "Red box" in early spring, and the line of flight was over our residence. One morning we missed the usual humming, and although the day was warm and clear, no bees were heard. We visited the apiary and while some bees left the hives, none returned. We opened hive after hive, to find combs full of honey and a ball of bees (about a handful) with the queen. These would afterwards swarm out and cluster promiscuously about the yard. The whole thing was so sudden and unexpected that we were helpless in the matter." The author has had some rather extensive experiences with bees dwindling away in the spring, but a visitation such as the above is not among them. One can only deplore the lack of information regarding remedial action.

SPRING DWINDLING.

This is another serious matter for the Australasian apiarist. No matter how well some colonies enter the winter they dwindle down to mere handfuls in the spring. About August a few dead bees will be observed at the entrance; the number increases, after rain especially, until almost the whole swarm is dead in front of the hive. Colonies with young queens have a hard struggle, but with close attention may be brought through the spring. Should a good flow of honey come on, the virulence of the disease diminishes, finally disappearing with the advent of summery weather. The bees dying contract into a characteristic "pinched up" position.

Microscopic examination of dead bees from some of these colonies revealed the presence of large numbers of spores of *Nosema apis*, but the same results are reported from examinations of live bees taken from hives that have never shown abnormal mortality. Recent investigation proved the existence of the spores in almost every apiary that submitted "subjects" for examination. Bees that behaved normally had as many spores as some that died; colonies badly diseased one year were entirely free the following season. So there is "nothing proved" up to the present. Damp hive surroundings are certainly conducive to this disease but nothing appears to be of much curative value. Breeding queens from stock that do not show the disease is the best line of defence, by this means producing a resistant strain. However, before any disease can make headway vitality must first be at a low ebb.

Nosema apis has been described as the primal cause of dysentery, but this is not proved by scientific research. Bees affected with "nosema" behave at times the same way as those suffering from "dwindle." They crawl slowly out of the hive and "hop" about the apiary, climbing grass stalks and other elevated points. Generally the bees look "sleepy," swollen, and somewhat oily-looking. Combs from affected colonies may be used without danger in healthy hives, for this has been proved by experiment. The author has tried spraying the brood-combs with salicylated syrup for spring dwindling, and the colonies certainly looked better, but as a good flow of honey followed the application of the spray a definite opinion could not be formed.

Scientists are not unanimous on the question of bee diseases, and in Australasia the various State Governments have given the matter little or no consideration. Dr. Price, of the Victorian Agricultural Department, states that "Nosema" is closely related to a disease that is found in silkworms, and that this too will probably have to be studied before the life history of the "Nosema" is available.

BEE-PARALYSIS.

This disease appears to be more prevalent in warm climates; just as dysentery favours the cold, moist portions of the States. At first the bees appear drowsy, and odd ones will be noticed excitedly running about the bottom-board greatly swollen and endeavouring to get away from the colony as fast as possible. Close observation will show some bees nervously trembling; they are also greasy-looking and dark. As with other bee diseases, the information regarding the cause is rather hazy. It is generally considered a constitutional disease of the royal mother, for the introduction of a young Italian queen to the diseased stock is usually effective. At other times removing the frames of brood to healthy hives, and replacing them with fresh combs has proved efficacious. The bees should also be sprinkled with sulphur. Some strains are very susceptible to paralysis, and the apiarist should refrain from breeding from them.

NECTAR AND HONEY-DEW.

HONEY-DEW.

After reading the last few pages on diseases of the bee it will be seen that food plays an important part in the successful wintering of the colonies. The honey gathered in autumn is not always good winter food. Perhaps it is not quite right to use the word "honey" without some qualifying adjective. In the autumn, bees sometimes bring home a sweet material that is certainly not gathered from blossoms. It is variously known as honey-dew, aphide-honey, etc. Some of this sweet substance is very pleasant to taste, and is also light in colour, but the bulk of it is dark and very rank, quite unfit for winter stores. It has been referred to as "extra floral" nectar, but this is distinctly wrong and misleading. It is purely a secretion from certain plant lice. The aphides puncture the leaves and suck the saccharine juice from the plant; the secretion (not excretion) drops over the leaves and sometimes covers the ground under the trees. The aphides have two tubes near the terminal rings of the body, and it is through these that the secretion is expelled. (Ants follow the aphides to suck up the sweet substance as soon as it appears from the tubes, so the aphides have been termed the ants' "cows.")

The author once stood under an "Apple box" tree and witnessed the honey-dew falling like rain; it set into a white sweet substance like manna. This is not uncommon in Australasian forests, but the manna is not identical with that of the British Pharmacopœia. The manna there prescribed is that gathered from the Ash (*Fraxinus ornus*). Baron von Mueller named the "Manna gum" as probably the sole Eucalypt producing melitose manna, but this is now hardly correct. Manna has been gathered from various Eucalypts, viz.:—"Peppermint" (*E. amygdalina*) "Red gum" (*E. rostrata*), "White Iron Bark" (*E. leucoxylon*), and South Australian "White gum" (*E. paniculata*), from punctures supposed to be made by certain coccids.

Some of the garden Balsams secrete nectar at the base of the leaves to deceive unwelcome insect visitors (ants) that would rifle the nectaries of the flowers without effecting fertilisation. Ants also sip nectar from the base of the stipules of Vetch leaves. This is truly "extra floral nectar" as is also that of the Balsams. With certain Willows approach to the flowers (by ants) is debarred by wax-covered slopes as slippery as wet glass.

This together with a curved flower stalk effectually prevents undesirable visitors.

A bee-keeper in New South Wales reported Maize secreting a sweet substance at the base of the leaves. "A good flow is on here just now, but the source of the honey is somewhat of a mystery. At first I attributed it to Thistle, but now I fancy it is honey-dew. The quality is excellent, being of good flavour and of a beautiful golden colour. I am inclined to think that Maize produces honey—not from the flower, but from the leaf joints. I have noticed bees collecting nectar from the cavity between the leaf and the stalk. Some become imprisoned there. The secretion occurs after exceptionally heavy rain, such as we had in January, and there is no doubt that it has a sweetish taste." It is not a rare thing in Australasia for apiarists to extract considerable quantities of honey-dew. Honey-dew is from *psyllids*, which are the cause of leaf manna or "lerp" and *coccids*, which surround themselves with manna, but the bulk of it comes from the *aphids*. There is a big distinction to be made between honey-dew and floral honey.

NECTAR.

As already pointed out, true honey is nectar gathered from the nectaries of the flowers. The Eucalypts are splendid yielders of floral honey, and while all the honey has a characteristic flavour it varies in colour from almost water-white to dark amber. "Red Gum," "Yellow box," and "Red box" are probably the lightest coloured, and "Karri" and "Jarrah" about the darkest. Even the trees vary a little in each locality. "Stringy-bark" honey is splendid in Gippsland, but in New South Wales it is described as "having a rather acrid flavour—seems to catch one in the throat."

Considering that a pound of honey is made up of 20,000 bee-loads the following record provides material for thought. Here is one from Redland, Victoria. "In reply to yours *re* returns from two of my colonies, weights are as follows:—First hive, 13 tins 44 lbs. = 824 lbs. Second hive, 13 tins 27 lbs. = 807 lbs. These do not include weight of honey removed when uncapping; this would not be much. My average is eight tins, and all colonies are four stories high and pretty full.'' When the indigenous plants secrete nectar it is most abundant, and while the foregoing is a very large return it has been beaten in New South Wales.

There are authentic cases of bees working on nectar during moonlight. That bees travel great distances to work on honey is well known, and while the average returns drop as the bees cover the greater distances it is instructive to know that the insects will travel and store honey from up to four miles. There is an instance of bees travelling the distance mentioned and storing 9 lbs. in two weeks.

Apiarists generally prefer the pasturing ground within a mile radius. The Victorian Forest Department issue bee-ranges of this area; the apiary is computed as the centre of the range. This works out at about 2,000 acres to each apiary.

SUPERSEDING QUEENS.

FAILING QUEENS.

After the rush of the summer is over the bee-farmer frequently discovers embryo queen-cells in some of the hives. The novice will be puzzled somewhat at (what he considers) these preparations for swarming. However, there will not be much swarming; it is the bees' natural way of providing a young mother to supplant the ''old'' one, and this is known to bee-keepers as ''supersedure.'' To deal with this question in the most practical manner, it is necessary to be conversant with the conditions that influence the bees in this their natural method of dispensing with a queen that no longer fulfils the requirements of the hive.

As bee-keepers of extended experience are well aware, the welfare of the hive demands the queen to be prolific and of sound health. The apiarist may seek to add other qualifications, but that is a matter, however, more directly concerning the bee-culturist than the bees. Take, for example, the average hive about to supersede its queen. Ninety-nine times in a hundred the queen of such a colony will soon fail, which fact is apparent to the bees. True, certain writers inform us of acts which cause bees to supersede the queens: cutting off one of the queen's legs is said to bring about supersedure; however, better leave cruelty out of bee-culture. Supersedure brought about by similar means should not be within the purview of the average bee-farmer.

To hark back to natural conditions—the bees, aware of the failing queen (this fact alone precludes her use for a queen mother), proceed to construct, in a rather deliberate manner, the number (never very many) of queen-cells the bees imagine necessary for the purpose. Now keen observers have decided that the bees are not the best judges of the requisite quality of the queen cells; for some of the last built are frequently less than half the size of the first ones sealed. It is obvious that the queens naturally hatched from the smaller cells are not always killed, and it is quite reasonable to believe that such queens often supplant much better ones not only in the supersedure colony, but in some of the hives adjacent to it. Queens from the small cells usually have larger heads and shorter bodies, which goes to show want of development; in fact, they are more "worker" than queen. What a contrast to those that hatch from the large rough cells during the swarming season! When this matter is entirely in the "hands" of the bees it is pure chance that the hive is not ruled by a queen very inferior indeed.

YOUNG QUEENS.

Should a "just-fertilised" queen enter a hive while supersedure is going on, she will almost certainly be accepted. The "just-fertilised" queen will not always be the best; the chances are that without the apiarist's supervision, the accepted queen will be of the undeveloped class described above. Lessened productiveness, loss of size and stamina, and consequently honey, which is after all, the principal objective of bee culture, is the invariable result. With supersedure uncontrolled by the apiarist it is just a question of time before the entire benefits of scientific breeding must be lost completely.

Editor Root says:—"In nature the best queens are those that are reared either during swarming time or when the bees are about to supersede an old queen soon to fail. At such time we see large, beautiful queen-cells reminding one of big pea-nuts," but he forgets to add that sometimes the last cells are little larger than peas. So it pays the bee-master to place a chalk-mark on the superseding colonies to receive his immediate attention. The foregoing is sufficient to prove want of discernment on the part of the bees as to the best queen, and it behoves the up-to-date culturist to attend to them systematically.

GOOD CELL-BUILDERS.

If he neglects to work this cell-building proclivity to his own advantage the apiarist casts away many a golden opportunity to rear the choicest queens; for, given a strong force of bees and proficiency on the part of the apiarist, these hives are the "*ne plus ultra*" of all colonies for queen-rearing. A. I. Root says he had a supersedure colony that drew out about a hundred or so cells and appeared willing to keep on doing so for an indefinite period. Age is no criterion; supersedure has taken place with queens only a few months old, and with conditions distinctively unfavourable for queen-rearing. (See Queen-Rearing, page 109).

SPARE COMBS.

HOW TO STORE THEM.

Generally, the honey flow ceases as the end of March approaches with cool nights. This is not, of course, a hard and fast rule. At odd times one may experience a warm, dry winter, with a continuance of honey; the bees breed strongly, and it is impracticable to remove the supers. This is exceptional. In normal seasons clean up the last of the extracting towards the end of the month mentioned above. With this method of working, return the empty combs to the hive as fast as they are extracted. (The apiarist should not work this way if any disease is present or suspected). If the honey flow has finished, the bees quickly "lick" the combs dry.

When the nights are cold, combs should be left on the hives for a day or two; the apiarist will then have no difficulty in removing the entire super almost devoid of bees. Some bee-farmers prefer to allow the bees access to the wet combs, which have been piled in supers about the apiary, thus permitting the bees to "rob" the combs dry. The upset occasioned by the exposure, combined with the tearing of the combs, to say nothing of the danger of transmitting and distributing disease over the whole of the apiary, is sufficient to show the disadvantages of getting combs cleaned up in this manner.

When the dry combs are removed from the hives, simply stack them in supers to a height of six or seven feet, along the cool (southern) wall of the honey-house. Under each pile of supers place one of the wire screens, used for travelling bees, and another one on top. They may remain thus, undisturbed, until required in the following spring. The screens effectively exclude mice and rats, etc., and the apiarist will rarely find any combs damaged by moths, when supers are protected in this way.

Should the conditions be such as to preclude returning the combs for the bees to clean up, just stack them away, wet, in the manner described. There will never be any trouble from so doing; in fact, they induce the colonies to enter supers in early spring. The expected excitement due to returning wet combs does not occur, simply because the supers are not placed on the hives until there is something to store in them.

GENERAL AUTUMN WORK.

OLD QUEENS AND LAYING WORKERS.

When the super-combs are being removed from the hives the apiarist will often discover some colonies without a queen. This is awkward so late in the season, unless the apiarist has a nucleus with young laying queen, to give to the queenless lot. Should no laying queen be on hand, it is better to unite the stock with another hive. This "doubling up" is practised largely in some places during autumn. Queenless bees unite readily with those possessing a fertile queen.

At times the apiarist will be somewhat confused on opening a colony to find drone but no worker brood; this is not uncommon, and is due to an aged queen that has lost all trace of the fertilising semen, consequently only drone eggs result. As already pointed out, drones "have no father," so that when the spermatozoa are exhausted, "worker" bees are no longer produced. This phenomenon is known as *Parthenogenesis* (literally the ability of a virgin to bring forth young without the intervention of the male), and was discovered by Dzierzon (pronounced Tiertsone), who asserted "all impregnated eggs produce females, and all unimpregnated ones males (*e.g.*, drones). This is demonstrated daily during summer-time on many modern bee-farms. With this thesis before us, we can readily grasp the phenomenon of "worker" bees laying **drone** eggs.

Hives that are left queenless and without young larvæ for a considerable time will almost invariably have one or two "laying workers." These curious anomalies are rarely detected in the act of laying, and when once a colony has a few workers producing drone eggs it is a troublesome matter to get a queen introduced. How these bees should happen to have ovaries developed sufficiently to lay drone eggs (remember the "laying worker" has no sexual relation with a male bee) is not known. It has been suggested that the bees aware of their hopeless state feed the royal food to some of the younger bees, and this has the effect of developing the ovaries. Colonies with these pests will not readily accept even a queen-cell, nay, they appear to cherish these "undesirable females," fondling them with their antennæ, as they would a royal mother. The presence of fertile workers is quickly detected by the irregular manner in which the eggs are laid. Several eggs are laid criss-cross in a single worker-cell (not at all like those laid by a fecund queen) while the cells adjacent may be vacant.

The bees of such a colony are too old to rear a queen for themselves, and it is hardly worth risking good "ripe" queen-cells. In autumn the stock has small chance of building up strong enough to winter, and the best way to treat them is to unite the bees with another stock in normal condition. Wait until dusk, remove the cover of the normal colony quietly, and loosen the "laying worker" hive from its bottom board. If the weather be chilly, after an interval of a few minutes lift this body (still retaining its cover) and place it on top of the normal colony. Treated thus, there will be no disturbance or fighting. A careful bee-keeper rarely has to contend with "laying workers"; it is poor management to allow a colony to remain so long without a queen that it is unable to rear one.

HUNTING BEE-TREES.

This is another early autumn pastime for the budding apiculturist. If a warm day is selected it is advisable to visit the water holes of the district and watch for bees that come to drink. Good eyesight is essential, but a "black fellow's trick" is of some assistance: simply catch one of the bees and gum a tiny speck of down on the thorax. If the bees make a straight dive for home, close to the ground, the hive is not far distant, but should the insects circle once or twice "home sweet home" may be a mile or more away. The down should help in following the "line."

When the bee-tree is located, nine times out of ten it will have to be fallen to get the bees. Before this occurs, tie up the horse and cart at a safe distance, and get the smoker into working order. A large milk can—to remain in the cart—a couple of buckets, a strong knife, a damp rag to wipe the hands, and some nuclei boxes—each containing a comb—should complete the outfit. When the axes first strike the tree it may be necessary to use veils; after a little while the jarring will cause the bees to cluster compactly and give no further trouble.

As soon as the tree falls, blow a little smoke in at the knot-hole entrance, preparatory to splitting off a slab to expose the combs. Cut them from the attachments, brush off any adhering bees with a twig of wattle and place the dark brood-combs in one bucket, reserving the other for honey-comb. When this latter is full it should be emptied into the milk can. Keep a sharp look out for the queen and, if fortunate enough to find her, there will be no difficulty in hiving the bees. With the black race, the queens are rarely seen, and after shaking a number of bees into the nucleus the remainder should be driven with smoke. If any comb containing brood is left in the hollow the bees will not quit.

When they are all in, close the entrance and they are ready for removal to the apiary, where combs of sealed honey, or cakes of sugar candy as advised under "Feeding" (page 139), should be given to tide them over the winter. Unless every particle of comb is removed from the tree it is a vexatious business to get the bees into a box. Bushmen often ask bee-keepers to accompany them on bee-hunting excursions. They fall the tree; the apiarist "robs" the hive; and the spoils are divided.

The axeman takes the honey and his partner the bees. A swarm is almost always secured, but often times there is little or no honey.

The author has known of bee-trees in the ranges of Victoria that yielded several sheets of white comb-honey—up to eight feet long—and about eight Langstroth frames of nice brood. All **healthy** worker-comb should be transferred to proper wired frames,—the baby nuclei size is splendid for this purpose. Bee-trees are best taken in autumn, because the maximum amount of honey is then available, and the bees have little or no brood. Should the hive be diseased, burn bees, comb, and honey. If possible pile on the tree top so as to destroy all traces of disease.

MAKING HONEY-VINEGAR.

Comb-honey from bee-trees is rarely quite free from wood dust, punk and chips; only occasionally nice white comb is taken. When the honey will not pay to run over the cappings-melter it had better be made into vinegar, or else mead. Washings from honey-tins and the extractors may also be utilised. Soak and press the honey-combs in rain water and at once strain off the liquid. Before this syrup is allowed to stand any time it should be tested with a hydrometer—(an instrument for testing the specific gravity of liquids). If the syrup registers 11° "Beaumé" it is about right to make good vinegar. A number of apiarists use the rough test of a fresh egg. Should this float with a small spot (about the size of a sixpence) above the liquor the register is close up to 11° B. This figure indicates the syrup to contain about 3 lbs. of honey to every two gallons of water, which is the proportion recommended. A weak liquid ferments quicker, but the resulting vinegar is not so good.

The Pure Food Act requires vinegar to contain 6 per cent. acetic acid, and to get this test use 1½ lbs. of honey to each gallon of water. (Vinegar making is solely a matter of fermentation. The first "working" is called the vinous or alcoholic, and the second acetous. Take care not to mix the ferments or the result will not be vinegar). This syrup should be poured into a spirit cask standing in a warm room of equable temperature. Variations of temperature are detrimental to the growth of the cellules; a range of 67° to 87° F., is essential to the life of the ferments. Lay the cask on its side with the bunghole on top and fill it quite full of the sweetened water. Left to itself there is little danger of foreign ferments starting work, but half a pint of yeast added will start the first fermentation. When the boiling fizzing noise has subsided the alcoholic fermentation is completed sufficiently to allow transfer into an old vinegar barrel. The spirit cask should be tightly bunged up before storing away.

Once in the vinegar (or acid) barrel the production of acetic acid can be greatly accelerated by the free admission of air. Allowing the liquid to drip slowly from one vessel to another will accomplish much of the "making over" into vinegar. Old honey-vinegar casks often have large pieces of acetic acid crystals encrusted on the joints where a tiny leak has been. When the vinegar is strong enough, it should be heated and sealed down, to prevent the development of cells, that would ultimately attack the vinegar itself, finally destroying it.

The chief thing to observe in vinegar making, is to keep the two ferments separate; for instance, it is useless to allow vinegar cellules to get into the spirit cask, and expect the barrel to give good alcoholic ferments. During the process of fermentation, unless the bungholes are kept covered with cheesecloth, a small reddish vinegar-fly will soon put in an appearance. It is hardly necessary to point out that all metals should be kept from coming into contact with the liquid at any stage. Always use rain water and remember that the formation of acetic acid is due to the oxidation of alcohol. It takes about 2 years to make first-class honey-vinegar.

HONEY-MEAD.

The process of making honey-mead is in some respects not unlike that of vinegar during the first stage. There is only one fermentation, the alcoholic. When this has progressed sufficiently the liquid is bottled and sealed from the air for use as required. To make nice mead, add to every gallon of water 3 lbs. of honey and 1 lb. of raisins; allow the syrup to boil for 10 minutes, and carefully remove all scum that rises. Pour into a barrel (an old whisky cask is preferred) and add a little yeast when the liquor is almost cold. After the "working" has ceased, suspend the rind of two oranges over the liquid. Bung up the cask quite tight and let it remain 6 or 7 months, or even 12 months. It should then be cleared with isinglass and securely bottled.

If the liquid is allowed to remain in the cask, exposed to the air, after the first fermentation is complete, vinegar will be made. There are many drinks made by fermenting honey and water, some of which are very pleasant indeed. Metheglin is very intoxicating, but when used with discretion is to be preferred to many brewers' drinks on account of its purity.

HONEY-BEER.

Honey-beer was a popular drink at the court of Queen Elizabeth, and here is a recipe recommended by Mr. I. Hopkins, late Government Apicultural Expert, of Auckland, New Zealand.

In five gallons of cold water mix half a pound of hops and two ounces of ginger, the latter well bruised with a hammer; add twelve pounds of good extracted honey already melted with as much boiling as is requisite for that purpose; stir well with a stick and put the boiler or boilers on a good fire, stirring occasionally till the liquor boils; let it boil briskly for about an hour or until the hops cease to swim on the surface; take the vessel off the fire and let it stand for about six hours until nearly cold, when the hops and sediment will have settled near the bottom. Strain the liquor through some good straining material (so-called "butter-muslin" folded in four thicknesses answers well) into glazed earthenware vessels, and let these stand near the kitchen fireplace during the process of fermentation which will commence within twenty-four to forty-eight hours, according to the ruling temperature, and continue for ten or twelve days, or longer, according to the season of the year. The vessels should be secured from dust by means of tin covers pierced with holes to admit free access of air. Skim off the frothy scum and stir the contents with a stick once a day, to promote the powers of active fermentation, and when this has nearly ceased, *i.e.,* when the liquor, after being stirred, forms only a light froth on the surface which soon subsides of itself, it will be fit for bottling. Strain carefully into perfectly clean bottles, by means of a tin dish in which is placed a fresh straining cloth (four folds of butter-muslin); cork securely with sound corks well driven in and tied down with twine or bottling wire. Keep the bottles in a dry, cool place. The beer may be used three or four days after bottling, but is better if kept standing for a week or two, and, if the working has been properly attended to, will only improve by several weeks' keeping.

PREPARATIONS FOR WINTERING.

PROTECTION METHODS.

The bees should be prepared for winter during the autumn. One can hardly do this too early if there is no flow and the weather is rough and boisterous. In Australasia the winters are sometimes very warm and more or less honey is gathered. In these circumstances the hives remain much the same as they were in the summer. Normally, there is not a great deal of honey stored after March and April, so the colonies may be safely prepared for winter.

European and American bee-keepers experience great difficulty in wintering bees. In some portions of Canada entire apiaries are often covered waist deep in snow; nevertheless bees are successfully wintered on summer stands. Cellar wintering is very popular in the United States of America, Canada, and also among continental apiarists. Bees are sometimes carried through the rigours of the winter by burying in "clamps," or trenches in the ground. A long trench is dug, and two pieces of wood are placed in the bottom for the hives to rest on. After the colonies are in position, a quantity of straw is then thrown over them and afterwards covered with earth. It is an American plan, but it has not become very popular, as certain porous soil is essential to success.

While the temperate nature of the Australasian climate renders cellars, and earthen "clamps" somewhat superfluous, the author is of the opinion that too little attention is given to the subject of wintering. In many sections of U.S.A. double walled hives are in great demand, and there is a lot to be said in their favour, either as winter or summer hives. As the name denotes, the hive is constructed of an inner, and outer "skin" (formed of thin pine boards) with the intervening space filled with some kind of "packing" material—generally chaff. This is a splendid protection against the cold of winter and the fierce heat of the Australasian summer.

Uniformity of temperature is a desideratum; it secures a greater force of working field bees (who would otherwise stay at home to help the "fanners" keep the hive cool) during the summer flow. In winter, the equable temperature permits a decreased consumption of honey while maintaining the animal heat of the cluster. In spite of all these advantages the double-walled hive is almost unknown in the Commonwealth, though fairly common in New Zealand. Doubtless the steadily increasing cost of all wood work will further militate against its adoption. However, there are various cheap packings that in a lesser degree effect the same purpose, but, strange to relate, they are rarely made use of.

As apiculture becomes more keenly developed Australasians will undoubtedly be forced to give greater attention to wintering their stocks. The small majority are satisfied to see that the bees have abundance of stores, a dry hive, and a tight cover. While these preparations are right, they do not go far enough. A few sheets of newspaper folded over the top and down the outside of

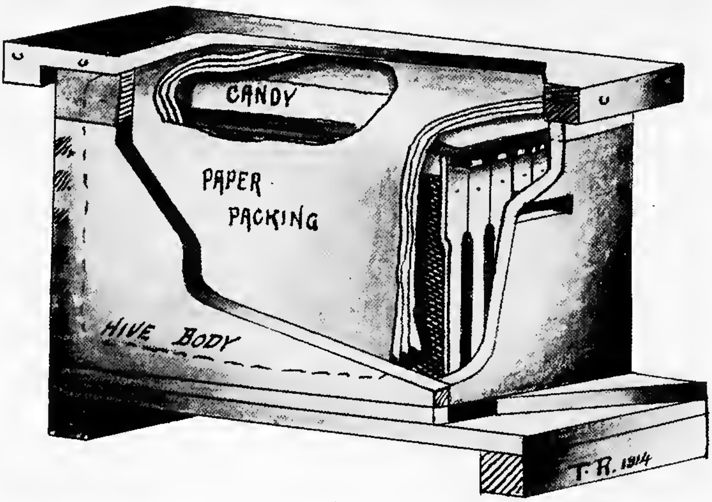


Fig. 65. Section of Hive Packed for Winter.

the combs make a very good fortification against frost. To further extend the good practice, prepare a "cushion" of hessian (or chaff bag) filled with sawdust, chaff, or dry leaves; after folding over the newspaper as directed, stand a super on the hive and press the cushion down firmly over the frames. When the super is covered with the hive lid the packing is completed. Latterly the author has successfully used a wooden rim (really a travelling screen minus the wire gauze) on the single storey hive (Fig. 65) for wintering.

