The Westinghouse Quick-Acting Brake.

Illustrated Description
with
Instructions

1893

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THE

WESTINGHOUSE

QUICK-ACTING BRAKE.

ILLUSTRATED DESCRIPTION,

WITH INSTRUCTIONS FOR THE WORKING

AND MAINTENANCE OF THE BRAKE.

THE WESTINGHOUSE BRAKE COMPANY, LIMITED,
YORK ROAD, KING'S CROSS,
LONDON, N.

1893.

CONTENTS.

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PREFACE.

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The present book has been devoted to furnishing a complete and concise description of our new Quick-Acting Brake Apparatus.

Since the introduction of this Brake system, it has been taken up in a most unprecedented manner, on account of its perfect adaptability and undoubted superiority over all its predecessors. Extended experience has proved its thorough reliability under all circumstances, and it has now been adopted in preference to the "Ordinary" Westinghouse Brake by the majority of the Railway Companies with whom we have the honour to do business.

To some of our readers it may be of assistance in better understanding the brake question, if we add a few remarks on the development of the Westinghouse Brake, before proceeding to describe the essential features of its latest improvements.

When the original Westinghouse Brake, commonly known as the **Non-Automatic Brake,** was introduced, a degree of safety in the movement of railway trains was made practicable beyond anything previously attained, and for a time this Brake system answered the requirements of train stopping as then understood. A few years experience, however, proved that for an appliance intended for saving life and property under all the contingencies to be met with in railway working, something more perfect was required.

This led to the introduction of the "**Ordinary**" **Automatic Westinghouse Brake,** which had been designed to comply with all the requirements then found wanting in the non-automatic system. Although the change to the automatic principle provided a much safer, more efficient and reliable apparatus than any of the non-automatic Brakes at that time in use, it met at first with a great deal of opposition, especially on the part of the Vacuum Brake Company, purely upon the ground, that "the non-automatic Brake was simpler and good enough." These objections, however, rapidly disappeared with all intelligent persons as the automatic Brake became better understood; its value as compared with the old form was fully appreciated, and the automatic principle, first introduced by Mr. Westinghouse, has now been accepted by the railway world, and also by the Vacuum Brake Company, as the principle upon which continuous Brakes should act.

For many years the Ordinary Westinghouse Brake has rendered valuable service, but time and progress in

the art of railway operation have developed new conditions and requirements which have been fully met by the introduction of the new **Quick-Acting Westinghouse Brake,** explained and illustrated in this book. The advantages resulting from its use are very important; its action is practically *instantaneous and simultaneous on all the vehicles of a train of any length,* and jerks and shocks are entirely avoided, even when the Brakes are applied with full force. In the endeavour to stop long trains quickly by means of the Brakes heretofore used, couplings and drawbars were frequently broken, on account of the brake force being applied to the front part of the train much sooner than to the rear portion. These difficulties, which hitherto prevented the application of continuous Brakes to long goods trains, have been entirely overcome by the improved quick-acting system, which has given every satisfaction in working the enormous goods traffic in the United States of America, and also in Australia, Mexico, Chili and elsewhere.

Although, however, the improved quick-acting Brake was originally designed to meet the wants of goods train service, its advantages are also of considerable importance to passenger trains, to which it has already been extensively applied. The extremely rapid action obtained by means of the new appliance, considerably reduces the distance in which a passenger train previously could be stopped, and the smoother working of the improved Brake is very noticeable when changing from a line where this is in use, to another employing a different system.

Whilst it may be said that a somewhat greater degree of intelligence and study is required to understand the construction of the new mechanism, yet the appliances of which it is composed have been designed to compensate as far as possible for the lack of these