Colonies in autumn rather short of stores and housed on eight Langstroth combs in a single body should have a cake of candy, prepared as already explained under

"Feeding" (page 142), placed over the frames and the whole covered with several thicknesses of paper tucked well down the outside of the frames. The wooden rim (2 inches deep by the dimensions of the hive-body) is then placed in position; this with the galvanised iron covers makes nice comfortable winter quarters, fairly well protected from cold. All the protection that can be heaped upon a hive is of little or no avail unless the insects themselves are strong and possessed of adequate stores of suitable food.

REMOVING OBSOLETE COMBS.

When packing colonies for winter, go through all the brood-combs and take note of all misshapen ones, or those with an undue proportion of drone-cells. These should be placed on the outside of the cluster, and if preparations are made early, the honey they contain will be removed to the centre of the brood-nest, within easy reach. During the following spring, overhaul these condemned combs as they may then be removed for melting without destroying the brood; as the colony expands, sheets of foundation should take their places. If this is attended to, the brood-nest in spring will be formed of nice, even, worker-comb.

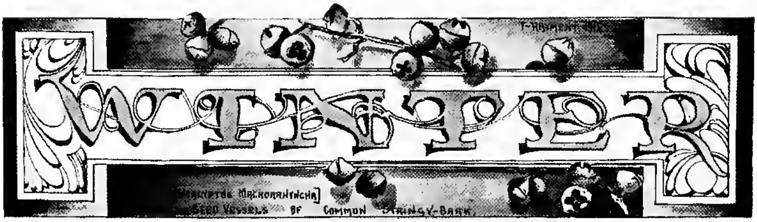
AMOUNT OF WINTER STORES.

Now, as to the required amount of stores; this all depends on the locality. A district suffering a long dreary winter, will probably make 30 lbs. of honey necessary. On the other hand, there are provinces that experience late autumn and early spring flows, so that colonies can be safely left with only 8 or 9 lbs. of store. This is not at all uncommon where "Red box" yields honey from June onwards, so that the bees augment the food supply instead of depleting it.

It is extremely difficult to make any hard-and-fast rule where the native flora is so variable. Colonies wintered successfully one season on 9 lbs. of honey may run out of stores before the next winter is half over with as much again. As a general thing at least 20 lbs. of honey are necessary for winter. The greatest demand is not made during the winter months but in early spring, when brood-rearing commences; it will then be consumed in a truly rapid manner. It is during this latter period that a shortage of stores affects the prosperity of the colony to such an extent that the entire season is wasted before a recovery is made.

When a super of "ripe" honey is left on the hive during autumn it is foolish to remove it to "winter" with one storey. The bees will occupy the top of the super as the warmest part of the hive, and when so placed usually winter well. Many argue that one storey is more easily kept warm. While this is indisputable, it should be pointed out that bees, clustered in the top of the super, have no necessity to keep the bottom storey warm. Heat rises, and bees will invariably seek the warmest portion of the hive. The entrance should be contracted to about half that of summer; too small an opening results in mouldy combs. In restricting the entrance, place the block so that the opening is at one corner. This is preferable to having it in the centre. Many apiarists use a sheet of "ruberoid" under the corner as a quilt, but this material condenses the moisture which then drips down over the bees and combs with disastrous results.

Mats, made of corn sacking, are popular in some localities, but if they should get damp during winter they will, unless replaced with dry ones, exercise a very detrimental influence on the health of the colony. The amount of water that accumulates in a hive during a winter's night will astonish the novice who will probably think that the cover is at fault. This moisture is caused by the condensation of the bees' breath on the underside of the cold cover; if this is painted on the underside the moisture drips down on to the floor, and when the sun shines the inside of the hive is soon dried. This is preferable to having the wood soak up the water and so remain damp right through the winter. It is much better, however, to have some material (*e.g.* newspaper) between the bees and the cover that the insects can keep warm and so prevent condensation, and subsequent dampness. Fig. 65 depicts a colony packed comfortably away for winter with the wooden rim and cake of candy for store. Note that the entrance is at the corner.



HEATING HONEY.

A WHOLESALE METHOD.

Should a bee-farmer have a crop to market in the winter, he would necessarily handle it in a different manner from one intended for immediate disposal. Should he decide to sell the honey as fast as it is extracted, the better plan is to use some gravitation system that heats the honey as it flows from the extractor. Under the latter circumstances, this plan undoubtedly saves time. He should then adopt one of the various honey-heaters advertised, or a smart man may make an apparatus suitable for the purpose.

The simplest form is that composed of a long shallow "channel." This should have a false bottom, with the intervening space full of water heated by a kerosene stove. Of course if one had a boiler on hand it would be better to use a steam pipe to keep the water hot. The "channel" should connect the gate of the extractor with the honey tank. The top of the plane should be inclined at a low grade, and if a number of transverse bars were soldered to the channel-top the machine would be made more effective, as the honey would take a longer time to complete the journey, thus heating more readily.

Should the tank be on a lower level than the extractor, all that would be required to complete the outfit is a cheese-cloth strainer over the mouth of the tank. Honey, when heated, runs through this cloth without trouble. All the preceding directions have been written on the supposition that a man wishes to market his product immediately.

BLENDING HONEY.

There are very few bee-keepers who find the practice of heating honey from the extractor to be the best one. Experience decides against it. First, study the market before shipping the honey. Perhaps the honey may be on hand for months; it may candy, and this would necessitate heating it again. Second, suppose it should happen that a crop of "Red-box" honey is secured in early spring (this is a white honey) and a flow from "Stringy-bark" is gathered during late autumn—of course the latter is amber coloured. Had all the honey been heated when extracted, the apiarist would have to make two grades of it, because it is found impracticable to blend cold honey. Sometimes as many as five flavours are gathered in one season. Third, it is found unpayable to sell three or four separate grades. Make a blend and stick to it for the entire season. Other places, other practices. This is perhaps against the orthodox versions of marketing honey, but stick to the thing that pays.

Here is a good practicable plan for Australasia. As the honey is extracted it is put into ½ ton tanks without straining, and left to settle. When this is accomplished remove the large covers of the tanks and take off the scum that has risen to the surface. This leaves the honey very clear. It is then run into 60 lb. tins, sealed down, and marked according to its origin. For instance, adopt the initial of the plant, *e.g.*, Y.B. for "Yellow-box," S.B. for "Stringy-bark," and so on. It is then packed away until a favourable selling time.

STEAM FOR HEATING.

"When the winter time comes round," with high prices, then is the time to sell, so proceed thus. Stoke up the boiler until 30 or 40 lbs. pressure is registered, and clean out the wooden vat which is made out of 1½ inch kauri-pine; calculate the various flavours, and the number of tins of each, and ascertain, by tasting and trying colour in glass, a good blend. Compute the number of tins of

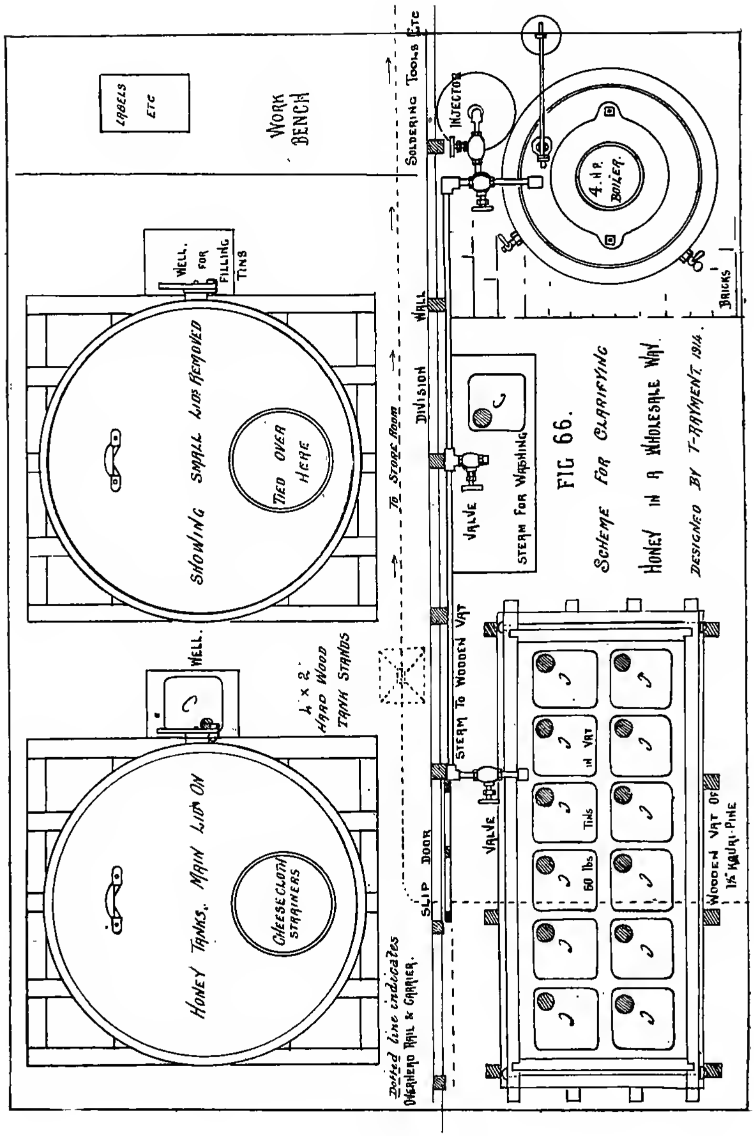


FIG 66. SCHEME FOR CLARIFYING HONEY IN A WHOLESALE WAY. DESIGNED BY T. RAYMENT 1914.

each flavour required, and place them in the vat which should be filled with water to within 3 inches of the tops of the tins. If more than this quantity be used, it is liable to flood over the bung-holes when heated. Gently turn on steam; in this way one can regulate the heat to a nicety.

If one variety is candied, arrange to have a few tins of this in all the time. When the liquid honey is heated, the candied will also be hot. It is not a good practice to "melt" 60 lb. tins of hard candied honey in less than 9 or 10 hours. As fast as the honey is ready, remove the small cover of the tank and fasten cheese-cloth over the mouth; the honey is then poured through.

Tanks of ½ ton capacity take 48 hours to cool sufficiently to skim. To do this, take a knife and cut around the edge, remove the scum by pushing it across to the opposite side of the tank, and hold it there with a feather edged piece of wood. With the "scum" banked up in this fashion, it is an easy matter to lift it clear with a large ladle. The honey is now sparklingly clear, the pollen grains having risen to the top together with the albumen and air bubbles.

THE PURE FOOD ACT.

Now about tinning the honey; the Pure Food Act precludes the use of second-hand tins. If not under the impurities section, the clause dealing with misdescription of goods places the liability on the bee-keeper. However, whether new tins or otherwise are used, make a speciality of labelling the entire tin.

A tin treated to a nice label looks more attractive than a "smeary" dirty one. On one side the name of the apiarist and of the apiaries should appear in large letters, and it will be found a splendid advertisement. Orders will often come from people who notice the honey in transit to other places. While there are many ways of treating honey, the above plan has been tried out, and it is sound and practicable for the handling of a large crop of honey. That is to say, it is a payable way.

HOW TO HEAT A SMALL QUANTITY.

For the small apiarist the scheme pictured in Fig. 66 is too extensive. There is another method, very popular with bee-farmers, illustrated in Fig. 67. It is nothing more or less than a boiler set on a suitable brick frame. The dotted lines indicate the position of a wooden rack that carries the weight of the four 60 lb. cans, and incidentally allows the water to circulate under the tins. This is most important, as honey is easily burnt should

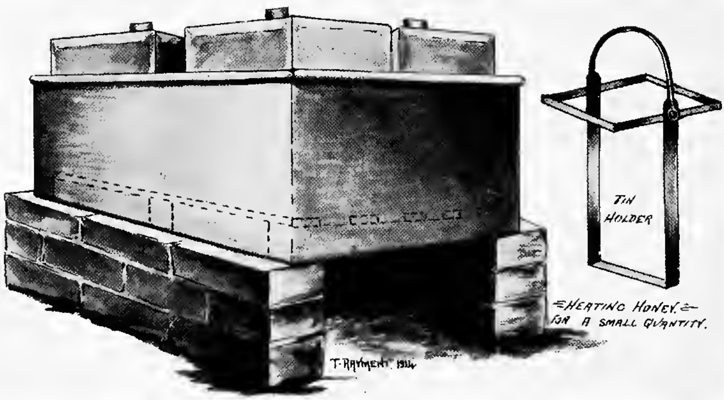


Fig. 67.

the tins rest directly on the bottom of any vessel to which fire is applied.

The ordinary honey-tin has a handle on the top to lift by, but they are rarely strong enough for the purpose. When handling honey in 60 lb. tins in heating-vats, it is safer to use a tin-holder. The overhead carrier shown in the large scheme may be modified where holders are in use.

Another point to remember when treating honey, do not overheat it. All honey contains albumen, and samples containing a large percentage have a "cloudy" look. To give this honey a clear, brilliant appearance, it is necessary to heat it to 150 degrees. F. This causes coagulation of the albumen, which will then rise to the surface, together with all air bubbles and pollen grains, in the form of a thick "scum," leaving the honey crystal clear. If the heating is carried beyond 150 degrees, the flavour may be impaired and the colour darkened. Low heat continued over a long term is always preferable to great heat for a shorter period; this is especially so when handling candied honey.

CANDIED HONEY.

As most people are aware, on the approach of cold weather some honey will assume a solid condition generally referred to as "candied." Thin honey will congeal much quicker than a dense ripe sample. The ground flora, such as Clover, Thistles, Cape weed, etc., produce honey that candies rapidly even in summer. Honey from "Needle wood" and "Wild hop" will solidify within a fortnight, so that if not quickly extracted, will candy in the combs on the hive. Variations in temperature also help to cause granulation. The primal cause, however, is the "ability of the dextrose to assume a crystalline character," leaving the water and levulose—the other constituents of honey—to follow slowly. With unripe honey, the levulose and the excess water is often found as a thin watery liquid on top of the solid portion.

Pollen grains and air bubbles—forced through the honey by the centrifugal action of the extractor—unable to rise quickly through the dense body, act as nuclei for the formation of the dextrose crystals. Candied honey is often retailed, cut up into small blocks of 1 lb. weight, and wrapped in a suitable paper, then enclosed in a nicely printed carton. Of course only hard dry congealed honey should be handled in this manner.

RETAILING CANDIED HONEY.

In America, honey, both liquid and congealed, is sold extensively in paper bottles. Honey on the point of candying is run into paper packages and stored away in a dry atmosphere until the process of solidification is complete. It is worthy of note that all honey has the peculiarity of absorbing moisture from the atmosphere, so that it should never be exposed to damp air. Always store in a dry equable temperature.

Retail grocers in Australasian cities often label the candied condition as "frozen," and when so described it sells quite readily. Experiments have demonstrated that after a number of years, candied honey will gradually return to the liquid state, but it is not chemically the same as new honey.

When honey granulates in the comb, the most practicable way of dealing with it is to cut it out and run it through one of the cappings-melters. If candied only in patches, uncap it, and spray with warm water, then place in the super of a strong colony. The water will assist the bees to liquefy the honey, but it will probably be necessary to spray the combs more than once. Honey that candies quickly is not suitable for marketing in 1 lb. sections. When so stored, it can only be separated by treatment with the uncapper.

As already mentioned, the Pure Food Act forbids the use of second-hand packages, so that all honey sent to market should be packed in new tins nicely labelled. For honey to be disposed of to wholesalemen, the 56 lb. tins are in almost universal use; these are similar in shape and size to ordinary kerosene tins. The majority have lever-tops, *i.e.* metal discs that open by upward pressure and may afterwards be closed again without injury. A few still require to have a circular piece of tin soldered over the bung-hole.

HOW TO WASH TINS.

Before filling, the tins should be thoroughly washed. If only a few are required, the "churn" pictured at Fig. 68 will be found very effective. As the diagram shows, it is simply a box fitted to hold the standard tin. Two cross bars intersect the bottom on which the cans rest. At one of the corners a small piece of strap iron, formed like a hook, secures the bar running across the top. This bar is pivoted at one end by a bolt or stout screw, and should be loose enough to allow the bar to swing to one side when removing the can. The underside

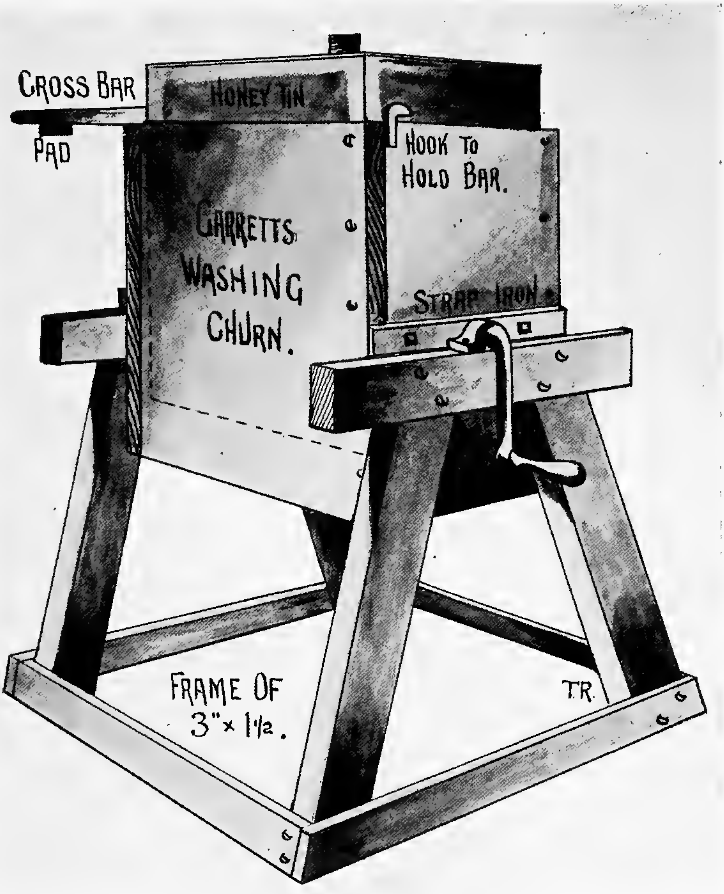


Fig. 68. Churn for Washing Tins.

of the bar has a small padded block, placed in such a position that it completely closes the bunghole whilst the can is rotated. Two bearings, one of which is adapted for a handle, are attached to the sides, and the whole affair is mounted on a stand as shown.

To operate: after placing tin with bunghole at the block corner, hot soda water is poured in, and the cross bar is secured under the hook. This action also closes the hole and holds the tin firmly. The churn is then revolved to allow the contained water to fall with considerable force from end to end.

WASHING BY STEAM.

When a large number of tins are to be washed, it is more economical to utilise the wooden vat shown in the honey-heating scheme. Twelve or fifteen tins are placed in the vat of water, a quantity of washing soda is then added, and steam turned on until the tins receive a good boiling. They are then lifted out and held under the spare steam pipe and given a good "blow out." The tins should then be tipped to dry, which the heat of the steam greatly accelerates.

PREPARING HONEY FOR SALE.

PASTE FOR LABELS.

When dry, the tins should be labelled. A small No. 8 sash tool makes a fine brush for pasting labels, a pile of which should be (printed side down) to the left of the workman. Paste made of flour and water with a little honey added is better than any "patent" adhesive. If it is desired to preserve the paste for a lengthy period, the operator should stir in a small quantity of bluestone.

HOW TO SOLDER HONEY-TINS.

Should the tins require soldering after filling, a soldering "iron," spirits of salts, a piece of sal-ammoniac, and some solder will be necessary; the solder should be 50 per cent. pure tin. The soldering bit should be made hot enough to melt the sal-ammoniac, on which place a small piece of solder. Continue rubbing the hot "iron" until the point is "tinned." The solder will now readily follow the copper bit round the edges to be soldered.

For soldering honey-tins, spirits of salts (hydrochloric acid) in an undiluted pure state is too strong. A small piece of zinc, sufficient to saturate the "salts," should be placed in the acid, which will "eat" up the metal with a boiling fizzy noise. When all chemical action has ceased, add an equal quantity of water. This medium should be applied to the portions to be soldered, with a small brush, and the hot "iron" drawn around the cap of the tin. After once "tinned," the soldering "iron" should not be again made red-hot.

CASES FOR HONEY.

When honey is to be sent a long journey it should be protected. Two 56 lb. tins are generally placed in a case which should be hoop-ironed on the ends. Even with "lever top" lids it is advisable to drop a spot of solder on the edge of the caps to prevent "unauthorised" persons sampling the contents. Some of the State Railway Departments make concessions in freight charges for the carriage of honey in lots of ½ ton and over. New empty honey-tins are carried from the cities at cheap rates, so there is no liability on the Department's part for "crushed" or "dented" tins.

RETAIL TRADE.

Very few Australasian bee-farmers pack honey in glass on account of the freight rate on fragile packages and also of the greater risk of breakage during transit. A number have built up a retail trade in small tins; the 2, 4, and 7 lb. sizes are the general favourites. Cases similar in size to kerosene boxes accommodate 3½ dozen 2 lbs., 1½ dozen 4 lbs., and 1 dozen 7 lbs. tins.

Some bee-farmers wait until winter time, then take a periodical ticket on the railways and do their own "commercial travelling." One of our apiarists who has made a success of selling his crop thus gives his plan of campaign in the following:—"My plan is to call on the towns-people first, present my card, exhibit my samples of honey and wax, sometimes a little literature is left, and I rarely fail to book orders for honey and a cake of wax for the irons of the women folk. This I usually do first day; the second day I go around the surrounding district, calling on the farming community, and, generally having a good time. The orders of the day are forwarded home each night and receive prompt attention. This method of travelling I consider to be the most profitable way for the bee-keeper to fill in his spare time. First, it enables him to get into direct contact with the consumers of honey, thus enabling him to gauge better the people's likes and dislikes. Secondly it obliterates the middleman and his generally extortionate commission charges."

He further fills in the winter doing odd jobs about the honey-house. His work during the winter is given here in his own language:—"Usually, after cleaning up the last extracting, I attend to all the super-combs and frames, scraping the latter clean, and cutting out all broken and misshapen combs, collecting all scraps of wax and making same marketable; some of the wax I mould into small cakes, to be sold at 6d. per cake as described later on. All the wax disposed of, I then give my attention to the frames, repairing same, and wiring, with foundation, leaves the combs and frames clear of my mind until next spring. Then supers, hive-bodies, floor-boards, and covers are repaired and painted; in fact, leave everything just right for work next season."

A FLOW OF HONEY IN THE WINTER.

Sometimes the honey flow continues throughout the winter and then, of course, the apiarist will have plenty to do extracting honey and attending to the necessary routine of the bee-farm. The winter flowering-trees that sometimes yield a surplus of honey during the wet months are the "Ironbark," and "White" box; occasionally the "Cider" Eucalpyt and one or two others. Whether a winter flow is something to be desired or otherwise is a very debatable matter. Some bee-farmers consider the unseasonable laying of eggs affects the queens detrimentally.

The following article on the effects of a winter flow is based on the author's experience four or five years ago. The practice of having a number of young queens on hand is a very safe one, and would sometimes make all the difference between success and failure.

A WINTER FLOW OF HONEY.

SOMETIMES DETRIMENTAL.

A winter flow must, of necessity, cause an undue strain upon the colony, which reacting upon the queen, prematurely determines her egg-laying capacity. That a queen-bee is predestined to lay a definite number of eggs and no more is a belief generally held by the more experienced bee-farmers of to-day. Reasoning from analogy, however, this appears to be the case.

If we take a Leghorn chicken and dissect it, we find the ovaries well developed, or otherwise. When large and well formed with the ovules abundant, then we can rest assured that, had the "subject" of our experiment been permitted to fulfil her destiny, she would have presented us with an opportunity for yet a further experiment. This we will presently see has a direct bearing on the subject of queens "going off" after a winter flow.

Recurring to the chicken, an experienced poultryman given chickens as described above, would by good management, suitable food at the proper season, housing in unpropitious weather, etc., cause them to lay during abnormal weather or season, with a continuity that would practically exhaust the ovaries ere the fowls attained their second year. This is the objective of all egg-farmers; they know that the ovaries are exhausted, and the best feeding and housing in the world cannot cause a fresh growth of ovules. The hen has laid the number of eggs she was created to lay, and her career, as an egg-producer, is at an end.

Is it not so with queens? They lay in spring, summer, and gradually contract their laying towards winter, until the rigour of the season causes complete (in some cases at least) cessation of oviparous duties on the part of the royal mother. This enables the queen to rest, not because the ovaries require replenishing, for this is impossible, but because it permits the original and final number of eggs to be deposited over a much longer period. Not for one moment should one imagine the queen sole arbiter in this matter; for food plays an important part in the number of eggs laid for the day, for a week, or a year, but not for the queen's lifetime. The food and season only determine the number of eggs for a given period, and cannot influence the total number of eggs laid.

Mr. Garrett, one of our most experienced apiarists, and son of one of the pioneers of modern bee-farming in Australasia, had an imported queen four or five years old. She was a fine, large, well-developed queen and apparently strong, but had ceased to lay for some considerable time before her death, thus demonstrating the contention that the ovaries had reached the limit of productiveness. Since the queen did not produce drones out of proportion towards the end, the fertilising fluid must have been sufficient for the number of ovules.

This is not the case with the drone layers; for the fertilising spermatozoa are exhausted before the ovaries become barren, and as egg production is persisted in, the result is unfertile eggs, and drones. The author is unable to recall any specific instance of microscopic examination of queens that had ceased to lay through exhaustion of the ovaries, revealing the presence of the semen. Harking back to apiculture, should the season for honey production be so extended as to cover a period of double the ordinary time, is it not clear that a greater number of eggs laid within a shorter period than nature originally intended, must eventually cut short the utility of the queen?

EXHAUSTED QUEENS IN SPRING.

It sometimes happens after a dry critical period in midsummer, the apiarist will experience a late autumn flow (usually from "Iron-bark" or "Stringy bark") and should the weather be mild the flow continues throughout the winter. This brings the position already outlined prominently before the apiarist who is confronted in the spring with an apiary headed by queens (not aged) exhausted with the continued brood-rearing during an abnormal period. Without the exercise of some foresight the previous autumn, the apiarist will probably experience severe loss in the spring.

One after another, the queens cease to lay, with the result that the hives get below normal strength as the spring flow increases. When this is suspected, prepare a number of nuclei while the bees are yet strong in the autumn and raise sufficient cells to provide a queen for each nucleus. In due time a number of laying queens will be on hand. With the warm weather and honey flow the nuclei will build up strong enough—perhaps to cover 5 frames—to winter nicely. It is no "stunt" to winter nuclei in Australasia.

Then in spring, as fast as the queens fail, proceed as follows:—Wait until dusk, then remove the outside combs of the colony which are probably broodless, and place the four or five framed nucleus in the space so made. Handle the nuclei frames without displacing them from the group, so that the queen is not disturbed on the centre combs. The loss of queens in capable hands will not be over ½ per cent. This plan is very sure and the colonies are in splendid condition for the early flow. In fact this is a good practice to follow when dealing with old queens failing in early spring, before the bees are numerous enough to rear young ones. This condition is not at all uncommon in Australasian apiaries.

GENERAL WORK IN WINTER.

WARMING EXTRACTING COMBS.

One disagreeable feature of extracting in the winter is the coldness of the honey and its reluctance to leave the cells. Apiarists subject to these unusual flows of

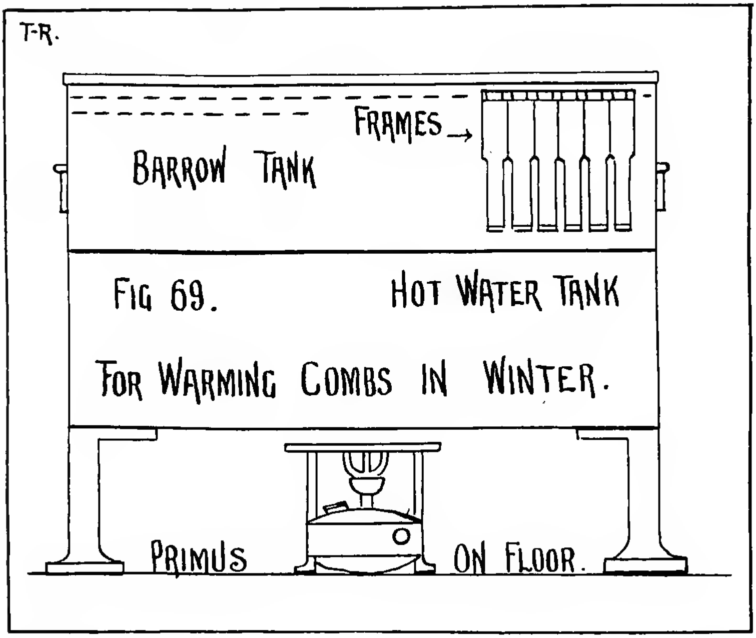


FIG 69. HOT WATER TANK FOR WARMING COMBS IN WINTER.

honey contrive to have a tight room, the temperature of which is raised by a kerosene stove or other means, and supers of honey are stored here until the combs are warm enough to extract. The supers should be piled "criss cross" so that the warm air can circulate about the combs. Of course the upper portion of the room will be the warmest, and the supers on the top should be extracted first. It will take a few hours to warm up the combs thoroughly, because honey is a slow conductor of heat. Should the thermal register be too great there is a danger of the combs falling from the frames as the beeswax will be hot long before the dense body of honey.

One winter the author paid a visit to the Narrang Apiaries at Fernbank, Victoria, and while there was shown a scheme for warming combs to extract in the winter months (see Fig. 69).

A galvanised iron tank holds the combs, and is placed over a copper containing boiling water, heated by a stove. As fast as the combs are brought in the super bodies, they are lifted out and placed in the tank, the operator at the same time pushing the combs already heated to the space created by the man uncapping at the other end. By this means the extracting is carried right along without a hitch. The top of the tank is covered by a piece of "duck," or even corn sack to retain the heat.

TO KEEP HIVE COVERS ON.

During a winter flow, the burr and brace combs—so good for holding the lids on tightly—are constantly removed, so that when a high wind springs up a number of covers are liable to be displaced. The author has for a considerable number of years used small staples to fasten them on.

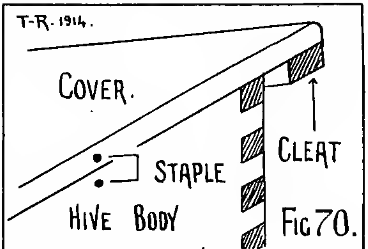


FIG 70.
FASTENING FOR HIVE COVER.

The "*Australasian Bee-keeper*" printed the following note from the author:—

"The Americans with all their go-ahead ways and labour-saving contrivances have yet to evolve a convenient fastening for a hive cover. As a matter of fact they still adhere very strongly to a large rock, stone, drain pipe, or some other equally unhandy means of keeping the lid in place. It is much easier simply to remove a pair of staples (one on each side) with the fingers. The position of the staples is shown in the appended sketch. The legs of the staples measure ⅞ of an inch long, (Fig. 70) and the space between them is 1¼ inches wide.

To secure lids firmly enough to withstand the strongest wind is a simple matter with these staples. A bradawl is used to make a hole in the edge of the cover and the corresponding hole is made in the hive body. The bradawl requires to be slightly less in diameter than the legs of the staples.''

It is during winter that the elements are so destructive to the woodwork of hives, so that the paint brush should be brought into requisition during the slack months.

PAINTING HIVES, ETC.

It certainly is very necessary to paint bee-hives, as a painted body lasts ten times as long as one unpainted. This is the practical experience of the author. Last year a neighbour bought a small apiary of 8 frame Langstroth hives; they were only two years old, and had never been painted, but he much preferred some of his bodies ten years old that had received a coat of paint every two years. The author has some twelve years old and they are good hives to-day.

Nature never intended the inside of a tree to withstand the weather, the bark looks after that. Now, when the bark or outside cover is removed and the timber cut, the fine ''tubes'' or cells are exposed to the action of the weather. These ''tubes,'' if one may be permitted to so describe them, are really the channels through which the tree draws up its nourishment from the soil. They are commonly referred to as the ''grain'' of the timber. When the wood in a hive-body is examined, it will be found that the ends absorb more paint than the flat sides; the reason for this is, the porosity of the tubes more readily conducts the liquid portion into the interior. The smooth sides cannot do this because the openings of the tubes are not so exposed. For this reason the ends of all timber decay much quicker than the sides.

To prevent this, give the ends of all hive-boards a coat of raw linseed oil before nailing together. Painted hives look nicer, and keep the bees dry. What colour? White looks well and in any climate is certainly the best.

The objection to pure white is its propensity to "blow" or wipe off in powder after a time; to overcome this defect add a very small quantity of raw sienna—just enough to produce a creamy colour. Treated thus, the lead will not blow, while all the advantages of white are retained.

HOW TO MIX PAINT.

There is only one pigment suitable for resisting the weather, and that is lead—pure white lead. A good method of mixing paint is as follows:—If any quantity is to be made an oil drum is the best to use. After putting in the requisite quantity of lead, it should be thoroughly mixed with raw linseed oil, for every two pounds of lead add a piece of patent dryers about the size of a pigeon's egg; this should be mixed thoroughly until it assumes the consistency of newly separated thin cream; it is then ready for use.

Use no turpentine on any outside work, as it only increases the propensity to "blow." "Turps" is a medium to enable paint to be applied more easily, but as it possesses no weathering qualities, it is well left out. The best material is the cheapest when buying paint; insist on getting Champion's lead, and Blundell's oil. It is not necessary to paint the insides of the bodies, but the bottom-boards and lids should be painted on both "faces;" lids not painted on the underside have a tendency to become convex, owing to the action of sun heat on the outside, and damp (condensation) on the inside.

Some object to painting the outsides, "because it prevents the moisture from the inside escaping through the pores of the wood." They argue thus—"if the outside of the hive be impervious to moisture, the condensation is prevented from drying out." This is a fallacy. As has been explained, if the "grain" of the wood were straight through from the inside to the outside, there might be something in the idea; but as it is only the sides of the tubes on the inside of a hive, no water could escape per medium of these channels. Apart from this the bees coat the inside of the hive with a thin skin of propolis that renders the wood practically impervious to moisture.

The author has never yet encountered a strong colony in a hive painted on the outside only that suffered from the contained damp. If one is cleansing foul brood it is a good plan to paint inside and out; it makes little difference to healthy bees whether we paint the inside or not, but it makes a lot of difference to the lifetime of a hive if it is not painted on the outside. The first coat should be rather thin,—red oxide is very suitable for the priming—and care should be exercised to work it well into the grain, especially the ends. The hives should then be left in a warm dry atmosphere for a few days to allow the paint to harden.

Before giving the second coating, all cracks and nail holes should be "stopped" with putty made from whiting and oil. The second coat should consist of white lead, oil, and a little dryers all worked up until a smooth consistency is obtained. The second coat should be thin and laid on evenly; a further period should elapse before the final coat is given, and choose a clear, dustless, warm day for the work.

NUMBERS ON HIVES.

When the final coat is hard and dry, the hives should be numbered before using. Where a number of colonies are together, it is impossible to remember every operation performed, and it is necessary at times for the apiarist to know just the condition of each colony, without opening a single one. The neatest way to number them is to use small stencils. It is rather an advantage to number covers in preference to bodies, which often get displaced in working the apiary. The lids, however, can always occupy the same location.

The paint for stencilling should be made of vegetable black (2 tablespoonfuls), raw linseed oil, (1 spoonful), a little turpentine (10 drops), and terebene (12 drops), all mixed to a creamy smoothness. An old short stumpy brush will do very good work. The stencil should be frequently wiped clean with a cotton cloth to make nice clear figures. Apiaries otherwise neat and orderly are often disfigured by numbers written with a stick, a stringy-bark brush, or some other equally unhandy tool. Before putting the hives in position, the bottom-boards on the underside should receive a coat of hot coal-tar. This acts as a mild disinfectant, preserves the wood from damp, and the attacks of the termites or white ants.

EXHIBITING.

PREPARATIONS.

It is during winter that the apiarist had better prepare any exhibits of wax, bees, or honey, etc., should he intend to show at any of the spring shows or exhibitions. Wax should be moulded into a variety of shapes, the honey-jars should receive careful attention, and it is well worth while to polish the glass-ware finally with methylated spirits and newspaper. Figs. 71 and 72 show hives with glass sides for observation—for exhibiting hive-bees at Agricultural Shows, etc.

Fig. 71 is very convenient for holding a single frame of bees with queen: this is usually known as the single frame glass nucleus. It is covered with a wire gauze top for hot weather, and on cold days the solid lid takes the place of the screen. It is also popular for advertising honey, etc., in shop windows. Bees under observation in this nucleus can be conveniently studied in a drawing-room if a flight hole is provided by raising the window sash a little with the nucleus contiguous.

Fig. 72 depicts an observation hive for a full colony of bees, the shutters of which are covered with green baize; sometimes a glass super containing honey-comb is shown in conjunction with it. This hive was constructed by the author and afterwards successfully exhibited at many shows, where it always drew a crowd of the curiously inclined.

Frames of comb-honey—also exhibition frames of foundation—treated to a border of white lace-paper look very showy. The section boxes, enclosed in a neat carton tied with ribbon also help to give a "complete" appear-

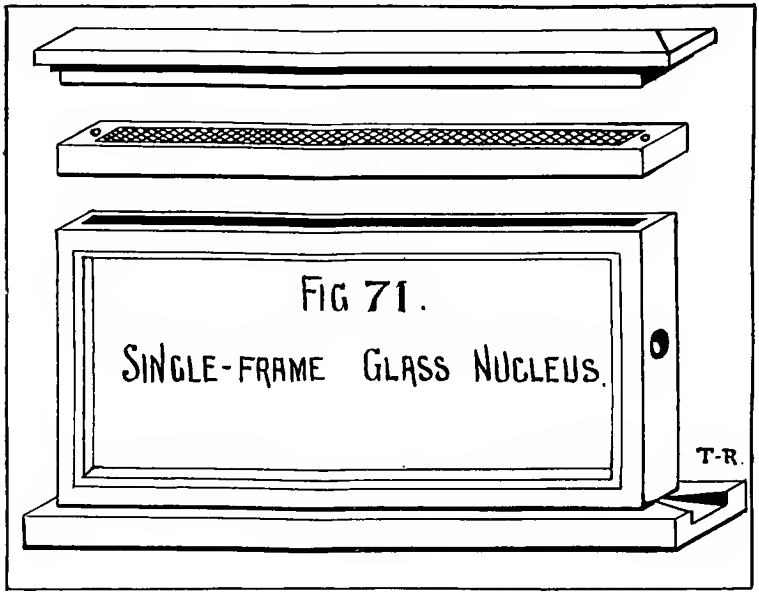


FIG 71.
SINGLE-FRAME GLASS NUCLEUS.

ance to an exhibit. The bottled honey should be finished with a square of tinfoil over the cork. Latterly many apiarists have been giving free demonstrations of hive manipulation with a colony of bees inside a large wire cloth cage.

LECTURES, ETC.

At the request of various societies the author has attended and given lectures at Agricultural Shows, handling bees and extracting honey. Needless to say the bees always attract a large crowd, and demonstrations of this class materially increase the number of honey consumers. This is an important matter in Australasia where the average amount of honey consumed per capita is so small.

Regarding the matter of prizes, the amounts offered are not sufficient to tempt a provincial apiarist to exhibit outside of his own particular district, and in many cases

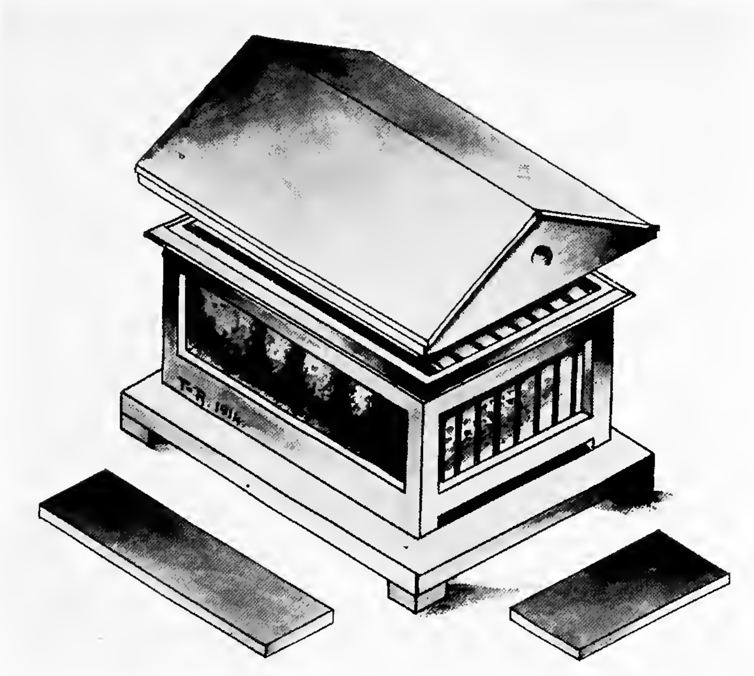


Fig. 72. Observation Hive.

the apicultural exhibits are judged by the cheese or butter expert. This is, to say the least of it, very unsatisfactory; the whole system of judging at Agricultural Shows should be revised. An official list of competent judges should be compiled and circulated throughout the various States. Show Committees would then have something reliable before them when selecting the adjudicators for their annual fixtures. A scale of points should also be adopted, and in this manner exhibitors would be educated, along with the general public. Shows are supposed to have some standing as educational mediums, but under present conditions little or no information is gained from the displays.

The majority of these societies stipulate that the produce exhibited shall be the property of the exhibitor and be harvested during the current season, but this rule is often violated. In February, 1914, the author attended an Agricultural show of a Victorian pastoral society, at the invitation of the Committee to adjudicate in "Class S., Apiculture." After sampling six or seven entries, a sample of Eucalyptus honey (probably "Box" mixed with "Stringy-bark") was encountered. Now all the local honey was gathered from ground bloom such as Clover, Thistles, etc., so this sample was a thing apart. There was no option but to disqualify the exhibit. This substitution is most reprehensible on the part of any exhibitor, but at the time of writing it is too frequent. The author when judging at the various shows has given his decision by points, so that the exhibitors had an opportunity to compare the various qualities.

SHOW POINTS IN AUSTRALASIA.

The Apiarists' Association of New South Wales adopted the following scale of points that pretty well "fills the bill," and it is worth the serious attention of associations and societies in other States.

Queen in an Observatory Hive.

Colour of queen	20
Form of queen	20
Size of queen	20
Purity of bees (*e.g.*, Evenness of size and colour of progeny)	40

Honey (Candied).

Flavour	50
Colour	30
Regularity of grain	20

Honey (Liquid Extracted).

Flavour	40
Density	30
Colour	10
Aroma	10
Clearness	5
Brightness	5

Comb Honey.

Evenness	25
Fulness	25
Appearance	25
Neatness	25
Flavour	Nil.

Wax.

	White	Yellow
Aroma	10	10
Colour	25	25
Clearness (transparency)	25	25
General appearance	20	20
Tenacity	20	20

Comb Foundation.

Impression	50
Quality of wax	50

BEESWAX.

HOW OBTAINED.

Bees secrete wax only during a honey-flow, and some apiarists then describe the bees as "fat." When the flow ceases the wax disappears. Wax is concomitant with the honey-flow, and its creation is involuntary on the part of the bee. From this it will be seen that it is good economy to provide comb-building facilities for bees engaged on a good honey crop. Under modern bee-farming methods less wax is produced than when the box-hive was in vogue. Wax now-a-days is derived chiefly from cappings helped out occasionally by rendered scraps, old and misshapen combs, etc.

The return of wax per colony on a modern bee-farm is of a variable character; some uncap the combs with a deep cut, others just shave off a wax film; the former, of course, secures the greatest average yield per colony. When extracting combs are sealed clear to the bottom-bar they will average fairly high, but many extract when the combs are only half capped. Some apiarists average and usually calculate the return at 1 lb. of wax per each 56 lb. tin of extracted honey; others again would reckon on only half that amount. As when melting old combs, the product will depend largely upon the operator. From eight Langstroth frames some obtain 1¼ lbs. of clear wax, others only ½ a lb. The average would probably be about 1 lb. per eight Langstroth combs.

The number of cells made by bees from 1 lb. of wax has been variously estimated from 30,000 to 50,000. That a swarm of bees must consume many pounds (estimated by Huber at 20) of honey to produce 1 lb. of wax is undoubtedly true.

WHAT IS BEESWAX?

It is a secretion of certain glands of the honey-bee, and as the majority of bee-keepers are aware, the glands are most active during a heavy honey-flow. As a certain English authority states, "the fat of animals and the wax of the bee are in some respects not unlike." The conditions required for the production of both are identical; to fatten a bullock, a sheep, a fowl, or in fact any animal, the first essential is abundance of provender, then warmth, so that the extra food given is not diverted into maintaining an equable temperature. Semi-darkness also assists; witness the darkened fattening coop of the poultryman. The lowered light diminishes the activity of the creature and accomplishes the intention of the fattener. Quietness is helpful; the horse ridden hard and the bullock galloped round the spacious paddock, rarely fatten.

How like all this to the tiny insects clustered together in the darkness of the hive, quiet, gorged to repletion:

> "So filtered through yon flutterer's folded mail,
> Clings the cooled wax, and hardens to a scale;
> Swift at her well-known call, the ready train
> (For not a buzz boon Nature breathes in vain)
> Spring to each falling flake, and bear along
> Their glossy burdens to the builder throng."
>
> —*From Dr. Evans' Poem, "The Bees."*

The most prominent distinction between fat and beeswax is the absence of glycerine in the latter. Animal fat, when under treatment with any alkaline agent, always produces glycerine; but when wax is saponified no glycerine is produced. This is a useful fact to remember when cleaning frames or other objects coated with wax. Many readers must have encountered, at odd times, the difficulty of thoroughly removing wax from various domestic articles, and they will find this information of value in that respect. A handful of washing-soda in the water completely saponifies the wax, rendering its removal an easy matter.

Now, this brings a very important fact under our notice. While the alkali is so helpful during all cleansing operations, the apiarist must be very careful indeed when melting wax for manufacture into comb foundation, or whenever the pure article is required. Many bee-keepers have noticed when melting wax that, after the cake has cooled, it has a peculiar spongy mass adhering to the underside. This is caused by a mineral in the water attacking the cerotic acid (one of the constituent parts) of the wax, thus producing an insoluble lime soap, and wax so affected is utterly lost to the apiarist.

MELTING WAX AT OUT-YARDS.

The fact that large numbers of bees are kept in yards situated at considerable distances from the apiarists' homes, necessitates the use of whatever water is at hand. In a great many instances the water is obtained from springs, wells, or creeks, etc., and as is well known, the water from these sources is sometimes highly mineralised. Many bee-farmers prefer to render the wax at the out-apiaries, as the blocks are more portable than combs or cappings, etc.

When one is so situated, it is advisable to determine the chemical contents of the water in use; otherwise there is considerable danger of spoiling the wax. If one is unable to obtain rain water for treating wax, and is compelled to use water described as "alkaline," it is necessary to use an acid, which, by combining with the lime, prevents it affecting the wax. A number of acids will accomplish this purpose. Vinegar would suit if only a small amount is to be treated; should a quantity be on hand it is cheaper to use sulphuric acid.

It is found in practice that a tablespoonful of acid to the gallon is sufficient. If the wax is to be melted in tin, on no account use nitric acid. It is best to use a wooden vat and a steam pipe; failing this, a black-iron vessel does very well. To prevent the acid affecting the metal and thereby discolouring the wax, first heat the iron and then rub over the inside with a piece of beef suet. Caution: when using any of the above acids, add them to cold water. A certain text-book advises "bring wax to near boiling point, then thoroughly stir in the acid;" this advice, if followed, would probably create an explosion. Needless to say, the acids are deadly poisonous, and if allowed to drop on one's clothing will burn holes therein.

COLOUR, ETC.

Combs containing any quantity of pollen (Flatweed especially), if brought to a vigorous boil will usually result in staining the wax slightly. The same thing will occur if the combs contain much honey. In this latter case the honey burns a dark brown colour. Wax boiled in a copper tank usually assumes an "orangy" shade, but if remelted, then suddenly run off into icy cold water, it regains some of its original shade of colour. Iron-rust stains the wax a dark ferreous brown, zinc and galvanised iron impart a dark olive green colour; brass gives a green, somewhat of a verdigris tint. It is extremely difficult to remove the colour from stained wax.

In melting beeswax a knowledge of its chemical constituents is useful. Otto Hehner ("*The Chemistry of the Hive*") has corrected many errors and gives us the following facts. "If wax is boiled in alcohol, cerotic acid forms about 14½ per cent. of the body and dissolves out, while the residue, myricine, remains practically unaffected. Cerotic acid crystallises in fine delicate needles, fusing at 172 degrees F. Myricine, without crystalline formation, is of a greyish-white colour, fusing at 127 degrees F. If myricine is boiled with sodium sulphate it is divided into two parts, myricylic alcohol and palmitic acid; the latter uniting with the alkali forms a soap."

It is apparent from the foregoing that the best sample of wax is obtained when treated with moderate heat. Indeed, when overheated, wax may undergo a certain amount of chemical change. One further matter, a careful man is required to supervise the running-off of the acids, as carelessness in this matter may result in a proportion of the acid remaining in the wax. This would of course render it unsuitable for many kinds of delicate work, besides injuring the tools of certain skilled workers. Over-heating causes the wax to assume a grained consistency, and the only way to restore it is to melt again by running over a dry heated surface. It is well to bear in mind that it is better to keep wax just below boiling point at any time. The melting point is about 144 degrees F.

HOW TO RENDER WAX.

The specific gravity of wax is about 967 and water 1000, so that when melting old combs the free wax invariably rises to the top. Pieces of "burr" and other light-coloured wax scraps should be melted separately from old brood-comb. This latter should be broken into small pieces and soaked in rain water 24 hours previous to rendering. As already stated, the dark colour of the brood-combs is caused by larval excrement packed between the cocoons of each succeeding generation. The silky cocoons act as absorbents, so that as soon as the wax is liquefied the cocoons become charged, and the wax is unable to rise to the top. With old combs soaked as directed above, the wet cocoons cannot hold the wax.

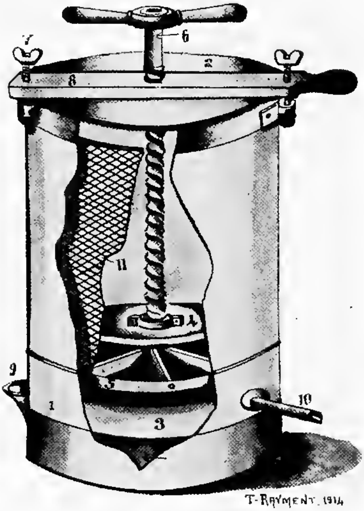


Fig. 73. Press for Treating Wax.

The old method was to bundle a lot of combs, wax, scraps, etc., into a hessian bag. This was then placed in a suitable boiler, and a slatted board, weighted with stones or pieces of iron, pressed the bag to the bottom. The free wax rose to the top and was allowed to cool into a cake. This was a wasteful method, for only a small proportion of the wax was recovered.

To overcome this waste a Hot Wax-Press was placed on the market (Fig. 73). When only white comb is to be treated, it is packed into the wire basket (No. 11), that rests on the grate (5) and water is poured into the bottom compartment *viâ* the "lip" at 9. The whole can (1) is then stood on a stove, or a primus lamp is placed underneath. As the water heats, steam rises through the centre of the false bottom (3) and passes through the comb, which melts, flows down and out of the wax tube (10) into a mould. Of course the pressure plate (4) would be at the top of the can when starting; as the wax ceases to flow the screw (6) is rotated so that the last drop of wax is secured. Before putting in the comb it is well to line the wire basket with straining cloth.

When very old combs are to be treated the procedure is varied a little. After twenty-four hours' soaking the combs, etc., are melted in a boiler, or if steam is available, in a wooden cask, close to the press. When all liquefied it should be dipped out with plenty of hot water into the cloth-lined wire basket; the cover (2) and cross-bar (8) are then replaced and secured firmly by thumb-screws (7). The handle is then turned to apply pressure until the refuse (or slumgum) is consolidated into a compact dry cake. The thinner this cake of refuse the more wax will be secured. The wax and hot water will flow out at the pipe (10) where a can should be provided to hold it. If this vessel has a tap at the bottom, the hot water may be drawn off and poured back into the boiler as the work is continued. When the wax has set into a cake it is lifted out, and if a high grade is desired it should be again treated.

To secure a high grade article wax should be melted in wooden vessels, but this, of course, entails the use of steam, and the small operator would not be justified in getting a steam plant. The small man can turn out good clear wax by using tin cans, or an iron boiler. Rub over the inside of the cans or boiler before starting with suet, and pour in the requisite amount of rain water, adding 1 tablespoon of sulphuric acid to each gallon. When the water is near boiling point, put in the cakes of wax, and watch that it does not boil when melted; stir occasionally.

When all liquefied, withdraw the fire, and cover warmly to retain the heat as long as possible, and to exclude dust.

When the temperature of the wax has receded to 150° F., the acid, by reason of its greater specific gravity, will have settled to the bottom of the vessel. The clear wax should then be carefully dipped into moulds with "flared"—*i.e.*, the top of greater size than the bottom—sides, which have previously been smeared with glycerine or painted with thin flour paste to prevent the wax adhering. Stop dipping when any sediment shows, and allow the remainder to set; when "caked" into a block, it should be lifted out and the bottom scraped to remove the dirt. This cake of wax should be held over until the next lot is treated. When a steam plant is available, a better article and more of it can be turned out in a shorter time.

REFINING BEESWAX.

Wax-cakes of all grades and colours—are placed in a wooden vat or cask with the necessary amount of water and sulphuric acid. Steam is turned on, and when the wax is made liquid the steam pipe is withdrawn; the vat should then be closely covered and gradually allowed to cool off. The acid, as mentioned above, will settle at the bottom of the water, together with a great amount of impurities precipitated by the action. The clear wax is then drawn off—by gates conveniently situated—into moulds; these are then placed in hot water so that they cannot cool in less than seventeen or eighteen hours.

Be very careful when handling all acids. The cakes of wax should be moulded into suitable sizes; if it is intended for retail disposal the cake should be in 1, 2 and 4 lb. blocks; if selling wholesale, 15 lb. blocks (four to a kerosene case) are very convenient. If the apiarist exhibits at shows, etc., small cakes at 6d. each are always in great demand.

FOUNDATION.

ITS MANUFACTURE.

On most bee-farms the wax is required for making into comb foundation; of course many apiarists prefer to sell the wax,—receiving from 1s. 3d. to 1s. 6d. per pound —and buy foundation, which costs from 1s. 9d. to 2s. 3d. per lb. Where bee-farming is made a speciality, the apiarist usually works the wax into foundation for his own use and in some cases has a fair-sized trade built up among the smaller bee-keepers. The cost of a suitable mill and the necessary vats and tanks is only justified when apiaries are conducted on a rather extensive scale.

To make good foundation requires considerable experience and patience, to say nothing about a conveniently situated wax-working plant. Bee-farmers making foundation usually leave its manufacture until the slack winter months. The temperature is then rather low, so that a room fairly warm is a necessity. A large vat of refined wax should be on hand kept at about 160° F. This tank or vat should be elevated so that its gate is over the dipping-tank. The structure of the latter tank is very simple, merely one tank within another, the intervening space (about 1 in.) being filled with water heated by a steam pipe or a Primus stove. The inner tank holds the wax at the temperature of 160° F. One or two water tanks at 95° F., for tempering the wax sheets will also be required, together with three dipping boards of pine—these should be slightly larger than the frame in use. Before the boards are used they should be soaked in water for twenty-four hours, or boiled in a vat with steam until thoroughly saturated with moisture.

When everything is in readiness, draw some wax from the large vat into the dipping tank; wait until all bubbles, etc., have risen to the top and the wax stands at 160° F.; take the dipping boards from the **warm** water—about 120° F.—(if the boards are too cold the wax sheets will crack), and shake off the surplus water. Hold by the handle and gently lower into the wax until submerged, then lift quietly upwards until all drip ceases. Repeat this operation until the desired thickness is attained. Thick brood foundation requires more dipping than thin surplus.

Some operators reverse the boards after each dip to secure sheets of even thickness, otherwise the lower portion of the sheet will be considerably thicker owing to the wax "freezing" as it runs to the bottom of the boards. Only experience can determine the number of dips necessary to produce any particular weight. The boards, with the adhering wax sheets, are then plunged into one of the water tanks for a second, and the edges are then removed. If the boards were previously saturated with water two sheets of wax may now be peeled from each and stacked convenient to the foundation-mill. (Fig. 74).

The man working the mill selects a roomy bench, and firmly secures the machine with four screws. He then prepares some strong soapsuds to act as a lubricant to prevent the wax sheets from sticking and clogging the rolls. The small trough that carries the soapsuds is so located that the bottom roller is constantly running in a soapy bath. The plain wax sheet is taken from the heap and passed through some warm water at 112° F., to render it more pliable; the handle of the mill is given a few swift turns to "soap" the top roll. The thinnest end of the sheet is then fed into the rollers which should be about 80° F., by steadily turning the handle.

Experience will enable the operator to decide when the sheet is at the toughest stage. If milled too warm the sheet sticks and clogs the indentations of the pattern, if on the other hand, the wax is on the cold side, it will crack off like glass. Too great attention cannot be paid to the temperature of the room. Should a direct draught blow on the wax sheets before peeling from the dipping-boards they will invariably crack badly and have to be re-melted. Two flat pieces of wood should be at hand to catch the edge of the sheet as it comes through the

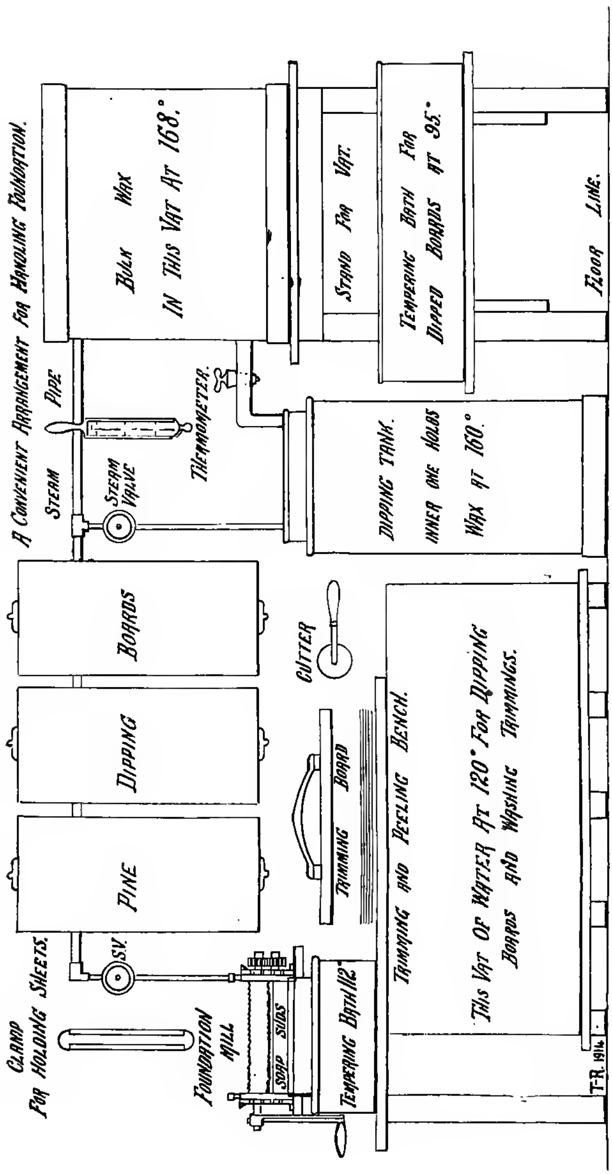


Fig. 74. Convenient plan for Making Foundation.

rollers. Wax at the "tough" stage will stand a fairly strong pull, but exercise discretion when drawing the embossed sheet from the mill. After dipping some little time, should the wax show a tendency to stick to the boards—which should be free from knotty or resinous spots—rub a little soapsuds on the offending place. To make sure of the edge of the sheet showing clear of the rollers it is sometimes dipped into soapy water before feeding. It is much easier to mill narrow (up to six inches wide) sheets; wider ones (12 inches or so) are more difficult to get through.

After milling, place the cutting board—of the inside dimensions of the frame in use—on top of four or five sheets at a time and trim to the requisite size. The embossed sheets are much larger than before milling, and when trimmed, a number of narrow strips accumulate. These trimmings should be melted up as the work progresses, but a word of warning is here necessary. Before re-melting it is essential that these scraps should be washed free from soap as the alkaline properties would have a detrimental effect on the wax. If this is neglected the resulting wax becomes so "rotten" that its tenacity is destroyed and the operator will be unable to pull the sheets from the rollers.

Should this clogging of the rolls be once encountered it will teach the inexperienced better than pages of print. Should this unfortunately happen it is well to refrain from picking at the rollers with any sharp implement; the metal used is very soft (type metal) and easily damaged. Remember that benzine dissolves beeswax readily, and the machine should be cleansed by washing, not scraping.

THE FACTORY-MADE ARTICLE.

There are factories that make a business of manufacturing foundation by what is known as the "Weed" process. Fig. 75 is a view of the three machines that turn out "Weed" foundation, at Pender's factory in New South Wales. These expensive machines are linked up

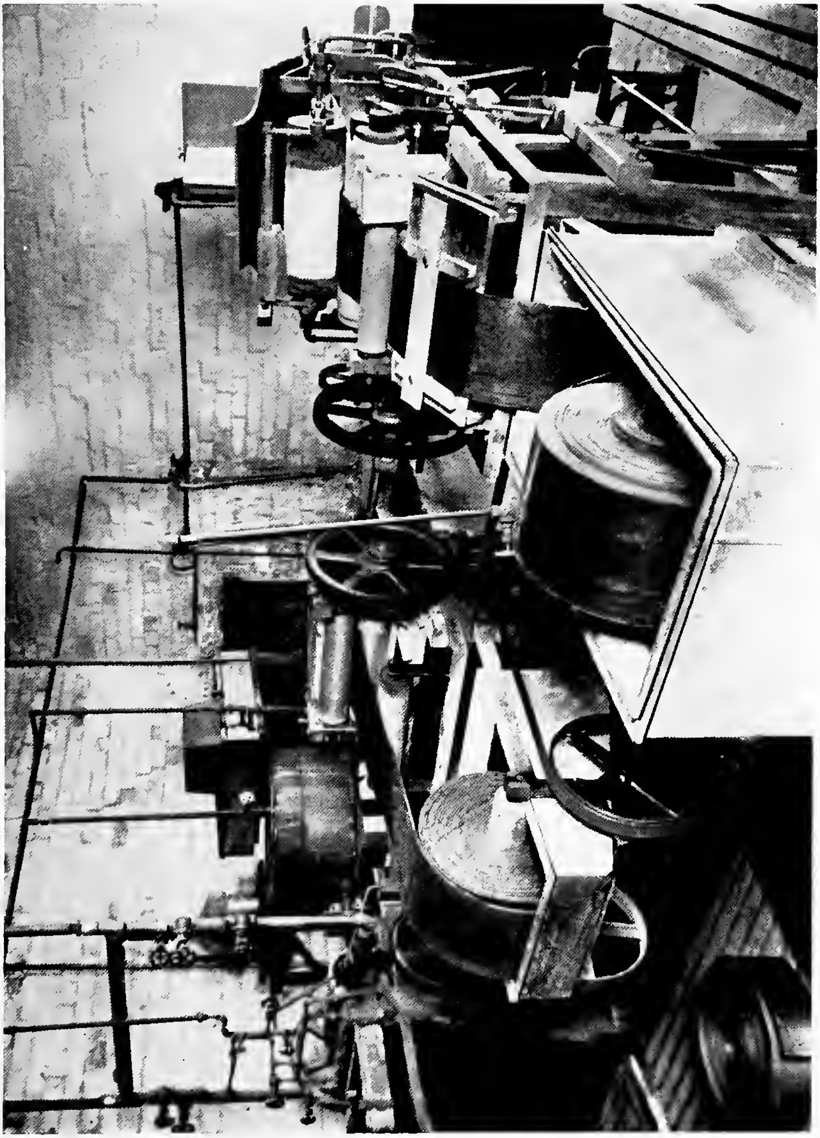


Fig. 75. View of "Weed" Process Machinery, at Penders Ltd., N.S.W.

with a number of steam and water pipes that control the temperature of the various parts. The vat in the far corner is capable of holding and treating about six hundredweight of wax at one time. It is here that the wax remains liquid from four to six hours, effectually destroying any disease germs, and permitting all impurities to settle. The next step is to draw off the wax into 60 lb. moulds; these are placed in a special receptacle that retards cooling for a day or more. The purified wax cakes are then stored away until the "off" season permits their transformation into foundation.

When in operation a wax cake is placed in the elevated tank as shown, where a system of steam pipes liquefies it, and gradually performs the task of making a long wax "ribbon" ¼ inch thick. The machine immediately rolls this "ribbon" into a compact coil, which is, when completed, transferred to the centre machine. The function of this change is to reduce the wax ribbon to the correct thickness to make foundation of the weight required. The coiled wax is shown on the forepart of the machine. The next process is the removal of the coil to the right-hand jacketed tank ready to pass through the foundation-rolls.

After milling it is automatically cut into lengths and a piece of tissue paper placed between each sheet. It is then stacked ready for casing. The attendants at this machine remove all defective sheets which are then returned to the melting pot finally to complete the process. Against the wall on the left will be noticed a steam pump employed forcing cold water through the various parts to maintain the necessary temperature.

THE VALUE OF FOUNDATION.

Foundation has revolutionised the practice of bee-keeping. For some years many apiarists held the opinion that the use of foundation in full sheets for the purpose of getting good workable combs was a rather extravagant method. They used starters—narrow ½ inch strips—and availed themselves of every opportunity to induce the bees to build all worker comb. The opportunity seldom came; still they managed by constant pruning, a pinch here, and push there, and finally hanging in the super to obtain attachment to bottom-bar—to secure very fair combs. Frames that contained all worker-comb were reserved for the brood-chamber; mixed comb, *i.e.*, worker and drone (Fig. 76) was used in the supers.

A queen with a full chamber of working bees soon desires a little piece of drone-comb, and, in some cases, finds her desire in the super. The most economical method

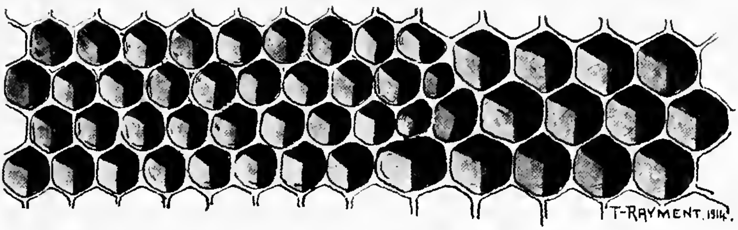


Fig. 76. How Bees change pattern of Comb.

to overcome this is to use full sheets, one or two frames at a time, in each super during a honey-flow. The frames of comb so obtained cannot be excelled. Each comb is fastened perfectly to the wood, top, sides and bottom bar. If one had, say a hundred colonies, with a sheet of foundation in each super, in ten or twelve hours he would have one hundred frames of perfect combs, not to be surpassed for beauty or utility, at practically no expense.

The author had twenty two-storied colonies of bees during a honey-flow draw out forty sheets of perfect comb in eight hours, two frames each colony; yet the hives in question produced equally as much surplus as any two-storied colony in the yard, proving that the strain on bees and honey was practically nil. Can this be said of any other procedure? Dadents, of Ill., U.S.A., estimate that 10 lbs. of honey must be consumed for each pound of wax secreted by the bees.

There are many bee-keepers who get along very well with "starters," but when the general run of these combs are compared with those drawn from full sheets, the comparison is not at all flattering. The comb produced naturally is frail, and will not bear handling to the extent of one drawn from a full sheet of foundation. Some apiarists use foundation made on plates, and the combs are very strong, but rather too much wax is used. It would hardly do to have so much wax idle in the midrib. Combs built of sheets, seven or eight to the pound, are quite strong enough for every day use. A bee-keeper that has never had a mill or an unlimited supply of full sheets, has never really experienced the full benefit of comb foundation.

When one wishes the most economical production of worker-comb, there is only one way,—a full sheet in the super during a honey flow. It is hardly necessary to repeat that foundation cannot be given to colonies during the winter months even should a flow of honey be available. While the bees may gather some honey, they are unable to "work" wax during the cold months of the year. In Australasia there is little or no wax produced after March nor before the following August or September.

TRAVELLING BEES.

COOL WEATHER BEST.

During the interval mentioned above, bees rarely have much brood, and the population is less numerous; this latter circumstance is often the deciding factor when bees are to be moved to a new site. In some foreign countries, which suffer a rigorous winter accompanied by heavy falls of snow, it is impracticable to transport them during the cold months. Early spring and the "fall" are usually selected for hauling bees. Australasian conditions, however, are such that bees may be moved without injury during spring, summer, autumn, or winter. But because the winter months are usually the slackest they are most generally favoured for the purpose.

To move a large apiary successfully without loss calls for considerable preparation beforehand. Should the combs be new and full of honey they should be removed, and well-wired old tough combs put in their place. The author has moved several apiaries hundreds of miles by road and rail, and speaking from experience, it is very

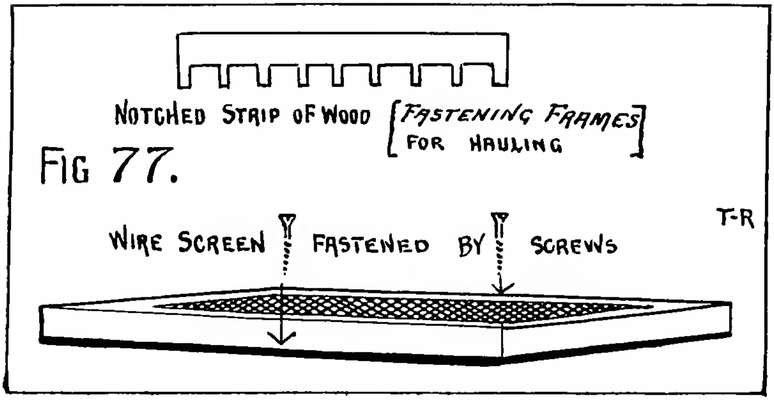


FIG 77.

unwise to travel hives well stocked with honey. When preparing colonies, leave sufficient honey to see them to the journey's end, and no more. Ventilation is sometimes neglected, the temperature of the hive rises with the excitement of shifting, and the combs become very soft, those heavy with honey finally dropping from the frames smothering the unfortunate insects in a sticky mass.

When only a little honey is left the bees cannot raise the temperature to a dangerous point, because of the absence of free ventilation. On one occasion Mr. Haase, of Gymbowen Victoria, presented the writer with 20 stocks of bees. They were placed in a railway truck with about 1 lb. of honey per hive to see them over a journey of 382 railway and 13 road miles. They were over a week in transit and came through in splendid order. Wire screens covered the tops of the hives and the entrances were closed with wire cloth. Not a solitary comb—some were quite new—was broken; had the combs been heavy with honey, some must have fallen from the frames.

It is a good practice to place the surplus honey-combs in supers for removal. In case of mishap only the combs and honey are lost; otherwise, if the honey is in with the bees, all are destroyed. Attend to the combs a week or more beforehand, and at the same time fasten all frames securely. The "Hoffman" style only requires crowding together tightly and two wooden wedges inserted between the outside frame and hive wall. The "Simplicity" frames are, of course, unspaced and a pair of sticks, illustrated in Fig. 77, must be cut for each colony. The sticks preserve the essential distance between each frame and in this way prevent crushing the insects. Two 1 inch nails will secure each stick in place at the ends of the frames.

WIRE SCREENS.

After fixing the inside of the hives, the outside will require attention. The bottom-boards should be secured with 6 staples, two in each side, and the same number in the back; simply drive one leg of the staple into the edge of the bottom-board, the other into the hive-body. Some apiarists use four pieces of wood (see corner of hive in Fig. 78) nailed at each corner to the bottom-board, hive-body, and wire screen; this makes things very snug for hauling. If the weather is not too boisterous the screens may be attached by two screws as shown, two or three days before, and the top of the wire protected with bags, or several thicknesses of newspaper, with the hive lid covering all.

The screens are simply constructed, merely a wooden rim of 7/8 inch thickness by the dimensions of the hive, covered with wire gauze or fly-wire. Should the weather be sultry when loading the bees, tack a piece of lath 1/2 inch thick on each end of the screen so that the lid cannot sit down on the wire. The cover, if desired, may be secured by two staples as already explained.

At this stage, the apiarist should provide a piece of wire gauze or safe-zinc for each entrance. The perforated zinc or wire should be bent into the form of a right angle and if the pieces are cut 14 inches long by 3 inches wide they will be about right for the 8 frame hives. Two slats of wood (14 inches by ½ inch) will be found very handy for securing the wire cloth to the entrance. The night before shifting, drive two 1 inch nails into each

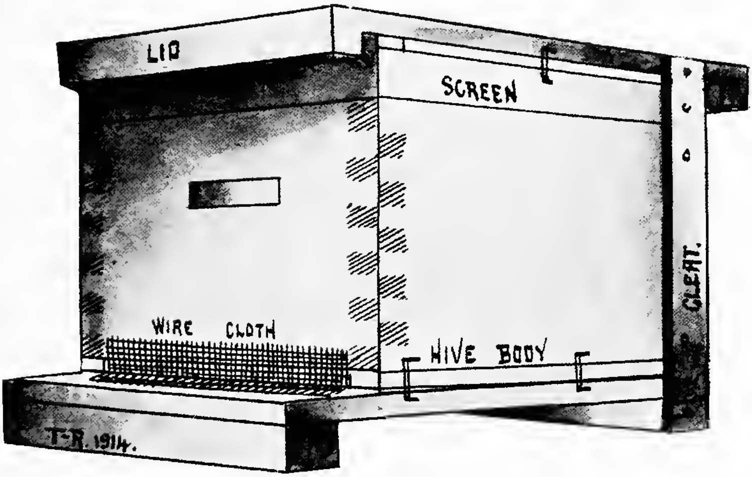


Fig. 78. How to Pack Hives for Travel.

slat, which, together with a piece of wire, should be laid near each colony to be packed. After the bees have stopped flying for the day, get the smoker in good trim and proceed to pack up. Go to the first hive, puff in a little smoke and quickly slip the strip of wire or zinc into place so that it closes the entrance; hold it securely while an assistant tacks the wooden slats along the edges. In very hot weather and with extra populous colonies, two wire screens may be necessary, the lower one taking the place of the bottom-board.

For road travelling, pack hives on waggons so that the top-bars of the frames are parallel with the axle; the combs resist the side rocking of a horse vehicle much better in this position. When packing into railway trucks, which "kick" only backward or forward, the combs should "run" with the rails, taking the shock "end on" so to speak. Sheep trucks are excellent for travelling bees during summer; in winter louvred trucks (*e.g.* produce trucks) are better. One hundred and sixty 2 storey colonies, 8 frame size, or double that number of single hives can be loaded into the ordinary sheep truck. During the summer months an attendant should go with the consignment to supply water by occasionally spraying it through the screens.

Always load bees on to a wagon or other horse-drawn vehicle before "yoking up" the team. Previous to unloading, remove horses and tie up at a safe distance. These precautions may perhaps save the life of a valuable beast, should a colony get dropped whilst unloading.

HOW FAR SHOULD BEES BE MOVED?

Colonies moved to a new site within a mile of their original location will usually have some bees go back to the old stand and many will be lost. In moving bees to out-yards—which are often too closely situated—it is advisable to take them at least four miles from home. All of the foregoing directions are good for frame-hives, but it is a different matter when colonies of bees in old kerosene cases are to be moved. At times, the box hives are simply jammed down onto a board or even a piece of tin and the bees have combs attached to it. Very often the board is much larger than the box, and until this is taken off it is almost impossible to pack the hive for removal. A fine steel wire, with a wooden handle on the ends, is useful for cutting the combs free. Hold it firmly in each hand and pass the wire underneath the box at the back, so as to form a loop; steady pulling on the wire will cut the combs without much disturbance to the bees.

If the box is tight and without holes, a piece of wire gauze should be tacked over the opening. Always carry box-hives with the wire gauze on top. Bees invariably store their honey above the brood, and when the box is carried the reverse way to which it occupied the stand, the honey will be at the bottom. The combs are now standing up instead of being suspended from the roof, and they carry best in this position.

In most cases the boxes are too leaky to move as described, and the simplest plan is to enclose the whole outfit in a tight hessian bag, and securely tie the mouth with strong string. In cool weather the latter mode of packing will do very well; it is far too close, however, for summer time. Remember also that bees, when shaken violently, will cluster like a natural swarm, therefore the starting of a journey is the most critical time. After a mile or two is traversed the bees will give little or no trouble.

TRAVELLING SWARMS.

Swarms of bees without combs will travel well at almost any season if packed by an experienced apiarist. In summer, many swarms are sold and despatched in special wire cloth carriers. Bees heavy with honey (like human beings after a banquet) require plenty of air, and should not, after caging, be allowed to stand in the hot sun.

HONEY-FLOWS AND THEIR SOURCES.

DEARTH OF INFORMATION.

The inquirer will search in vain the bookshelves of the leading city libraries for information regarding the honey-producing capabilities of the indigenous flora. This deficiency is not due to any laxity on the part of library authorities, because up to the issue of this little chapter no information dealing with the subject has been published. It is admitted at the outset that this tabulation is not complete, for it is not possible in a small compass to enumerate all plants of value to the apiculturist. Again, in many of the remote portions of this Continent, there are immense areas of country many miles in extent literally covered with blossom. No honey-flows have been recorded from these sources, because no bee-farmer has tried them and that is the only way to test the country.

As far back as August, 1908, the author—in the columns of the *Federal Independent Beekeeper*—approached the task of collecting reliable information from bee-farmers in the various States; this work has never been abandoned, and the result is before you.

From the many botanical specimens received the correct designation of each is assured. It must be understood that the Eucalypts are extremely difficult to identify from common names. One correspondent writes "these are the names as known to me: every ten miles different names," and this is where the whole matter becomes involved. One apiarist reports a flow of honey from

Fig. 79.

"White Gum" in March, another a flow from "White Gum" in November. This is very misleading until we learn that the trees referred to are, in one case "Manna Gum" (*E. viminalis*) and the other "Cider Gum" (*E. Gunnii*). Likewise it is confusing to hear one man praise Stringybark honey and another from "over the border" class it as "uneatable." While both samples may have been gathered from "Stringybark" trees, yet they came from different varieties.

Again, each district has its special favourite for pride of place as "the best honey-tree." Near the Snowy river, in New South Wales, the "Snap" gum is easily first; at York district, Western Australia, the premier trees are the "York" and "Yate" gums; Western District, Victoria, nails its colours to "Red" Gum and "Yellow" Box; South Australia declares in favour of "Red," "White" and "Blue" gums, but the "Coolibah" (*E. microtheca*) of Queensland is not to be despised, and beautiful honey is gathered from the Clover of South Gippsland, New Zealand, and Tasmania.

With all these differences the reader can rest assured that the following particulars are gathered from the author's own experience and an extensive correspondence with professional apiarists situated throughout the Commonwealth. There is no hearsay about it. To make the information as concise as possible the honey-plants are given in alphabetical order. The nomenclature adopted by the Victorian Plant Names Committee is used in many instances, not in all, for the simple reason that the labours of the Committee are not yet ended. Under the head of Eucalypts will be found some further information dealing with the vagaries of the indigenous flora.

The Wattles are often named as the national flowers, and because of their wide distribution throughout the Continent, are selected to head the list of plants valuable for honey-bees. The earliest blooming variety is the "Cootamundra," yielding a profusion of blossom and a great supply of golden pollen from June onwards; also it is a quick grower as a wind break. Mr. Pender, of

A. J. Waugh, Esq., photo

Fig. 80. Cootamundra Wattle.

A. J. Waugh, Esq., photo

Fig. 81. Golden Wattle.

West Maitland, writes interestingly on this species as a bee-plant: "I have five trees spreading up to twenty feet in diameter and twenty-five feet high; they are a mass of feathery drooping flowers, and every moment the bees are able to fly they are gathering pollen from the trees. The trees are easily grown from seed. I would advise all bee-keepers to give them a trial, especially where pollen is short in early spring."

The "Golden" gives a smaller quantity of yellow pollen. The "Silver" and the closely allied "Green" wattle are also excellent in early spring to start brood-rearing. The "Black" or "Tan" wattle comes into bloom about November, with a wealth of creamy yellow pollen. The "Sunshine" wattle bursts its buds in March in Victoria, and the familiar "Prickly moses" (corrupted from "Prickly mimosa," (*A. verticillata*) is conspicuous in the early spring.

Analysis by the Victorian Department of Agriculture separates the Wattle pollen as the richest in protein and therefore of greatest value to bee-farmers. It is undoubtedly the national flower of Australia and deservedly so. The Wattles yield pollen in September in Western Australia; they show the yellow pollinia in August about Monaro, New South Wales; the "Green" wattle blossoms at the latter place during December, January, and February. This latter variety (*A. mollissima*) is a handsome tree. In Queensland the bees get busy on wattle pollen in July. The Acacias of the northern State are not quite the equals of their relatives further south. The following is an official list of Acacias issued by the Victorian Plant Names Committee.

Thorn Acacia	..	*A. continua*, Benth.	V., N.S.W., S.A.
Spiny Acacia	..	„ *spinescens*, Benth.	S.A., V., N.S.W.
Woolly Acacia	..	„ *lanigera*, Cunn.	V., N.S.W., Q., S.A.
Furze Acacia	..	„ *colletioides*, Cunn.	V., N.S.W., S.A., W.A.
Sickle Acacia	..	„ *siculiformis*, Cunn.	T., V., N.S.W.
Juniper Acacia	..	„ *juniperina*, Willd	V., N.S.W., Q., Tas.
Thin-leaved Acacia	..	„ *tenuifolia*, F. v. M.	V.
Spreading Acacia	..	„ *diffusa*, Edwards	V., N.S.W., Tas.
Rock Acacia	..	„ *rupicola*, F. v. M.	S.A., V.
Wallaby Acacia or Nealia	..	„ *rigens*, Cunn.	V., N.SW., Q., S.A.

Reed-leaved Acacia ..	*A. calamifolia,* Sweet	V., N.SW., Q., S.A.
Rough Acacia ..	„ *aspera,* Lindl.	V., N.S.W., S.A.
Hedge Acacia ..	„ *armata,* R. Br.	V., W.A., S.A., Q., N.S.W.
Golden Grapes ..	„ *spectabilis*	N.S.W., Q.
Ploughshare Acacia ..	„ *vomeriformis,* Cunn.	S.A., T., V., N.S.W.
Harrow Acacia ..	„ *acanthoclada.* F. v. M.	V., N.S.W., S.A., W.A.
Spoon Acacia ..	„ *obliqua,* Cunn.	S.A., V., N.S.W.
Hairypod Acacia ..	„ *glandulicarpa,* Reader	V.
Gold Dust Acacia ..	„ *acinacea,* Lindl.	V., N.S.W., S.A.
Streaked Acacia ..	„ *lineata,* Cunn.	V., N.S.W., Q., S.A.
Small Pod Acacia ..	„ *microcarpa,* F. v. M.	V., N.S.W., S.A.
Mountain Acacia ..	„ *montana,* Benth.	V., N.S.W., S.A.
Varnish Acacia ..	„ *verniciflua,* Cunn.	S.A., T., V., N.S.W.
Leper Acacia ..	„ *leprosa,* Sieber	V., N.S.W.
Straight-leaved Acacia	„ *stricta,* Willd	T., V., N.S.W.
Bramble Acacia ..	„ *sentis,* F. v. M.	W.A., S.A., V., N.S.W., Q., N.T.
Hickory Wattle ..	„ *penninervis,* Sieber.	V., N.S.W., Q., Tas.
Golden Rain ..	„ *prominens*	N.S.W.
Golden Hickory Wattle	„ var. *falciformis*	V., N.S.W.
Wirilda ..	„ *retinodes,* Schlech.	S.A., V.
Golden Wattle ..	„ *pycnantha,* Benth.	V., S.A., N.S.W.
Sword Acacia ..	„ *obtusata,* Sieber	V., N.S.W.
Boomerang Acacia ..	„ *amoena,* Wendl.	V., N.S.W., Q.
Hakea Acacia ..	„ *hakeoides,* Cunn.	V., N.S.W., S.A., Q.
Willow Acacia ..	„ *salicina,* Lindl.	V., N.S.W., S.A., Q., W.A.
Weeping Wattle ..	„ *saligna*	W.A.
Sweet Acacia ..	„ *suaveolens,* Willd.	V., T., S.A., N.S.W., Q.
Flax Acacia ..	„ *linifolia,* Willd	V., N.S.W., Q.
Crescent Acacia ..	„ *lunata,* Sieber	V., N.S.W., Q.
Silvery Acacia ..	„ *brachybotrya,* Benth.	V., N.S.W., S.A.
Hairy Acacia ..	„ *vestita,* Edwards	V., N.S.W.
Ovens Acacia ..	„ *pravissima,* F. v. M.	V., N.S.W., S.A.
Myrtle Acacia ..	„ *myrtifolia,* Willd	V., N.S.W., S.A., W.A., Q., Tas.
Three-nerved Acacia	„ *trineura,* F. v. M.	V., S.A., N.S.W.
Long-pod Acacia ..	„ *elongata,* Sieber	V., N.S.W., Q.
River Acacia ..	„ *subporosa,* F. v. M.	V., N.S.W., Q.
Sticky Acacia ..	„ *Howittii,* F. v. M.	V.
Yarran Acacia ..	„ *homalophylla,* Cunn.	V., N.S.W., Q., S.A.
Umbrella Acacia ..	„ *Osswaldi,* F. v. M.	V., Q., N.S.W., S.A., W.A.
Eumong Acacia ..	„ *stenophylla,* Cunn.	S.A., V., N.S.W., Q., N.T.
Hard-leaved Acacia ..	„ *sclerophylla,* Lindl.	N.S.W., S.A., W.A.
Mealy Acacia ..	„ *farinosa,* Lindl.	V., N.S.W., S.A., W.A.
Blackwood ..	„ *melanoxylon.* R. Br.	V. N.S.W,. S.A., Tas., Q.
Lightwood ..	„ *implexa,* Benth.	V., N.S.W., Q.
Spike Acacia ..	„ *oxycedrus,* Sieber.	V., N.S.W., T., S.A.
Prickly Acacia ..	„ *verticillata,* Willd	V., N.S.W., T., S.A.
Eastern Acacia ..	„ *subtilnervis,* F. v. M.	V., N.S.W.
Catkin Acacia ..	„ *Dallachiana,* F. v. M.	V.
Alpine Acacia ..	„ *alpina,* F. v. M.	V., N.S.W.
Sallow Acacia ..	„ *longifolia,* Willd	V., N.S.W., T., S.A., Q.

Coast Acacia ..	*A.* var. *sophorae,* R. Br.	N.S.W., V., T., S.A.
Narrow-leaved Acacia	„ *linearis,* Sims	N.S.W., V., Tas., Q.
Mulga ..	„ *aneura,* F. v. M.	V., N.S.W., Q., S.A., W.A.
Carrawang ..	„ *doratoxylon,* Cunn.	V., N.S.W., Q., S.A., W.A.
Rosewood Acacia ..	„ *glaucescens,* Willd	V., N.S.W., Q.
Fringe Wattle ..	„ *Mitchelli,* Benth.	V., S.A.
Sunshine Wattle ..	„ *discolor,* Willd	V., N.S.W., Tas.
Early Black Wattle ..	„ *decurrens,* Willd	V., N.S.W., Q., T., S.A.
Late Black Wattle ..	„ *mollissima,* Willd	S.A., T., V., N.S.W.
Silver Wattle ..	„ *dealbata,* Link	V., N.S.W., Q., Tas.
Cootamundra Wattle	„ *Baileyana,* F. v. M.	N.S.W.

It is to be regretted that so many individual botanists are constantly permitted to "juggle" with the classification of the Australian flora. In many cases they desire to appear infallible and rather than allow a rival to score a point prefer to make confusion more confounded. The Eucalypts and the Acacias suffer grievously in the process. One botanist has suggested that the list of Acacias in this book is very incomplete. He states that over 500 forms of acacia are indigenous to Australia and in the preface of a small work deplores the existing tangle, then straightway proceeds to urge the creation of a new variety. Many of the Acacias are of no practical value to the apiarist, and the author would remind kindred critics that this work is a bee-book, not a botanical census.

The distribution of the Acacias over the various States has been compiled by the author from a numerous collection of letters from interstate bee-farmers; it is therefore reliable.

Acacia (Hedge), (*armata*). A bushy shrub bearing numerous spines and bright yellow blossom similar to many other acacias; yields a fair amount of yellow pollen in spring. It is extensively used as a hedge plant, and is one of the few native plants proclaimed a noxious weed by the State of Victoria.

Acacia (False), (*Robinia pseud-acacia*). This is the Black Locust of the United States, and is common enough in the flower gardens of Australia. It bears beautifully symmetrical clusters of creamy white flowers papilionaceous in shape and gives a great flow of pale honey delicately flavoured, and also a quantity of cadmium-coloured pollen. It is a handsome tree, and the scent combined with the humming of the bees is sufficient to awaken the apiarist on a sunny summer morning.

American Honey-Plants. Some years ago the author had a number of honey-plants—introductions from the United States of America—growing near the apiary. Several varieties of Golden rod (*Solidago*), also the Tulip tree (*Liriodendron tulipifera*), Borage (*Borago officinalis*), Buckwheat (*Fagopyrum*), and the Maple (*Acer*). The Judas-tree (*Cercis Canadensis*) along with the Borage made the best show, and the Spider plant (*Cleome pungens*) was the greatest failure; it had neither honey, pollen, nor beauty. Generally they could not be compared with the natives of the Australian bush as honey-plants. This will also show that while a plant indigenous to a country may be a sure yielder of honey, transported to another clime it may not be "worth a rap," although the Eucalypts grown in California yield splendid crops of honey much appreciated by our cousins overseas. The Buckwheat would pay handsomely if grown for grain; it is a splendid crop for feeding pigs and is grown—to a limited extent—for that purpose in Gippsland, Victoria.

Bottle Brushes (*Callistemons*). A numerous family all yielding honey. Though natives, they seldom yield honey in sufficient quantity to make a show in the honey-supers.

Bauera (Wiry), (*Bauera rubioides*). Native honey-plants bearing beautiful blossoms fit to grace any garden. There is also another variety, but the florists appear to be very backward in placing them before the public.

Banana (*Musa sapientum* and *Musa Cavendishii*). One a native of Fiji and the other grown extensively in Queensland. Latterly the cultivation of this plant in the State mentioned has been somewhat neglected, owing to the superiority of the flavour of the Fijian product. It yields a light-coloured honey in fair quantity.

Basswood (*Tilia*). See "Exotic Trees." An American honey-tree, largely planted for ornamental shade.

Buckwheat, (*Fagopyrum*) is gaining favour in Victoria as fodder for pigs. The author once sowed some Buckwheat which showed green above the ground 3 days after planting. It was a mass of white bloom, but no bees were ever observed on it, and the hives certainly had no dark honey in them. However it equalised matters by yielding an extra large crop of grain. The clusters of tiny white flowers produce an abundance of honey in the United States of America. The honey is darker than any produced by Australian native plants. The American apiarist Alexander once had 700 colonies of bees in one apiary on a Buckwheat location in New York State, U.S.A.

Beans, (*Phaseolus nanus*). Now grown as a farm crop in various States and yielding rather thin pale honey in spring (late).

Borage, (*Borago officinalis L.*). A Mediterranean plant brought to this Continent with impure seed and has spread to a limited extent in the extreme south. The star-shaped blue flowers bear pale honey and yellow pollen all through spring and summer.

Blackberry (*Rubus fruiticosus L.*). Generally found in the moist portions of the States along creek frontages, etc. It acts as a splendid soil binder, thus preventing erosion of banks. Introduced to Australia from Europe and Asia, it has overrun some districts to the exclusion of everything else. In these places it yields water-white thin honey and green-coloured pollen during the spring and summer months.

Boxthorn (*Lycium horridum*, Thunb). A native of Africa brought to Australia—goodness knows what for—and farmers paid 2s. 6d. per oz. for the seed as a hedge plant. It spread, and was proclaimed a noxious weed, so the farmer now pays about 2s. 6d. per plant to grub it out. It gives white honey and creamy pollen the year through. On account of the thorns—slightly poisonous—it is one of the hardest plants from which to hive a clustered swarm of bees.

Bugloss (Vipers). See "Paterson's Curse." This is the Blue "thistle" mentioned by American apicultural writers.

Briar (Sweet), (*Rosa rubiginosa*, L). This is also a proclaimed plant in some States, but it has spread considerably and yields pale yellow pollen during late spring and early summer; Swiss bee-keepers think it a good bee-plant.

Busaria or Prickly Box, (*Busaria spinosa*). Frequents the high ground along creeks and river-banks. A rather straggly habit of growth, but the great masses of cream tiny flowers bear tawny pollen about Christmas and the honey-scented odour is very fragrant.

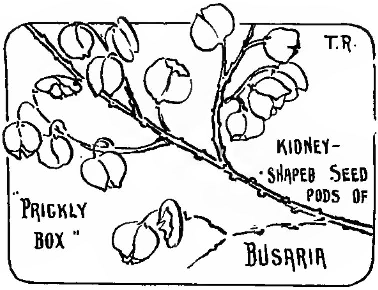


Fig. 82. Busaria.

Bush Flowers. The Bush-pea (*Pultenaea*), Parrot-pea (*Dillwynia*) and the Flat-pea (*Platylobium*) together with the *Bossiaea* all have some exquisite flowering species very suitable for garden culture, and all help to make the Australasian bush one blaze of floral colour in springtime. The poet who described the bush as "sombre-clad" had surely never witnessed the "Narrow-leaved Bitter-pea" in bloom—hundreds of acres clothed in nodding golden-red blossom. The foliage, a delicate tint of grayish green, and the long flower racemes (4 or 5 feet in length) present a very gorgeous appearance during October. The lovely flowering shrubs of our bush are almost unknown to the dweller in the smoke-laden cities of the coast.

Carob-Bean, (*Ceratonia siliqua*). Some few trees are to be found in Australasia, but not sufficient to yield enough honey to store in the supers. At Mildura, Victoria, there are some splendid specimens. Considered a good honey-tree in America.

Chicory, (*Cichorium intybus*). A plant not unlike the Parsnip and cultivated as a commercial crop in portions of the Australian States, Phillip Island off the Victorian coast especially. Chicory yields very well during showery weather.

Cape Broom, (*Cytisus canariensis*, Stendel). A native of the Canary Islands, now a pest in some Australian States, and like the English broom, is a proclaimed plant; both varieties yield pale honey in spring. It is sometimes planted as a hedge, and the yellow papilionaceous flowers are very conspicuous. Being a leguminous plant it enriches the soil with nitrogen.

Cotton Bush, (*Adriana acerifolia*). Blooms from beginning of September until first week in November, and is valuable for pollen in Western Australia.

Clematis, (*Clematis aristata*). Sometimes called "Supplejack." A native climber found throughout the Australian bush. It has a striking appearance hanging in festoons from the "scrub." In some States the beekeepers have been able to trace a greenish-tinted honey to the flowers of the Clematis. One of the species has a profusion of creamy star-like flowers, and another has pretty bell-shaped blossoms tinted with purple and splashed with dark-coloured dots. Blooms about September in Victoria. In Queensland one of the Supplejacks has a small verdant flower and yields the greenish honey during the months of November and December.

Clematis, (*microphylla*) is another variety of the above Supplejack. The mountain streams of the Australian Alps present magnificent pictures of white Clematis during October. Bees work strongly on it, too.

Cape Weed, (*Cryptostemma calendulaceum*, R. Br.). A native of South Africa introduced to Western Australia as early as 1836 and now spread over the entire Australian Continent. Its bright yellow flowers bear a large quantity of pollen vivid orange in colour during the spring months; consequently it is of great value to the Australasian apiarist. Colonies build up in a remarkable manner while the Cape Weed is in bloom, and it has earned the goodwill of bee-keepers from the "Leeuwin to the Gulf." The yellow paddocks of Cape Weed yield also a flow of honey bright gold in colour. It has a unique aromatic flavour, and candies quickly in coarse grains of a sombre creamy white. The author once harvested an average of 20 lbs per hive from this source alone.

Cape Weed is perhaps the most important pollen plant in Australia. It is a proclaimed weed in some portions of Australia—for some unknown reason—it would be almost as practicable as getting rid of the Eucalypts. In some districts Cape Weed is of undoubted value for feeding stock; milch cows do especially well on it during winter when there is little else available. Professor Ewart, of Melbourne University, speaks of it having "no practical value as a fodder or otherwise." Strange as it may seem the pollen from the Cape Weed affects some people in a peculiar way, giving them what is called "Hay fever" and a fit of sneezing.

Cedar trees, Red, (*Cedrela Toona*), Brown, *Ehretia acuminata*). Of some little value to apiarists in Central Queensland. *Toona* is found also in New South Wales and India.

Clover, (White), (*Trifolium repens, L.*). The coastal districts of portions of Australia are eminently adapted for the growth of the various clovers. The island of Tasmania produces considerable clover honey, likewise many of the islets situated in Bass Strait. This clover is the first to bloom in spring. It flourishes on river flats and the honey is somewhat like that gathered from Lucerne; pale in colour and of very delicate flavour. Yields pollen of a peculiar dirty tint approaching olive.

Clover, (Red), (*T. pratense*). This is not quite so good for yielding honey as the white Clover. Like that of many clovers the honey is rather thin in consistency, but is of fine flavour.

Clover, (Alsike), (*T. hybridum*). This is sometimes called Pink clover. It will grow on drier soil than most clovers and is fully equal to the white for honey. It is gaining in popularity as a pasture.

Clover, (Crimson), (*T. incarnatum*). Easily the most beautiful in form and colour of all the clovers. Grown considerably in the "wet" districts for hay, also as a garden plant.

Clover, (Strawberry). (*T. resupinatum L.*). A clover of creeping habit introduced to Australia from Switzerland by a pastoralist on the banks of the Tarwin River, Victoria. It requires moist soil, in fact it will stand water running over it—as it often has in South Gippsland. It grows very luxuriantly in some places and yields pale delicately-flavoured honey. It is the latest (autumn) clover to bloom, and the honey gathered from it is equal in every respect to the clover honey of Great Britain.

Unfortunately the yield from colonies in the clover districts is not large; 60 lbs. of pure clover honey per colony is considered a fair average. This honey could successfully compete with the clover honey of America, Canada and New Zealand. At present it does not pay to locate on purely clover country. There are a great many other clovers, but the above are the principal ones, which flower in the order given above. Red clover pollen is of a dark distinctive green colour.

Castor Oil Plant, (*Ricinus communis*). Latterly Queensland apiarists have been drawing attention to this plant as a pollen producer. It is easily grown and yields pollen throughout the year. The seeds if swallowed even in small quantities are poisonous to stock. The plant was known to the Egyptians over 4,000 years ago.

Dandelion, (*Taraxacum officinale L.*). This plant is now spread over the civilised world, the moist portions at any rate. It does not grow so luxuriantly in Australasia as it does in America, where the blossoms reach a very large size—two or three inches in diameter. In the northern States of U.S.A. it is considered good pasture for milch cows.

A large variety is cultivated by the market gardeners of the eastern States U.S.A. as a vegetable. It blooms in early spring, yielding a fair honey of yellow tint, and pollen very similar in colour to that of Flatweed. Coming so early in the spring (cold wet weather appears to favour it) it is of value to colonies building up after a severe winter. The whole habit of Dandelion closely resembles Flatweed.

Date-Palm, (*Phœnix dactylifera*). A splendid honey-plant. Several plantations are to be found in South Australia, but no large honey-crops have been reported up to the present time. Probably no bee-keeper has tried the localities sufficiently to give reliable reports.

European heather, (*Erica Tetralix*). The European Heath is a good honey-yielder, but the plant is distinct from the shrubs indigenous to Australasia commonly known as "Heath." It is a curious fact that while European heather yields considerable pollen the bee cannot gather it. The pollen-bearing anthers are so situated that the bee, in seeking the nectary of the flower, must disturb them with her head. The liberated pollen is then distributed over the bee's brow, out of reach of the insect's pollen brushes; she is thus unable to pack it into the pockets on the legs. In Scotland and various other places the honey from these plants is dark, and owing to its peculiar consistency cannot be extracted by centrifugal force, *i.e.*, the honey-extractor. The tiny blossoms—borne in great quantity—measure only ¼ inch in length and are somewhat egg-shaped. The reason for including the Ericas in this work is to enable the apiarist to distinguish them from the so-called "Australian Heaths" (*Epacris*).

Epacris, (misnamed Heath), (*E. impressa*). The so-called "Heath" of Australia is not Heath at all, though the long "tubes" of the *Epacris* are not quite unlike some of the flowers of the true Heath (*Erica*). The *Epacris* is abundant in Victoria, and frequents the poor thin sandy soils. It bears handsome flowers in the spring. Some blossoms are white and some pink; occasionally the flowers are almost red. The plants are too well known to go into details. Unlike the European Heath the *Epacris* yields very little honey, so that it is never seen on the market, whereas the heather honey of Great Britain cuts quite a figure among the English people.

Ericaceæ (Poisonous). Some of the species are very handsome and make effective garden plants. Unfortunately the honey from one species (*Kalmia latifolia*) produces severe sickness if eaten.

EUCALYPTUS.

GUM TREES.

No plants in the world yield honey equal in quantity to the indigenous trees of Australasia referred to as "Gum Trees." There are 200 or more recorded species of Eucalypts and with one or two exceptions, the genus is limited to Australasia and its southerly island. The name Eucalyptus is very appropriate, being derived from the Greek *eu*, well and *kalypto*, I cover. If we study the buds of any Eucalypt we will notice a "cap" covering the upper "half" of the bud. In one Western Australian species—the "Yate" tree (*E. cornuta*)—the cap or operculum is horn-shaped and about three times the length of the calyx or lower portion of the bud. Some of the caps on buds of the "Red" box tree are very small.

The Eucalypts have been classified according to the structure of the flower and again from the formation and disposition of the bark. Because this latter method of differentiation is most apparent to general observation it is most popular with bee-farmers. For instance we have 1st Gum trees with smooth, soft, thick bark, *e.g.* "Red" gum, (*E. rostrata*) and "Blue" gum (*E. globulus*); 2nd Box trees (in two subdivisions), one with solid, hard, short-fibred bark, which extends to the highest limb, *e.g* "Apple" box (*E. Stuartiana*); with others the bark is confined to the trunk or bole with the upper branches smooth and clean, *e.g.*, "Yellow" box (*E. melliodora*);

3rd, Stringybark'' trees with soft thick long-fibred bark from the ground to the top-most branch; 4th, ''Ironbark'' trees with dark, hard, short-fibred bark, deeply furrowed, *e.g.* (*E. sideroxylon*).

Now if all the Eucalypts could be placed under the above heads it would be fairly satisfactory, but there are such a number of variations due to hybridisation, differences owing to geological formation and climatic influences, that the trees appear to be a demonstration of botanical gradation. As an example, on dry gravelly formation the ''Manna'' gum (*E. viminalis*) has a trunk covered with hard brittle bark, almost black in colour, with top branches white and clean. Along river banks and in deep-shaded, wet forest gullies the trunk is white, smooth and clean; as a natural corollary the tree becomes ''White'' gum. The buds in both instances are arranged in the characteristic manner—*e.g.* disposed mostly in threes somewhat after the pattern of the broad arrow.

However, these variations are most confusing to the apiarist and also to the student of Botany. It will be noticed that the specific name—the only true one—is given in every case. Bushmen, and likewise bee-farmers, often complain of the free use of Latin, but a little consideration will show the necessity of having a name that means the same to the Italian botanist and the English scientific lecturer in an Australian University. It would not be much trouble for an apiarist to ascertain the specific denomination of every Eucalypt in his district. The author has had considerable experience in the Australian bush and this has—together with extensive correspondence—helped considerably in forming a fairly accurate idea of the chief supplies.

WESTERN AUSTRALIA.

The crop of honey in the Western State is gathered from the ''Yate'' tree (*E. cornuta*); ''York'' gum (*E. loxophleba*); Western Australian ''White'' gum tree (E. *redunca*), locally known as ''Wandoo'';

"Karri" (*E. diversicolor*); "Jarrah" (*E. marginata*); Western Australian "Red" gum (*E. calophylla*); the "Flooded" gums of the South West (*E. rudis* and *E. decipiens*); Western Australian "Blue" gum (*E. Megacarpa*); and the Sandalwood (*Santalum cygnorum*). This is not a complete list by any means, but the plants enumerated are the principal sources of supply. The "Crimson flowering" gum (*E. ficifolia*) is also of some value.

SOUTH AUSTRALIA.

In this State "Red" gum (*E. rostrata*); "White" gum (*E. paniculata*); South Australian "Blue" gum (*E. leucoxylon*); "Sugar" gum (*E. corynocalyx*); "Pink" gum (*E. fasciculosa*); South Australian "Peppermint" tree (*E. odorata*); "Blue" Peppermint (*E. amygdalina*); and "White" box (*E. hemiphloia* var. *albens*), yield big crops. The "Red" gum of West Australia (*E. calophylla*) has been largely planted by apiarists on account of its honey, which is very dense and of good flavour. Here is the comment of a Victorian on some samples received from an extensive honey-producer of the great central State:—

"Mr. F. Pope, Jun., Honeydale Apiary, South Australia, sent five samples of honey during the month. Three were from "gum" and two from "peppermint." The White and Black Peppermint were candied and white in colour, and Red and Pink gum in the liquid, but the Blue gum had candied. They were nice samples, the candied as soft as butter, and the liquid bright and clear."

VICTORIA.

"Yellow" box (*E. melliodora*); River "Red" gum (*E. rostrata*); Forest "Red" gum (*E. tereticornis*); "Red" Ironbark (*E. sideroxylon*); "White" Ironbark (*E. leucoxylon*); "Red" box (*E. polyanthemos*); "Swamp" gum (*E. paludosa*); "Cider" gum (*E. Gunnii*); "Blue" gum (*E. globulus*); "Narrow leaved" Peppermint (*E. amygdalina*); "Blue" Peppermint (*E* *dives*); "Grey" box (*E. hemiphloia*); "Apple" box (*E. Stuartiana*); "Black" box (*E. bicolor*); "Grey" or "Spotted" gum (*E. goniocalyx*); "Manna" gum (*E. viminalis*); "Brown" Stringybark (*E. capitellata*); "White" gum (*E. pauciflora*); about once in seven years another "White" gum (*E. rubida*); "Messmate" (*E. obliqua*); "Mahogany" gum (*E. botryoides*); "Silver top" (*E. Siberiana*);"Common"Stringybark (*E. macrorrhyncha*); "Gippsland" Stringybark (*E. eugenioides*); Lucerne (*Medicago sativa*); Tea tree (*Melaleuca ericifolia*); Cape Weed (*Cryptostemma*); Heath-Myrtle (*Thryptomene Mitchelliana*); and Clover (*Trifolium*).

NEW SOUTH WALES.

"Yellow" box (*E. melliodora*); "Red" gum (*E. rostrata*); "White" mahogany (*E. acmenioides*); "Snap" or "White-topped" gum (*E. vitrea*); "Bloodwood" (*E. corymbosa*); "Red" Mahogany (*E resinifera*); "Apple"-box tree (*E. Stuartiana*) "Peppermint" (*E. peperita*); "Stringybark" (*E. capitellata*); "Narrow leaved" Ironbark (*E. crebra*); "White" Iron bark (*E. paniculata*); "Forest" Red gum (*E. tereticornis*); "Tallowwood" (*E. microcorys*); "Fuzzy" box (*E. Baueriana*); "Cabbage" or "White" gum (*E. coriacea*); "Grey" gum (*E. punctata*); "Spotted" gum (*E. maculata*); "White" gum (*E. haemastoma*); "White" box (*E. hemiphloia*); "Black-butt" (*E. pilularis*); Sydney "Blue" gum (*E. saligna*). In the irrigated districts good crops of Lucerne (*Medicago sativa*) honey are harvested. Some of this honey is now exported to London. In the Monaro district there is also a honey-tree called "Sallee" or "Muzzlewood" (*E. stellulata*).

Here is a report by a bee-keeper in the Inverell district:—"In this district (Inverell) we have no surplus from 'Yellow' box or 'Red' gum, usually our best sources. In January and February a fair amount came from the 'Apple' tree. Stringybark's contribution in February and March was good. April gave us practically nothing, but 'Red' box is now yielding well."

QUEENSLAND.

The north eastern State has "Yellow" box (*E. melliodora*); "Grey" gum (*E. saligna*); "Coolibah" (*E. microtheca*); "Narrow-leaved" Ironbark (*E. crebra*); "White" gum (*E. haemastoma*); "White" Stringybark (*E. acmenioides*); "Grey leaved" Ironbark (*E. melanophloia*); "Broad-leaved" Ironbark (*E. siderophloia*); "Blue" or "Flooded" gum (*E. tereticornis*); "Spotted" gum (*E. maculata*); "Bloodwood" (*E. corymbosa*); "Blackbutt" (*E. pilularis*); "Swamp Mahogany" gum (*E. robusta*); and last but not least "Prickly Pear" (*Opuntia monacantha*).

TASMANIA.

The eucalypts of Tasmania are not remarkable for producing large crops of honey. The trees of the Island State make fine mill logs, but from the remarks made elsewhere it will be seen that when the energies of a tree are going into wood the honey-crop suffers. "Blue" gum (*E. globulus*); "White" gum (*E. viminalis*); "Stringybark (*E. obliqua*); "Swamp" gum (*E. regnans*); and the "Yellow" gum (*E. Gunnii*); are the chief representatives of the order in Tasmania. The honey crop is from Clover (*Trifolium*) and in this respect is comparable with New Zealand and England. In fact the Tasmanian climate is not unlike that of South England.

NORTHERN TERRITORY.

The trees of the great arid expanses inland yield nectar in abundance. Ex Mounted-Constable Wiltshire—who has, to use his own expression "cobwebbed" the vast interior—states that the Eucalypts contain numerous wild bees' nests three and four in one tree; in fact he believes money could be made by a party fitted out specially to gather the prolific harvests of honey and wax. The native tribes' name for a wild hive is "white pfellas sugar bag." The most common Eucalypt is the "Illumbra" of the blacks, botanically termed *Eucalyptus* *tessellaris.* According to Messrs. Smith and Baker, of Sydney, in their genealogical chart depicting the evolution of the species, this type is probably the original one. The "Blue" gum (*E. globulus*) is regarded as the most recently developed, while the "Forest Red" gum (*E. tereticornis*) occupies a position halfway between the two.

NEW ZEALAND.

The conditions that promote honey secretion in the Volcanic Islands closely approximate those existing in Tasmania, England, and America. The countries mentioned are typical clover honey-producing lands and this accounts for the popularity of the New Zealand sweet on the London market. The clover honey of the Islands is identical with that of Europe. Of course there are a great many native plants that yield nectar abundantly such as the Hakea and "Rewa Rewa," to which the reader is referred. The articles on clover are specially applicable to New Zealand as are also those on Gorse, Cape Weed, Dandelions, Thistles and other ground flora. "Flax," native to New Zealand yields pollen and honey in profusion. A drink of nectar may be obtained by humans from the flowers.

HONEY FROM EUCALYPTS.

While all the Australian States are favoured by the Eucalypts, the honey from each species is quite distinctive in colour, and flavour. The colour ranges from the dark vandyke brown of the common "Stringybark" to the pale tints (almost water white) of the honey from "Yellow" box and "Red" gum. Even the same species under differing climatic conditions vary so much from the typical form as to justify the creation of a separately named variety.

The "Red" gum of North Gippsland (*E. tereticornis*) probably came from the other side of the range where the common "Red" gum (*E. rostrata*) abounds along the river flats and creek banks. "Gippsland Red" gum is extremely hard timber with the grain often "in locked." The buds are covered with an operculum or cap, the peak of which is less pronounced than that of its Murray River prototype. The honey is much darker yellow in colour and when heated a white scum rises to the top. This latter feature is quite unlike that of the "River Red" gum.

Under chemical analysis the honey from the various species shows wide divergence. This is also true of the flavour. It is remarkable that no two species yield honey of exactly the same flavour. Apiaries separated from each other only 5 or 6 miles show very different results. On the next page will be found a table of analysis of various honeys.

As pointed out in another place, some of the honey gathered from the different species has earned rather a bad reputation. This is due—in some cases at least—to the dwindling of the bees whilst working on the honey-flow; but stranger still, a Victorian apiarist has noticed that on various occasions the honey in blossoms of the Ironbark is quite visible, and when a branch is shaken nectar is distributed in quite a shower. Yet the blossoms were not visited by the bees. Whether this is due to some peculiarity of the honey or to some abnormality of the bees is not known. There is here a splendid field for scientific investigation.

Eucalypts, when "rung" by the grazier, produce much unseasonable bloom and bees work eagerly on the nectar. Possibly honey secreted under such circumstances is deficient in some of the elements necessary for the maintenance of bee life. That the honey from any plant during normal life should be detrimental to insects it is hard to believe. Nevertheless the tannic acid content is sufficiently high in some honeys to affect honey-bees adversely. There is also another factor to consider: some of the Eucalypts—Yellow box for instance—yield splendid crops of honey, but stocks of bees working on it dwindle down to mere handfuls. This is no fault of the honey; it is due to the small quantity of pollen produced.

ANALYSIS OF VICTORIAN HONEY BY THE VICTORIAN DEPARTMENT OF AGRICULTURE

Those marked * are not, of course, Eucalypts.

Produced at	Species	Before Inversion	After Inversion	Moisture	Ash.	Acidity as Formic acid	Condition
Tooborac	Bastard Box	21·30	22·80	23·50	·30	·092	Clear, brown, very liquid
,,	Yellow Box	24·30	27·00	17·45	·17	·037	Comb
,,	,, ,,	24·20	28·50	17·00	·15	·037	,,
,,	Red & Grey Box	24·70	28·40	17·51	·15	·037	,,
,,	Grey Box	31·80	34·00	20·50	·20	·023	Semi solid
,,	,, ,,	24·75	27·50	23·15	·25	·032	Solid
,,	*Flatweed	18·80	23·50	19·05	·32	·046	Brown, solid
Hamilton	Red Gum	12·80	22·00	14·85	·22	·032	Dull, partially crystallised
Glenorchy	*Heath	22·50	26·50	18 00	·25	·055	Clear, liquid
,,	Red Gum	19·70	24·80	15·60	·15	·027	,, ,,
Grampians	*Mountain Scrub	24·00	27·40	21·97	·25	·046	Semi solid
,,	Yellow Box	22·00	26·00	16·35	·17	·023	Clear, pale liquid
Sandon	*Spotted Thistle	19·50	24·00	16·41	·17	·092	White, solid
,,	Red Box	28·00	29·00	16·00	·08	·055	,, ,,
Eltham	Red Gum	13·30	17·70	15·45	·23	.023	Clear, semi solid
Briagalong	Red Box	24·70	26·40	17·07	·25	.037	Clear, solid
,,	*Wild Hop	22·75	25·60	16·87	·12	·032	White, solid
Fernbank	Stringy Bark	26·00	27·50	18·70	·22	·027	Crystal
Taradale	Red Box	26·00	28·00	17·45	·10	·035	Dark, liquid
,,	Iron Bark	23·20	24·40	20·21	·20	·055	Semi solid

Again, bees will winter better, and in spring build up stronger, where the stores of the colony are well ripened —not necessarily sealed—so that the moisture content is not too high. Consequently, when some of the late-blooming varieties like Ironbark (*E. sideroxylon*) yield a flow of honey during wet, cold months, the mortality rate per hive is unduly inflated. Why? Is it because the late-gathered honey is not sufficiently ripened and the excess moisture causes bowel distension and its attendant dysentry? During bad spells of weather the bees are unable to fly and so clear the bowels of the accumulated residue. The cold, inclement weather may chill the tiny foragers so that they are unable to return home. Perhaps the honey has some obnoxious properties.

However, when the Gippsland Stringybark (*E. eugenioides*) blooms in the winter months the trees build up and have almost as much brood as at any time during the summer. The author is unable to decide which is the correct reason. For a real good bumper crop of honey from the Eucalypts a showery "muggy" season is the best. It is particularly noticeable just before a thunder storm, the trees fairly drip nectar, but when once the wind veers to a cold quarter the honey-flow comes to an end.

Some years ago the author harvested a large honey-crop from "Stringybark." Each morning the sun rose in a clouded sky and in consequence of numerous showers the atmosphere was very humid. The honey odour could be detected 500 yards from the apiary. About 2 o'clock a slight thunder shower and a change of wind—which was always accompanied by a cessation of the honey-flow —would come along, and thereafter until night, hardly a bee would be visible. Yet this showery thundery season yielded one of the largest crops the author ever harvested.

Other apiarists have experienced good seasons even when the rainfall was only half the average. In this case the subsoil previously had a good soaking, which stood the trees in good stead during a prolonged dry spell. Generally all Eucalyptus blossom takes on a rusty colour and looks "pinched" during a drought, and though the bush be "white with bloom" little or no honey is gathered. At other times, when the season is favourable, the trees may have very little blossom, yet the yield of honey is something to be remembered. The author's experience is that wind from any quarter will check the yield of honey.

An abnormal growth of wood, *i.e.*, the tall trunk of the Mountain gum (*Eucalyptus regnans*) with very little foliage, absorbs the surplus starch that would otherwise be converted into nectar. It is generally true that the "poor" land, *e.g.*, rocky mountainous country, gravelly foot hills, and "thin" sandy soils, all carry stunted, dwarfed, timber with the large spreading "tops" so eagerly sought after by bee-men. This class of land rarely produces good mill logs. On the other hand the deep rich volcanic soils of the wet districts carry some of the tallest timber in the world—not excepting the giant Pines of California. These trees have trunks perhaps 150 feet high without a single branch, and the scattered tufts of foliage that crown the lofty columns afford little or no nectar for bees.

The flow of honey from the Eucalypts is astonishing when the conditions are just right; it does not always cease at night. Mr. Pender, Editor of the *Australasian Beekeeper,* New South Wales, reported his bees working on a flow during bright moonlight nights. Yields of 400 lbs. of honey per hive during the working season are not unknown, and the author is personally in touch with an apiarist who harvested 20 tons of honey from 153 colonies, all gathered within a space of 3 to 4 months.

At odd times a flow of honey has been reported but where the supply came from was quite unknown. Here is a sample from Mr. McIlveen, of Elsmore, New South Wales. "In 1908 I obtained about 3 tons of honey from some source quite unknown to me. It was delicious honey and I have had none of it since." This gentleman is a keen observer and the author can bear him company in his statement.

With this general outline of the conditions favourable for a flow from the Eucalypts the author here presents a list of the most prominent species. The flowering periods vary with the season and situation, so the time of blooming is based on what generally happens to the average bee-farmer in the Australian bush.

Apple Box (*E. Stuartiana*). This gum tree varies greatly as a producer of honey. In New South Wales the honey is gathered during January and is described as dark and inferior in many places. Near the northern rivers the yield is sometimes heavy and the colour pale. In Western Victoria the blooms last from February to April. Honey dark, of sharp flavour, and when candied has a close, fine grain rather murky in colour. The "Apple" box in Eastern Gippsland yields pale honey and the flavour is distinctly "box." The average yield is about 60 lbs. per hive; pollen fairly abundant and like that of all other Eucalypts, pale yellow or creamy in colour; buds usually in clusters of 5 to 8, and blooms every second year. Not unlike Manna gum in some localities, and sometimes flowers three consecutive years.

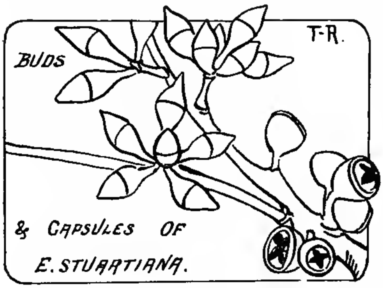


Fig. 83. Apple Box.

Black or Bastard Box, (*E. largiflorens*). This is a good tree for apiarists on account of its wide distribution. It ranges from South Australia, East to the Gulf of Carpentaria. The honey is fairly pale in colour and of good body.

Blue Gum, (*E. globulus*). This Eucalypt received its name from the shape of the large fruits. Some measure an inch in diameter. This species is found principally in Tasmania and along the Southern Coast of Victoria. There is also a small fruited variety found in North Gippsland. A good tree for pollen and also for medium amber honey of rather thin consistency. Blooms in early spring every year. The sickle-shaped foliage is quite distinctive. About 30 lbs. of honey per hive is the record up to date. It would be rather difficult to state exactly the number of Blue gum seeds to an ounce. About 10,000 approximately.

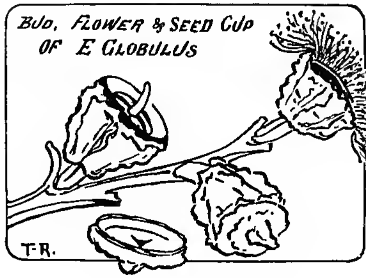


Fig. 84. Blue Gum.

Bloodwood, (*E. corymbosa*), found in New South Wales, Victoria and Queensland. At times a good yielder of pollen and light amber-coloured honey. This latter is rather sharp in flavour and not equal to honey gathered from Red gum.

Blackbutt, (*E. pilularis*). Yields a little dark amber honey and a fair quantity of pollen in New South Wales, Victoria and Queensland. Not remarkable for a large show of flowers in early summer.

Cabbage Gum, (*E. coriacea*). Blooms in December, and yields rather dark honey. Abundant near the source of the Snowy River. Pollen fairly plentiful, and is a useful tree about Monaro, New South Wales.

Cider Gum, (*E. Gunnii*). Commonly known as Swamp gum and sometimes as "White." It frequents the low-lying damp soils and blooms late in autumn. The honey and pollen are about the same in colour as those gathered from Spotted gum.

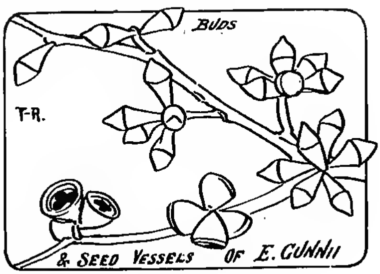


Fig. 85. Cider Gum.

"Coolibah," (*E. microtheca*). A native of Queensland and the Northern Territory, sometimes called Gum-topped box, and comes into bloom about April or May. Yields considerable amber-coloured honey, fairly dense.

Flooded Gums of Western Australia, (*E. rudis* and *E. decipiens*). At Mount Barker in Western Australia these Eucalypts bloom every second year from beginning of August to middle of November. The amber-coloured honey and creamy pollen is greatly valued for brood-rearing, coming as it does so early in spring.

Grey Box, (*E. hemiphloia*). The name really means "half-barked" but the tree is not generally so. A better name should surely be found. A good yielder, but the honey has a distinctive flavour that is not quite popular. However, where blending is resorted to the flavour is indistinguishable. This honey has a flavour sometimes described as "tallowy" and is responsible for a certain person's advice to Australasian apiarists "not to keep bees where they could gain access to sheep skins hung out to dry." One would imagine the bee to be a carnivorous animal after reading such nonsense. The honey from Grey box is fairly light and of very thick body. Up to 100 lbs. per hive has been recorded from this source. Guilfoyle calls this species "Forest" Box and names its habitat as Victoria, New South Wales, Queensland and South Australia.

Grey Gum, (*E. saligna*), Grey Gum of South Queensland (*E. punctata*) Grey Gum of New South Wales. Both these Eucalypts are splendid honey-yielders. Pollen fairly abundant and cream in colour.

Ironbark (Red) (*E. sideroxylon*). This is a very conspicuous tree with dark deep-fissured bark extremely hard and rough. The flowers vary in colour from cream to pink. The wood is red-coloured, hard and dense. It is a late-blooming variety and some years, though honey is abundant in the nectaries, the bees make no attempt to gather it. The reason for this neglect is rather obscure. Some apiarists associate bad wintering of bees with the advent of Ironbark bloom. The honey is pale in colour but not so dense as that from Red gum, probably owing to the time of flowering, late autumn to early winter. Wintering bees on honey containing an excess of moisture would be responsible for considerable trouble with dysentery. Whatever the cause, Ironbark honey is not popular for winter stores.

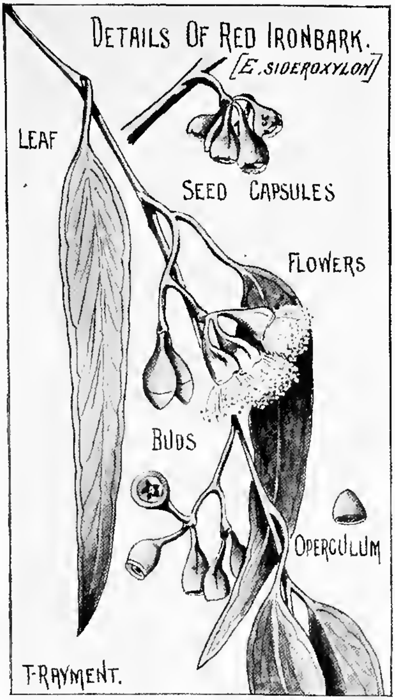


Fig. 86.

Ironbark (White), (*E. leucoxylon*, from *leukos*—white, and *xylon*—wood)—sometimes referred to as Smooth Ironbark. In South Australia it is called White gum. A splendid yielder during October, November and December. In the Southern States they bloom much earlier in the year. In New South Wales Ironbarks flower in August and yield pollen and nice pale-coloured honey. Yields of 150 lbs. per colony from Ironbark are not uncommon.

Illumbra, (*E. tessellaris*). This tree is confined to the north and centre of Australia, but travellers in those arid portions give definite accounts of its value as a honey-tree. Bee-keepers may yet pioneer the land of "The Never Never." (See under head of Northern Territory).

Jarrah, (*E. marginata*). Begins to bloom as early as October. From the middle of November until Christmas the "Jarrah" blooms well, and bees breed strongly on the flow. The honey however, is very dark and strong, quite unfit for table use. It is mostly left on the hives for the bees. Usually they are just about able to fill the super-combs from this source. The aroma is also rather objectionable. The tree is confined to Western Australia.

Karri, (*E. diversicolor*). Like the Jarrah this species is limited to Western Australia. It blooms in August and yields a fair amount of pollen and honey. The honey is of rather thin consistency but the colour is pale yellow, classed as a fair honey.

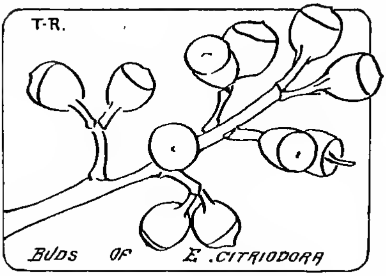


Fig. 87. Lemon Gum.

Lemon-scented Gum, (*E. citriodora*). This handsome tree blooms about March and the bees work on it for pollen and honey, but unfortunately it is never plentiful enough to make a show in the supers.

Manna Gum, (*E. viminalis*). This Eucalypt varies considerably. In dry districts the trunk is covered with hard dark fibrous bark. When found on the richer land of river banks, it has a clear white stem and is often called White gum, River gum, etc. The tree is easily identified by the peculiar and characteristic arrangement of the buds. They are mostly in threes and disposed after the pattern of the broad arrow \|/. This tree blooms irregularly, but mostly in early autumn. Yields of 60 lbs. per hive are recorded. The honey is amber-coloured, and when heated will produce more scum than any other honey in Australasia. The flavour is not unlike White gum honey. Bees winter well on it, and as it blooms every year it is especially valuable. Flowers, buds for the present year, and the tiny specks of next year's buds, and also the last season's fruit are often to be found on the trees at one time. Certain aphides puncture the leaves of this tree and suck out the saccharine juices. A

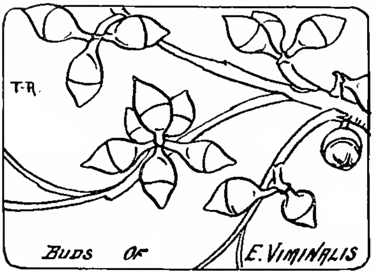


Fig. 88. Manna Gum.

clear translucent liquid is ejected from two tubes on the back of the aphides. This liquid hardens to a white candy-like substance called manna, hence the name. This is also true of other Eucalypts. The author has stood, with the sun behind an Apple box tree and watched the clear liquid ejected by the aphides falling like rain, until the twigs on the ground were covered with a "crust" a ¼ of an inch in thickness and snow white.

Muzzlewood, (*E. stellulata*). A limited quantity of amber-coloured honey during March, April and May in New South Wales, also known as "Sallee."

Messmate, (*E. obliqua*). At first glance this is not unlike a Stringybark tree. The foliage is rarely dense and the buds are quite unlike those of the Stringybark. The trunk and limbs are covered with fibrous but smooth bark, which has no deep fissures like the Common Stringybark. It blooms every second year, but yields a crop only every four or five years. The flowers show about November, and yield pollen, also a mild-flavoured honey golden-amber in colour. Heated to 150° F., very little scum rises to the surface. This is the "Stringybark" of Tasmania. An average of 60 lbs. per colony has been gathered from Messmate. Messmate is easily the first Eucalypt to bear a crop of blossom after burning by bush fire. The stool shoots 2 years old frequently carry a full crop of buds.

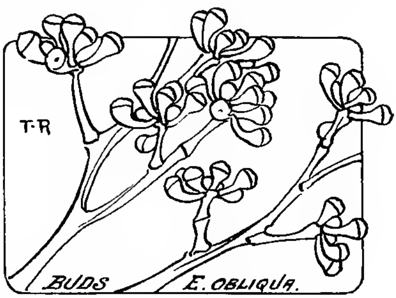


Fig. 89. Messmate.

Mahogany, (*E. botryoides*), is distributed right along the east coast of Australia from Victoria to Queensland. Its flowering period is rather uncertain, ranging from November to March. Good for pollen, and also yields a pale-coloured honey. The flavour is inclined to be acid and is rather peculiar. Still some very large crops have been harvested from this tree.

Mallee scrub. Huge areas of Australia are covered with varieties of Eucalypts called Mallee scrub. Flowers may be seen on one or more species at any time of the year. Some of the Mallees are rather handsome and valuable for bees. Here are a few of them.

Red flowering Mallee	*E. pyriformis*	W.A.
Scrub Mallee ..	*E. incrassata* var. *dumosa*	S.A., Vic., N.S.W.
Slender Mallee ..	*E. gracilis*	N.S.W., Vic., S.A., W.A., and Q.
Hooked Mallee ..	*E. uncinata*	Vic., W.A., N.S.W., S.A.
Oil Mallee ..	*E. oleosa*	Vic., S.A., W.A., N.S.W.
Giant or thick-leaved Mallee	*E. incrussata*	Vic., S.A., W.A., N.S.W.

Peppermint, (*E. amygdalina*). A very irregular-blooming Eucalypt widely spread over the eastern States. The honey is not dark-coloured in New South Wales, where it blooms in October. It blooms in some places in summer, at others in autumn and the honey is then very dark.

Pink gum, (*E. paniculata* var. *fasciculosa*). One of the South Australian Eucalypts. It yields a considerable quantity of honey of very dense body, which does not readily candy. It is a very handsome tree and is of great value to the apiarist for pollen.

Peppermint (Blue), (*E. dives*), flowers in Victoria during the spring, summer and autumn. The honey is dark, but bees winter well on it. Peppermint is also "handy," in autumn for pollen.

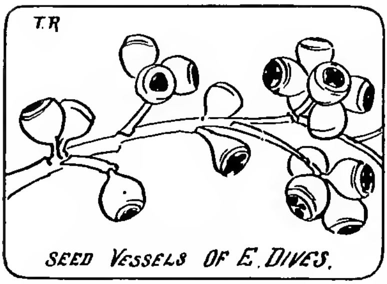


Fig. 90. Peppermint.

Red Box, (*E. polyanthemos*). This tree is truly named "many-flowered." It is a remarkable producer of honey when everything is just right. It blooms early in spring—sometimes in June, and the flowering period lasts until November—and has some flowers every season.

Every second year the trees are quite white with bloom. It certainly yields a quantity of cream-coloured pollen some seasons. Mostly the weather is boisterous during the blossoming period, and this militates against the production of a large crop. Nevertheless good yields of honey up to 100 lbs. per hive places "Red" box on a high plane as a honey-tree. It certainly keeps up its reputation for many flowers. In some districts the honey is almost water-white; in other locations the honey is rather dark-coloured.

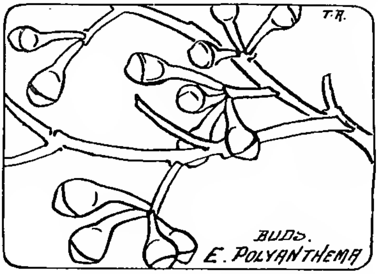


Fig. 91. Red Box.

"**Red Gum**" (River), (*E. rostrata*). Sometimes referred to as River Red gum. Where the rising land carries "Yellow" box it is fairly safe to say that the damp flats will have some red gum on them. This is so generally true that the two honeys are usually associated with each other. Many apiarists regard it as the finest honey-producing tree in Australasia, and for some districts this is undoubtedly true, but it will be apparent to the reader as he scans the list of Eucalypts, that each district has its own particular favourite for quality and quantity. It receives its name from the unique peaked caps of the buds, *e.g.*, *rostrum*—a beak. It yields large quantities of beautiful pale thick honey, also some creamy-coloured pollen. Yields of 150 lbs. per colony are not rare. The honey candies fairly quickly and with fine grain. The candied article is whiter than that of most Eucalyptus samples.

The trees have an "on" and an "off" year. This is quite distinct from the South Australian Red Gum, (which see) but is often confounded with it. See also the remarks of a Victorian Editor on Mr. Pope's honey from South Australia. "Mr. Pope's sample of South Australian Red gum has quite a different flavour to the honey we get from the same kind of tree here. Ours candies in less than a week after extracting. It is the only honey we have any trouble with. We sometimes put it aside until we get time to liquefy it. The Red gum blossoms every third year here and yields a great quantity of honey for about three weeks." Like all other Eucalypts this species sometimes fails to live up to its reputation. Here is an extract from a letter received while corresponding with a Northern Victorian apiarist. "Although Red gum failed, Yellow box has again proved itself the bee-keeper's stay, and up to the present is still in bloom. In this district Grey box has proved the most reliable of any this season. It began to bloom early in February, and at the date of writing is yielding nectar freely, also pollen. This makes six successive flows, some light, but most were good to fair. Of course, only one-half bloom alternately. I would like to know if this is usual, in other districts. Taking the last six years Red gum has yielded once, consequently only one-sixth quantity of honey was harvested. We find ourselves wondering why bee-keepers set their hearts and hopes on the so-called King of the Forest—Red gum." A yield of 400 lbs. per colony was once harvested from this Red gum in Western Victoria.

Red Gum (Forest), (*E. tereticornis*). This is the Blue gum of Queensland. From the Latin, *teres*, rounded, and *cornu*, horn. This Red gum is usually found as a forest tree on drier formation than the River Red gum. It is very similar in appearance to the above-named tree, except that the peak of the flower buds is less pronounced. Ten tons of honey have been harvested from 160 colonies working on an open forest of this variety. The honey is amber-coloured and (unlike that of River Red gum) when heated to 150° a fair amount of scum will rise. It blooms more or less every year, but yields a crop only every three years. This is the Red gum mentioned in the above remarks on Mr. Pope's sample of South Australian honey. As there remarked, this honey candies quickly.

Red Gum of Western Australia, (*E. calophylla*). This is unknown to the Eastern States, but it is a splendid honey-tree. Blooms from beginning of February until end of March every second year. The average yield per hive during a good season is about 150 lbs. In Western Australia it alternates with the Yate tree. In South Australia large crops are gathered from this source. The colour is amber-orange. Also useful for pollen. This is classed as the best honey gathered in Western Australia, though rather on the thin side. A variety of the former is also a splendid honey tree. It is a pink-flowering beautiful tree worthy of a place in any garden. Known botanically as *E. calophylla* var. *rosea*. During May, 1914, in Victoria, the author gathered a teaspoonful of nectar from three blooms growing on a young tree at North Gippsland. The amount secreted was certainly most remarkable.

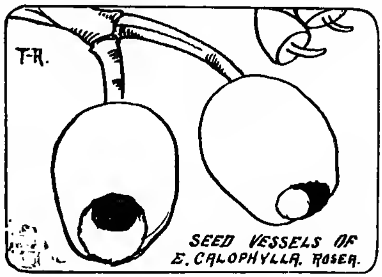


Fig. 92. Red Gum of Western Australia.

Ribbon Gum, (var. of *E. viminalis*), blooms about March in the Ranges and yields nice amber-coloured honey.

Stringybark, (Red), (*E. macrorrhyncha*). Widely spread over Victoria. It has "on" and "off" seasons, but yields a bumper crop every three years. The buds have a sharp peak on top, not unlike the buds of the Red gum. This variety receives its name from the protruding valves of the seed vessels: *makros*—large, *rhynchos*—beak. This Stringybark is a valuable tree for pollen. Bees breed up very strong and winter finely on the honey, which is at times dense enough to prevent the extractor-reel revolving. It blooms in profusion in the autumn, beginning about first of February. The pollen is abundant and creamy in colour. The honey-flow lasts up to six weeks and is very heavy. The unripe honey is very strong and "catches the throat" when tasted. The flavour of *ripe* Stringybark honey is quite distinctive, and people accustomed to it prefer this rich-flavoured dark honey to any other. "Stringybark" honey is of crystal clearness and may be kept for years without candying. Apiarists have reported yields up to 160 lbs. per hive.

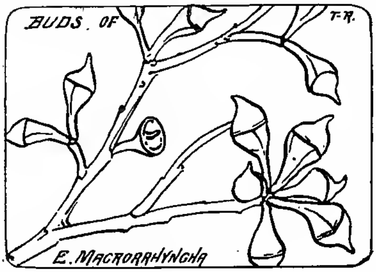


Fig. 93. Stringybark (Common).

Stringybark, (Yellow), (*E. Mulleriana*). A poor-blooming species of little use to the apiarist for honey, but gives a little pollen. One of the hardest timbers in Australia.

Stringybark (Brown), (*E. capitellata*). The Stringybark tree of the Stawell district. The honey from this tree is about the darkest produced in Victoria and the flavour is anything but pleasant, in fact, the aroma of a newly-opened tin is decidedly disagreeable. It is not to be compared with the beautiful honey gathered from the Gippsland Stringybark. This great diversity in Stringybark honey has led to much controversy between Eastern and Western Victorian bee-keepers. The Western apiarist is quite unable to understand the Gippslanders' love of the Stringybark product. This is the Stringybark tree of New South Wales.

Stringybark, (Gippsland), (*E. eugenioides*). Variously known as Red and White Stringybark. Gippsland Stringybark would be more appropriate, for large crops up to 14 tons have been harvested from this "Gippslander." The buds—very tiny—are borne in numerous clusters and are quite unlike those of the Common "Stringy," being only one-third the size. A fine honey-tree from which a plentiful supply of pollen is assured. Bees winter splendidly on it, and sometimes brood-combs are clogged with its creamy-coloured pollen in autumn.

Needless to say this is very easy to put up with as it guarantees a supply for brood-rearing in early spring.

The honey is of crystal amber colour, and fine flavour, so that it sells well even against lighter-coloured honey. This is the main source of supply at Fernbank, Victoria, where E. Penglase has harvested some huge crops. At times the bloom straggles throughout the year, then it varies the procedure by a burst of blossom in the autumn.

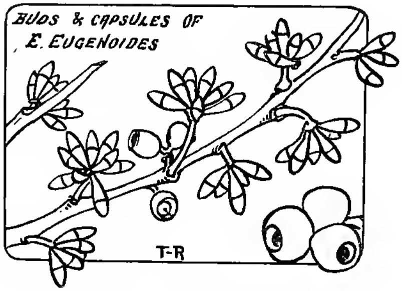


Fig. 94. Stringybark (Gippsland).

Stringybark, (Tasmanian), (*E. obliqua*). This is the "Messmate" of the Victorian forest. For full description see Messmate.

Swamp Gum, (*E. paludosa*). This is the true Swamp gum sometimes referred to as White gum. It is not unlike the Cider gum in general appearance and it may not be altogether incorrect to say that this is a form developed from varying geological formation. The flowers bear a fair quantity of creamy pollen and amber-coloured honey. The density is not so great probably owing to the dampness of the months during bloom—April to November. The flavour of the honey is not unlike that of our Spotted gum.

Spotted Gum of New South Wales and Queensland, (*E. haemastoma*). Along the coastal districts of the Mother State a winter flow is sometimes obtained from this eucalypt. The N.S.W. Spotted gum blooms once in three years, and the buds often hang on the trees for fifteen months before bursting. Nevertheless it is of considerable value to the apiarist. The density of the honey is hardly equal to that of Yellow box.

Spotted Gum, (Victorian), (*E. goniocalyx*). From the angular (*gonia*) ridges on the buds. (The impression of these ridges is best conveyed by likening them to cigars that have been tightly pressed in the box). This species is also known as White gum, Bastard box, etc.; like other Eucalypts it varies according to habitat. Yields pollen in abundance and also amber-coloured honey during the late autumn. In some districts it blooms every year. In other places it blooms every second year.

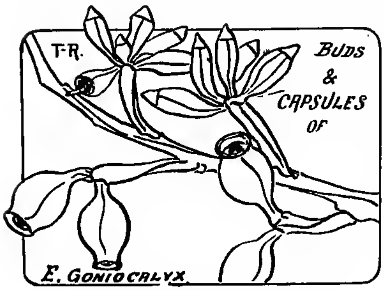


Fig. 95. Spotted Gum (Victoria).

"**Scarlet Gum,**" (*E. ficifolia*). A native of Western Australia, and now grown in house gardens throughout the Commonwealth. Blooms about end of January and yields creamy-coloured pollen. The bees work eagerly on the scarlet flowers for honey, but there are never enough trees to enable one to determine the quality or colour of the honey.

Silver Top or Gum Top, (*E. Sieberiana*). A valuable Eucalypt on the heavily-wooded southern slopes of the Australian Alps, where this variety flourishes and yields sustenance to innumerable colonies of wild bees. It is not uncommon for bushmen to fall a tree and take home 300 lbs. of beautiful white comb-honey. The author has known of combs up to eight feet in length. The honey is light amber in colour, and the pollen a dirty white. Blooms about Christmas time.

Sugar Gum, (*E. corynocalyx*). A very handsome shade tree with distinctive clusters of pale yellow blossom. It yields abundance of pollen and light amber-coloured honey of mild flavour. This variety is becoming increasingly popular with municipal authorities and settlers planting for shade or shelter. Blooms during Summer, and is very floriferous. Beemen can wholeheartedly recommend this tree, which is a rapid grower. Here is a note by a prominent Victorian apiarist:—"Sugar gums will grow on poor land, and grow quickly. They should bloom in the fourth year. The timber is considered one of the best hardwood timbers in Australia for all railway purposes, sleepers, etc., and as for bees they are on the bloom from when it is first light until dark at night; I believe it to be a fair pollen-tree, but I am sure of it as a good honey-tree. I have heard of a bee-keeper up North in a Wimmera township securing three tins of honey per colony from the plantations in the streets in an apiary of twenty-five colonies. The tree is very hardy and adapted to warm climates; a good shelter tree if topped before getting too high, as it naturally grows tall. I think it will grow on any soil, and bloom every year without failing. Five hundred trees should be a good investment for any established bee-keeper to plant."

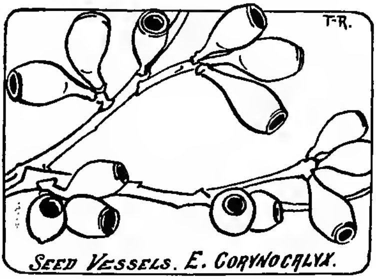


Fig. 96. Sugar Gum.

Snap Gum or Silver Gum, (*E. vitrea*). This tree is sometimes known as White topped gum. In portions of New South Wales the flowering stage is spread over a number of months, viz., November, December, January, February. About the Snowy River and Paupong, New South Wales, this is the prime favourite as a producer of good honey, dark amber in colour. It is also splendid for pollen. Known also as "White gum."

Tallow-wood, (*E. microcorys*). One of the late-blooming Eucalypts. It is useful for a limited supply of pollen and golden-coloured honey. Habitat, New South Wales.

Woollybutt, (*E. longifolia*). Blooms from January to March and valuable for pollen and light amber-coloured honey.

"**White Gum**," (*E. pauciflora*). How this tree came by its name is a mystery. It has a good crop of bloom some years, so that "paucity of bloom" is not true. It yields good crops of honey, amber in colour and considerable pollen of a dirty-white colour. Blooms every second

Fig. 97. Young Sugar Gums.

year and fairly regularly in each district, though each situation has its own particular month of blooming.

Blooms in November in some places with only a small quantity of honey; March in others with a flow of honey averaging 100 lbs. per hive.

White Gum of Western Australia, (*E. redunca*). This tree begins to bloom in April and lasts until June. It yields a surplus of 80 lbs. per hive in an average year and leaves the colonies in good order for winter.

White Box, (*E. Bosistoana*). A good honey-tree in New South Wales but blooms very irregularly. The flowering period is during November about the ranges of Monaro. At Elsmore the White box gives a flow of honey during May, June, July, and August some seasons. Pollen of a "whitish" tint is plentiful and also a pale nice honey during the "on" years. An apiarist at Inverell, New South Wales, sends the following note:—"White box: Those who should know say that there are two varieties in this district, one which should be called Red Box. The smaller branches are inclined to be red, and the honey is decidedly so. It blooms in the autumn, whereas the real White box blooms in winter and spring, and produces a very white honey of delightful flavour."

Yellow Box, (*E. melliodora*). This is perhaps the only Eucalypt known throughout the Commonwealth by one vernacular name. It is widely distributed and is the most popular honey-tree in Australia. Its beautiful honey-scented bloom is easily recognised; indeed the odour is discernible a considerable distance away. It is a prolific bloomer, yielding much honey but little or no pollen. The Australians of the cities prefer this honey to all others, but the Englishman objects to the characteristic flavour so much sought after by Australasians. This honey is usually associated with that of Red gum, and when heated very little "scum" rises to the top.

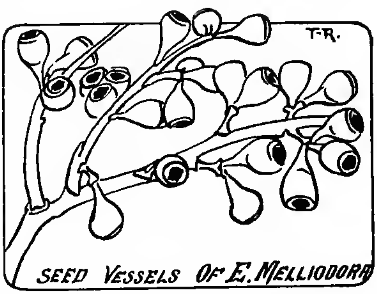


Fig. 98. Yellow Box.

The Yellow box forests certainly yield enormous crops of fine honey, but as they are nearly always accompanied by a dearth of pollen the bees die out unless moved to other flora bearing the essential nitrogenous food. This absence of pollen is characteristic of pure Yellow box forests. It blooms irregularly in Victoria from October to March and spreads over the months of September, October, November, and December in New South Wales. From all districts the honey is classed excellent. It has an "on" and an "off" year in all localities.

York Gum of Western Australia, (*E. loxophleba*). A valuable native of Western Australia. Blooms from the beginning of May to end of December and affords a good supply of pollen. An average of 60 lbs. surplus per colony is not uncommon. It varies the blooming period. sometimes coming in August. The honey is medium amber in colour and the York gum blooms every year.

Yate tree of Western Australia, (*E. cornuta*). So called from the long horn-like lid that covers the bud. This Westralian native blooms every second season. The clusters of flowers are very large and the stamens are often 1¼ inches long. When the flowers open, the bees—two or three on each blossom—have a great time loading up the abundant creamy-coloured pollen. It is a good honey-tree and strong colonies will store from 150 to 200 lbs. of honey. This is gathered from middle of January to end of February.

Mr. Lloyd, of Beeton Apiary, Western Australia, says the Yate trees bloom during the "off" Red gum year. The author has seen bees working on Yate bloom from sunrise without intermission until darkness sent the little labourers home. Contrary to general belief *wet* weather is the chief drawback to apiculture in the south-west of the great western State. The Eucalypts produce the honey crops of Australia, so the reader will pardon this lengthy list of indigenous trees.

Exotics. Some of the exotics are very fine producers of honey, but owing to the limited number of plants the amount of honey gathered makes no appreciable showing in the supers. Laburnums, Willows, Oaks, Elms, Planes, Chestnuts, Hazels, Filberts, Basswoods, Maples, Magnolias, Locust (see False Acacia), Palmetto, Pepper trees (see under that head), Laurels, and many others are excellent for pollen or honey, sometimes both.

Fireweed, (*Stypandra*). A small native shrub with linear leaves and bright blue starlike flowers. Valuable for vivid yellow pollen in early Spring. Generally found growing on the confines of the vast Eucalyptus forests.

Furze or Gorse, (*Ulex Europæus*). A native of Africa and Europe introduced to Australia. It is a "proclaimed weed," but has spread over a large area, presenting a golden landscape in early Spring. Yields considerable pollen, pale yellow in colour, and a clear bright honey.

Flatweed, (*Hypochœris radicata*). This is a plant much resembling the Dandelion. Originally from North America, it has now covered a vast portion of Australasia. The pollen, which is fairly abundant, is somewhat like that of the "Cape Weed" in colour, viz., bright orange. It is valuable in midsummer when the supply of protein is at a low ebb. As a matter of fact, Flatweed sends up flowers at all times of the year after a shower of rain breaks up a dry spell. Under these circumstances Flatweed pollen appears to be deficient in certain elements (albuminous nitrogen) as larval bee-food. In some quarters it is considered a contributing cause of a lowered vitality of bees. The honey—sometimes enough to store in the supers—is very yellow-coloured, inclining to red, and has a characteristic taste. Wax built during a flow from Flatweed is bright golden in tint. There is also a smaller variety introduced from Europe.

Flatweed (annual), (*Hypochœris glabra L.*). A small annual variety of the plant already described.

Fruit Trees. The districts devoted to fruit-growing are undoubtedly of some value to the apiarist, for almost all fruit trees yield honey and pollen. The honey is pale in colour and of delicate flavour. The average amount of honey per colony gathered in the fruit-growing districts ranges from 30 to 100 lbs. This latter average would be obtained only by very skilled management.

Here is a note from a practical bee-farmer:—"In America they often have a good yield of nectar from apple bloom; I have never had any noticeable gain here, although my bees got all the fruit trees within a three-quarter mile radius that they can possibly look after; in fact, there is no more gain than from colonies that are solely depending for nectar on virgin country.—C. J. Haese, Mount Barker, W.A."

Bee-farmers adjacent to orchards often lose heavily (see "brood-poisoning") because of ignorant growers who persist in spraying—with poisonous compounds—trees in full bloom. Though it is very necessary to spray for the purpose of keeping fruit pests in check, scientists have demonstrated the danger of damaging the pollen at certain stages. A decreased percentage of pollenization (consequently less fruit set) frequently results from the ill-directed use of poisons. Fortunately all progressive orchardists are well aware that the proper time to spray is just before the blossoms open and again as the petals fall.

Up-to-date men now regard bees as the surest agents to effect perfect fertilisation, and they not only encourage apiarists to locate close handy, but—in some cases—keep a few bees themselves. Thus they assure, as far as possible, the perfect development of each fruit. As most apiarists are aware, nectar is truly a bribe offered by the tree to insects. In search of this the insects act as distributors of pollen from flower to flower, thus performing one of the most valuable services rendered to mankind.

A correspondent who has studied this matter of nectar secretion writes as follows:—"The perfume of flowers is generally derived from their nectar; the blossoms of some plants, however, as ivy and holly, though almost scentless, are highly nectariferous. The exudation of a honey-like or saccharine fluid as has frequently been attested, is not a function exclusively of the flowers of all plants. A sweet material, the "Manna" of pharmacy, is produced by the leaves and stems of a species of Ash, "*Fraxinus ornus*"; and honey-secreting glands are to be met with on the leaves, petioles, phyllodes, stipules or bracteæ of a considerable number of different vegetable forms.

In early spring Almonds are the advance guard. Cherry plums soon follow, then for a few weeks there are the Cherry trees, Gooseberries, Currants and Raspberries; these last are grown in considerable areas in the "cool districts." Apricots, Pears, Apples, Plums. Walnuts, Peaches, Lemons, and Oranges (which see) all help to create a surplus store of delicious pale honey.

Flax Lily, (*Phormium tenax*). A native of New Zealand. During the flowering period—early summer in Victoria—long stems up to six feet in length bearing flowers at regular intervals shoot up above the foliage. The corolla or "tube" of the flower is too confined for bees to enter, but it is an interesting sight to see the insects insert their tongues—into the corolla where the petals overlap each other—and drain the nectar. When the roots of the Flax reach running water the flowers are extremely nectariferous. The author has seen as much as half a teaspoonful in the corolla of a single flower. The Victorian Government once planted a river flat with Flax, but it was a failure. The nectar is beautifully clear and limpid.

Golden Spray, (*Viminaria denudata*). A handsome flowering plant, a native of Australia. Well worthy of cultivation in the garden for its beauty and is also a good bee-plant.

Golden Pennants, (*Loudonia Behrii*). An attractive honey plant of the Victorian Mallee.

Garden Flowers. To the extensive bee-farmer the beautiful flower gardens of the cities are of no use. They probably help the town dweller's one or two hives to gather a little surplus. The "double" flowers, while very pretty, yield no honey since there is no seed to fertilise; for it must be understood that the flowers secrete nectar only as an inducement to insects to visit them, and thus carry the fertile pollen from flower to flower. In this way seeds are made fecund and the species multiplied. For instance, a tree newly "rung" will yield honey very heavily in the endeavour to have as much seed as possible made fertile in order that the species may be perpetuated.

Most garden flowers yield honey and pollen, but as it takes a large area of any plant to make a honey flow, the scattered dispositions of the gardens preclude the possibility of securing a large crop. About the cities 30 or 40 lbs. per colony is considered a fair return. Some of the outlying suburbs do much better. The flowers of outstanding value to bees are Rosemary, Gaillardias, Stocks, Sunflowers, Lupins, and Poppies. A New South Wales apiarist wrote to the Editor of the *Australasian Beekeeper* as follows:—Is it known amongst beemen that the Poppy flower is poisonous to bees? We have always had a few growing in our flower garden till the other day, but one morning, about seven o'clock, my wife drew my attention to a large bloom just opened, for it was crowded with bees, although the honey-flow was well on. So I got a Miller's cage and caged five, and put them in my office; in about one hour one was dead; by eleven o'clock I came in and every bee was dead. The next morning there were more blooms opening, so I took two cages and caged six bees from one hive, put them in the honey house and caged five off the poppy bloom and put them side by side. At eleven o'clock four of the poppy bees were dead, but the bees from the hive were alright. So I decided no more poppies should grow in my garden." Mignonette, Honey Suckle, Freesias, Crocus, Hollyhocks, Salvias, Ericas, Cornflowers, Pæony Roses (particularly for pollen), Wistaria, Primroses, and the highly-scented Lavender must not be forgotten. Some of the "*Prunus*" shrubs are splendid for bees, as is also the Ivy.

Mr. Beuhne writes on plants injurious to bees:—"A writer in *Munchener Bienen Zeitung* gives quite a long list of plants which either injure bees physically through contact with spines, or trap them. The principal offender amongst the latter is the Snap Dragon. Some time after

I commenced bee-keeping I uprooted all these flowers in my garden when I found that bees were being trapped in the blossoms.''

Hibbertias. Native bushes common on the heathy lands. In early spring the bright yellow flowers (somewhat like a Primrose) are useful for bright yellow pollen.

Honey Locust Tree, (*Gleditschia triacanthos*). Somewhat similar to the False Acacia (which see). The colour of the flowers is golden yellow.

Hawthorn, (*Cratægus oxyacantha*). Introduced to Australia as a hedge plant. In early Spring it produces a wealth of snow-white bloom that yields a beautiful delicately-flavoured honey, and bright yellow pollen. Wet weather usually prevails during the flowering period, but bees work on it even during a sharp shower.

Herbs. Many of the herbs are good honey-plants. The principal ones are Horehound, Thyme, Sage, Marjoram, Balm, and Pennyroyal. The Horehound is especially good, and at Warragul, Victoria, considerable Pennyroyal honey is gathered.

W. Reid, Senr., New South Wales, writes as follows:—''Horehound was brought to this country by the early settlers, being one of the few medicines of early days; was carried to the various stations as such, and did not only serve as medicine, but became a pest, and in the sixties, and even before, it was quite common to have honey very strongly flavoured with Horehound, and if Horehound honey held the same virtues as is claimed for the plant, I should have required no other medicine, as I was very fond of it and am still. Some say the honey is bitter, I don't think so, I would very willingly give a 60 lb. tin of Box honey for the same quantity of Horehound honey. The honey is very like Box honey, but has a green shade. I believe it is one of our best honey-plants, is visited all day by bees, and is equal or nearly so to American Mountain Sage or Mignonette. Horehound will grow nearly anywhere and in any season when there is enough wet weather, as well as being one of our best and simplest medicines. Dairymen say, if cows eat Horehound it will taint milk and butter. Sheep farmers complain that the seeds are a pest to their wool."

Honeysuckle (Native). (*Banksia*). In Western Australia these bloom in February and March and are of some small assistance in keeping colonies going until White gum comes at the beginning of April. The Waratah (*Telopea*) and Silky Oak (*Grevillea*) and *Hakeas* belong to the same order as the Banksia, *Proteaceæ*. There are about 600 Australian species and in spite of the name no large crops are ever reported. Some years ago a bee-farmer placed an apiary in a forest of Honeysuckle on the South Coast of Victoria, but the venture was a failure. It is to the indigenous forests of Eucalypts that Australia must look for big honey-crops.

Lucerne, (*Medicago sativa*). The Spaniards and Americans call this plant Alfalfa. It is widely grown throughout the Australian Commonwealth. With the introduction of irrigation huge areas of land that previously were of no use to the apiarist now give large crops of beautiful pale honey. That this plant can always be relied upon to fill the supers is not true. In those localities (*e.g.*, Tamworth, New South Wales), where the cultivation is undertaken for raising seed, bees have the benefit of the entire flowering period, so that a crop of honey is almost assured.

When grown for hay or pasture bees make little surplus. The practice of cutting the Lucerne crop just as the purple bloom opens is almost universal. Bee-keepers reap no benefit from such areas. Mr. Pender, of West Maitland, New South Wales, for years past has had eight miles of lucerne flat on one side of his apiary, and for six years has not had one extracting from this source. This is owing to cutting the crop at the flowering stage. At Tamworth, New South Wales, Messrs. Adamson and Phillips are situated in the midst of a seed-growing district, and their annual crop of Lucerne honey runs into many tons. Latterly these apiarists have succeeded in placing their honey on the London market.

The honey is similar in some respects to the Clover honey of Great Britain, and the British people take to it readily enough. Lucerne honey, like Clover honey, has a very delicate flavour, quite unlike nectar from the Eucalypts. To an Australian, Lucerne honey is almost flavourless. To the Englishman the Eucalyptus honey has a peculiar "twang." It is a matter of taste; Englishmen and Americans accustomed to honey from the Eucalypts raise no objection to its special flavour. Probably as greater areas are developed by irrigation more crops of Lucernes will be grown for seed, and the increased production of Lucerne honey will enable Australians to compete successfully with the Californians for the world's markets.

The honey from Lucerne is very pale in colour, and candies quickly with a fine grain. Of course, Lucerne is a long way behind the Eucalypts as a producer, and the thing to determine is whether the lesser quantity of exportable honey at 9d. per lb. will pay as well as bumper crops from the indigenous flora at 3½d. per lb. The author decides in favour of the Eucalypts and local consumption. At Christmas time about Elsmore and Inverell, New South Wales, considerable Lucerne honey is stored by the bees.

Mangrove (Australian White), (*Avicennia officinalis*). Frequents the coastline of tropical seas, and is found on the Australian coast from Port Darwin in the North to Wilson's Promontory in the far South. This tree is designed by Nature to reclaim land and build up the coast line. Americans regard it as a bonanza honey tree, but the Australian locations do not appear to have been tested.

Maize, (*Zea mays*). This is a crop that yields large quantities of pale yellow pollen in midsummer, which is a critical time for Australian apiarists, so its value can hardly be computed. The honey is of limpid clearness. (See Pollen Shortage, page 125).

Mustard, (*Sinapis arvensis*). Has yellow flowers and like rape is a member of the Cabbage family. It yields pale honey—rather thin—and yellow pollen in spring. The Treacle-mustard of the cultivated fields is of no use to the apiarist.

Meadow Sage, (*Salvia pratensis L.*). An introduction from Europe and is useful for honey during midsummer.

"**Moonah,**" (M. *parviflora*). A handsome bush extending from the Mallee (Victoria), to Western Australia. Yields honey but no large crops have been reported. One of the many *Melaleucas.*

Mistletoe, (*Loranthus*). As is generally known the Mistletoe is a parasite on many of the native trees, and is very prominent in the forests of the Eucalypts. Birds carry the glutinous-coated seeds on their bills and wipe them off on to the tree limbs. A "growing point" pierces the outer covering and finally reaches the life-giving sap. Mistletoe yields honey and pollen but never in sufficient quantity to enable the apiarist to express any opinion on the quality. Of course Mistletoe is destructive to the tree.

Melilot, (*Melilotus alba*). Belongs to the same family as the clovers, *e.g., Leguminosæ.* Some seeds of the family retain their vitality for a period of 30 to 50 years, two or three varieties up to 100 years. Americans regard the *Melilotus* (or Sweet clover, as they call it) as a first-class honey plant. The only Melilot covering any considerable area in Australasia is the "King Island Melilotus."

Melilot, (*Melilotus parviflora*). This has a good reputation among foreigners, but the author is unable to obtain any detailed information.

Mintbush, (*Prostanthera rotundifolia*). A beautiful shrub with distinctive foliage, as the name implies. During October the plants are just one vivid mass of beautiful bluey-purple flowers; in fact the foliage is completely eclipsed by the blossom. This plant loves the stony banks of creeks and rivers, and while in bloom is just covered with bees gathering a pale limpid nectar and some pollen. If the humming of the bees is any criterion the plant yields honey freely. However, the plant is a hardy native, and showy enough for the most fastidious gardener. What are our city florists thinking of to overlook the Mintbush?

Melaleuca. These plants are generally referred to as "scrub" by the bushmen. This word "scrub" is very comprehensive; it embraces Tea tree, the stool shoots of Eucalyptus, Dogwood, Hazel, or any other undergrowth in the Australian forest.

Melons, (*Cucurbita melo*). All the Melon and Pumpkin family are valued friends of the bee-farmer. The flowers bear enormous quantities of orange-coloured pollen during the dry months of the Australasian summer —generally a period of nitrogenous famine. Years ago a farmer neighbour—who owned a rich river flat—was advised to sow Pumpkins for pig food. To make sure of a crop he was also directed to secure a hive or two of bees—as there were none close at hand—to attend to the pollination of the blossoms. He laughed heartily over the latter portion of the advice, but subsequently called on the author for confirmation or otherwise of the information tendered.

Fortunately the results of a number of experiments were at hand, and the absence of fruit on a branch of a tree covered with netting to exclude insect visitors, was duly explained. Needless to say the absence of fruit was a most convincing argument. He was further shown the necessity of having honey-bees in glass-houses devoted to the culture of cucumbers: how the little insects carried the pollen from the male to the female flower, and so saved the grower the trouble of having to do the work with a camel hair brush and a paper screw. Finally he purchased a hive of bees, and the resultant crop of pumpkins was the heaviest recorded for the district. The pumpkins were piled high in heaps, a striking testimony to efficient pollination.

Mimoseæ. Includes all Acacias of which there are over 300 Australasian representatives. It embraces some species of great economical value, such as wattle for tanning leather. Others yield gum arabic from the stem. Myalls, with a highly-scented timber (well known as Raspberry Jam), have very hard and beautifully marked grain in great demand amongst cabinet makers. The noted Blackwood has pretty grain, and some trees are much sought after for the unique markings called fiddle-back. Big prices await the owners of logs showing this peculiarity.

A few years ago whole paddocks could be seen fenced with posts split from Blackwood trees. Surely an object lesson on wilful waste of beautiful timber, while the farm-house furniture was made of the cheapest Pine. The Mulga (also included in this extensive order) is relished by sheep in the far interior and the Brigalows bind loose sandy lands. Nearly all are amongst the characteristic and beautiful flowering shrubs of Australasia. (This item on the *Mimoseæ* was written after a study of the Australian Orders in Dendy and Lucas' "Botany.") The Blackwood posts were a personal experience of the author.

Needle Bush, (*Hakea leucoptera*). A shrub yielding bright yellow pollen in early summer. There is in Victoria an indigenous Needlewood. It is a splendid honey-plant and a Mildura (Victoria) apiarist writes as follows:—"I am sending you under separate cover sample of honey gathered from Needlewood, which blooms here in December. It is by far the whitest honey I have seen here, and candies very quickly. We have to extract once a fortnight, whether full or not. If left longer it will candy hard in the combs. I think I will cut it up in blocks and retail in cartons as granulated honey. It is very much appreciated here by those who have sampled it on account of its 'melting' taste."

Needle Bush, (*Hakea gibbosa*). In New Zealand, about July when there is such a dearth of nectar-yielding flowers—the Needle bush hedges are sure to attract the honey-bees. The inconspicuous minute flowers are thickly clustered among the needles. This plant is one of Nature's misfits, for the stigma is imprisoned by the staminode petals and self-fertilised before the nectar is available for bees and other insects. Strange to say, other plants make use of almost similar means to effect cross fertilisation.

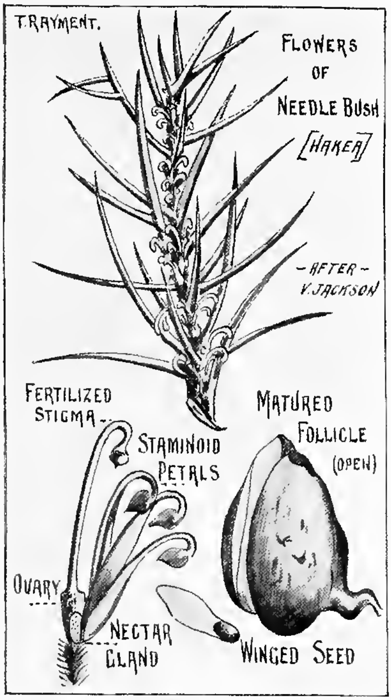


Fig. 99.

The *Hakea* family is strongly represented throughout Australasia. Vincent Jackson, B.A., records over sixty tiny flowers on a twig three inches long, yet the matured nut—containing two winged seeds— is almost as large as a hen's egg and hard enough to turn the edge of any chisel. The above explains why bees cannot gather pollen from Needle bush.

Native Currant, (*Coprosma*). A native shrub flowering in late spring. It grows about 8 or 10 feet high and has miniature round leaves, and tiny white flowers of very sweet fragrance. Bees work on it very thickly, but there is not sufficient of the plants to determine the colour of the honey. There is abundance of yellowy pollen.

Orange, (*Citrus aurantium*). In portions of New South Wales, where Orange groves are numerous, considerable honey is gathered from the blossom. The honey is water-white and fairly dense. The tempting delicacy of the flavour is a class by itself. Americans consider it one of the world's best. Unfortunately it is rarely to be purchased. Orange trees are also good for pollen.

Onion, (*Allium Cepa*). Onions grown for seed produce honey, which is reported to have the characteristic odour, but improves with age.

Prickly Pear, (*Opuntia monancantha*). This is a great pest in Queensland, and originally came from South America. Queensland bee-keepers report flows of honey from the cactus, and Mr. Holloway, of Roma, Queensland, described the colour as light, but he says some honey exhibited at Brisbane, and attributed to Prickly pear, was of a dark tint. During the month of November it yields honey and pollen.

Paper Bark, (*Melaleuca*). Blooms in Western Australia from Christmas to middle of January and is valuable for pollen.

Prickly Beauty, (*Pultenæa juniperina*). Along the upper portion of the Snowy River it blooms in September, and Mr. Reid, sen., of Paupong, New South Wales, says the honey is dark and unsaleable.

Patterson's Curse, (*Echium violaceum*). Known also as Viper's Bugloss. It was introduced to Australia from Europe by a settler named Patterson. Yields honey but hardly sufficient to store much in the supers. Bears pale blue or purple flowers and is a "proclaimed" weed. This is the "Blue thistle" of American writers. Of course it is not a true thistle.

Pittosporum undulatum. A small tree generally found growing in the moist districts. It is rather popular for hedges. The sweet-scented flowers are at their best during early summer and are useful for pollen (yellowish in colour) and pale-coloured honey.

Pennyroyal, (*Mentha Puleguim*). A perennial scent herb yielding ethereal oil. Medicinally it is a powerful stimulant; it is also an insecticide. This herb furnishes a crop of honey in those districts where it abounds. It thrives in moist climates such as Warragul in Victoria. It has practically over-run the North Island of New

Zealand, and has materially altered the flavour of the Dominion butter. The honey is pale in colour but of thin body. Like the nectar gathered from Horehound it does not appeal to all palates.

Plantain (common), (*Plantago major*). Introduced to Australasia from Europe with impure agricultural seed, and now widely spread over the pastures. It bears minute white flowers—on furry stalks—that produce a dull white pollen in spring and early summer.

Pepper Tree, (*Schinus molle*). This well known shade tree is to be found in all of the Australian States; thriving equally well in the dampness of Gippsland and the heat of Queensland. It stands drought remarkably well, and blooms more or less throughout the year. Mr. Holloway, an extensive honey-producer, of Queensland, says:—"It does remarkably well here, blooming right on from August till late autumn, sometimes even into the winter." It produces honey and yellowish pollen, and his experience differs from that of the Americans (who describe the honey as dark), for he is sure the honey is very pale in colour, and considers the Pepper trees of great value to the apiculturist. Mr. Holloway once secured 600 lbs. of beautiful honey from 13 colonies working on pepper trees. So he is in a position to judge.

Rape, (*Brassica rapa*). Of cosmopolitan origin. It is during the spring months that it rears up its tall spike of yellow flowers. Yields pollen and thin watery honey. Farmers find it a profitable crop and occasionally small yields of honey are reported from it.

Raspberry (wild), (*Rubus parvifolius*). Where plentiful it helps to build up the colonies in early spring. Pollen creamy white.

Rice Flowers, (*Pimelea ligustrina*). Some of the native pimeleas have very handsome flowers, and bees work on them, but no large crops of honey have been reported from the Rice flowers.

Rewa Rewa or New Zealand Honeysuckle, (*Knightia excelsa*. R. Brown). This native of New Zealand yields both pollen and honey. The latter is secreted in such quantities that it bursts open the florets of the gorgeous velvet-red cluster. Tuis and other birds—also insects—carry the pollen to effect cross fertilisation. The wood, which has a pretty speckled grain, is recommended for ornamental work. The clusters of tubular flower buds are not unlike those of the Queensland Silky Oak in appearance.

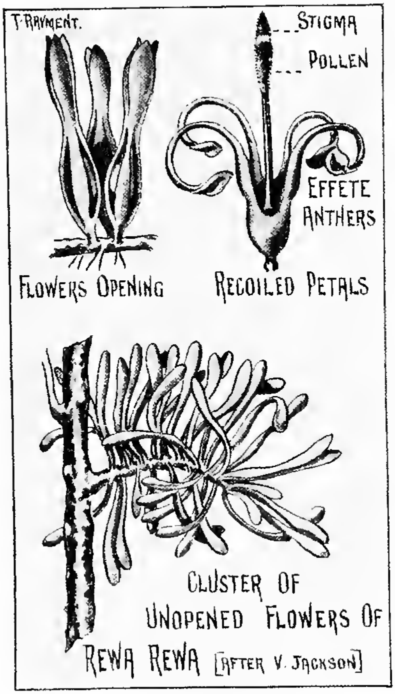


Fig. 100.

Scent Plants. Some plants are extensively grown for scent-making and it would undoubtedly assist the apicultural industry if the scent-distilling industry were placed on a firm basis. The Lavender is planted largely for this purpose in Victoria. E. T. Penglase, of Narrang, Victoria, experimented with some of the plants, and he writes from experience:—"We grew English Peppermint, Anise, Geraniums, and different kinds of Thyme. We did not go in to cultivate extensively, but went far enough to see there was money in it if one had the time to spare. Anise grew the best of any we tried, and yielded large crops of seed. One variety of Thyme we have here now grows on the pasture land, and during the long drought was always green. It blooms well and the bees work busily on it.'"

Scent-farming is confined principally to the South of France, and lately Algiers. The climate of these countries is very similar to that existing in certain parts of Australia. The industry has grown to such an extent that numbers of people have embarked upon the production of flowers to cope with the demands of the Parisian perfumiers. With the exception of some few experimental plots, little has been accomplished in this country towards establishing this very profitable industry.

Smooth Bell or Hare Bell, (*Wahlenbergia gracilis*). Grows luxuriantly about Monaro, New South Wales, especially in the ranges. A dark unsaleable honey is gathered from the blooms during October.

Sheep's Sorrel (*Rumex*). A small annual, introduced from Europe and established in Australia as far back as 1802. Yields pollen of a sombre tint and is considered valuable in some localities. This weed indicates a deficiency of lime in the soil.

Sandalwood, (*Santalum lanceolatum*). Yields honey and pollen in Queensland about September. The honey is dark, but it materially assists colonies to breed up in early Spring. The wood of the Western Australian species has a fragrant perfume likened to the Malabar Sandalwood. There are about 40 species in Australia including the Native Peach (Quandong) and the Native Cherry (Exocarpus). These two latter are common in Central Australia.

Sheoke, (*Casuarina*). Yields a fair supply of pollen during December and January in Western Australia. This order is scattered over the whole of the Commonwealth even in the vast arid areas of Central Australia. The timber of some species is extremely hard and solid. On account of their ruddy colour they are often referred to as "Beefwood" trees.

Silky Oak, (*Grevillea robusta*). The remarkable flowers of this tree may be easily identified even at a distance. The feathery unique clusters or sprays of bloom are cadmium orange in colour with a dark red spot in the centre of each floret. During the period of florescence the blossom completely eclipses the light green and silvery foliage. The timber—which is very ornamental—somewhat resembles the colour of the flowers, and has a pretty mottled grain which is sure to become popular for cabinet making. The author has often plucked sprays and received a shower of nectar from the flowers. Trees introduced to Victoria secrete honey plentifully during November and December, attracting the honey-eaters. The fine bills of these birds quickly rifle the flowers. This valuable and beautiful tree is a native of Queensland.

Tree-Violet, (*Hymenanthera Banksii*). This shrub frequents the banks of watercourses and has tiny, sweet-scented white flowers. It helps colonies along in Spring with white pollen. The plant bears blue-black berries.

Tree Lucerne, (*Medicago arborea*). Similar to the following in many respects. The flowers, however, are yellow.

Tree Lucerne, (*Cytisus proliferus alba*). This rapid-growing hedge plant is now widely known as a grand honey-yielder. As a wind-break for the apiary it is unrivalled. The white blossoms burst the sheaths very early in the spring, almost before the winter has departed. Bees work on it during a shower as the drooping habit of the flowers prevents the nectar washing out with the rain. The pollen is cadmium in colour and the honey very pale and clear, rather thin, and of mild flavour. To make a close hedge it should be severely cut back. Unfortunately, the sheep and cattle, also the kangaroos are very fond of it and keep it eaten down.

Thistle, (*Carduus arvensis L.*). Erroneously called Canadian and Californian thistle. It hails from Europe, Asia, and Africa. Introduced to Australia (it is the only perennial thistle), it has rapidly spread and become a "proclaimed weed" in many places. The honey is water-white in colour, candies quickly with fine white grain and is usually associated with clover honey.

Almost all thistles are "proclaimed" weeds; they yield honey finely, and when in bloom during a dry, early summer, the pollen is especially valuable. Some thistles have purple-coloured pollen, but the majority have cream-coloured. Thistle honey is very mild in flavour and generally mixed with that of other plants and is rarely gathered pure, though honey from "Spotted thistles" is included in the list analysed by the Victorian Department of Agriculture.

Tree clover, (*Goodia lotifolia*, Salisb.). A native shrub bearing yellow flowers and foliage somewhat like clover. It is a suitable fodder plant for poor, neglected land. Bees gather nice pale honey from the blossoms in Spring.

Tea tree, (Coast), (*Leptospermum lævigatum*). There are many varieties of tea tree in Australia. Some of them yield a small supply of pollen, a dull orange colour. In Victoria—as in other States—it blooms very irregularly. Sometimes in the spring, other times in the autumn, but more often just before Christmas. In West Australia the Tea tree blooms every second year, and while not noticeable for pollen, it yields a fair flow of honey, medium-amber in colour. The bloom, which opens about the middle of October, lasts until the end of November. There is also a prickly Tea tree.

Tea tree, (Manuka or Prickly), (*L. scoparium*). This is very common, especially about the "Grampians," in fact the Tea trees are characteristic of the Australian landscape. Known also in New Zealand as manuka.

Tea tree, (Woolly), (*L. lanigerum*). In various places this is often called "Manuka" scrub. Mr. E. Garratt, an apiarist of many years' experience, was once located on a belt of Tea tree. He had no fault to find with the quantity, but the quality was very inferior. It is almost the darkest honey produced in Australia, in colour something like treacle. As mentioned under "Extracting," the honey will not readily leave the combs, and Mr. Garrett was forced to adopt an original plan in harvesting his crop. He had all combs built on wired heavy foundation. When filled with honey they were taken from the hive and held over a drainer. The side walls were then scraped down to the midrib with a three-cornered implement. This tool was made from a piece of saw-blade shaped like a triangle. A hole bored through the centre allowed a convenient handle to be riveted on. The honey was allowed to drain from the wax, which was afterwards pressed fairly dry. The frames containing only the wired midrib were returned to the bees who built it out again as if it were foundation. Where Tea tree honey is abundant it should be used for feeding bees, though chemists buy it for making into cough mixture. A little makes no material difference to a crop. Tea tree honey has a peculiar flavour of its own, rather unpleasant in the author's opinion.

Tea tree, (Silky), (*Leptospermum myrsinoides*). Very widely distributed over the country of Western Victoria.

Trumpet flower, (*Datura*). A winter-flowering garden shrub, the flowers of which are very nectariferous.

Wild flowers. Spring in the Australian bush is remarkable for the display of papilionaceous flowers, notably the *Daviesias*, *Pultenæas*, and *Dillwynias*. (See Wild-hop).

Woodrush or Small Grasstree, (*Xanthorrhœa minor*, R. Br.). This plant is at times called "Candlerush," and not infrequently one may hear it dubbed "Bayonet grass." It grows in a compact tussock and the leaves will cut the hands in a way to be remembered. During early summer it sends up a flower stalk two to three feet high, the top of which for about 8 inches in length is covered with a mass of sessile cream flowers. During the blooming stage the flowers are fairly covered with bees who lose no time in packing away the pale-tinted pollen. This grasstree yields honey, but not sufficient is gathered to determine the quality.

Wild Sage, (*Salvia verbenacea*). An introduction from Europe to Australia and now helps with a little honey during the dry months of the year.

Wild Hop, (*Daviesia corymbosa*), (Smith). This plant has been given the name of Narrow-leaved Bitter-pea by the Plant Names Committee (Professor Ewart, Chairman). This is a plant of striking appearance. Its tall erect stems show a tiny red spot about the size of a pinhead at the base of each leaf about March; these gradually expand until October when the whole stem bursts into floral flame. The flowers—crimson and yellow—are shaped like a pea-blossom, only about one-third the size, and yield delicately-flavoured honey almost colourless. This is probably the palest honey gathered in Australia; in the candied form its fine snow-white grain cannot be beaten. Unfortunately its flowering period is often contemporary with cold showery weather and consequently a lot of honey is lost to the apiarist. This honey would sell readily enough against the best sample in the world's markets. Wild hop grows very luxuriantly in several of the indigenous forests, and large yields have been recorded from it under favourable circumstances.

Wild Hop, (false), (*Dodonaea viscosa*). A native plant with a yellow primrose-like flower often called Wild hop. It is not a member of the *Leguminosæ,* and the author has watched in vain to see honey-bees work on the flowers. It is probably of little value to them.

Yellow-wood, (*Flindersia Oxleyana*). Comes into bloom in Queensland about November, and assists things along with a little honey and pollen. The timber of this tree is valued for cabinet making.

Before closing this chapter on the Honey-plants of Australasia, it is necessary to point out that the colour of honey and pollen is largely influenced by the soil. There are variations in colour and flavour that cannot reasonably be explained, but it is generally conceded that honey is paler in colour and milder in flavour when gathered during a fast heavy flow. When honey secretion is slow and long drawn-out, the nectar apparently accumulates minute quantities of some other juices of the tree. Honey gathered from ground flora will usually congeal much quicker than that from the Eucalypts. Even they vary so much that it is extremely difficult to generalise.

Englishmen, and Australians too, in speaking of honey from the indigenous flora, *i.e.*, Eucalypts, often describe the characteristic flavour as Eucalyptus. They do not wish to imply that the honey tastes like the essential oil of Eucalyptus, because it is unnatural that the essential flavour should get into the nectar. However, it is a confounding term to apply to the flavour and has been the cause of much misunderstanding. Why not have described the flavour as "Myrtle," for all the Eucalypts belong to the *Myrtaceæ*?

[NOTE.—The Author will be pleased to communicate with any Australian or New Zealand apiarist who desires to include in this list some plant that yields honey or pollen in abundance].

INDEX.

PRINTED BY

WHITCOMBE AND TOMBS LIMITED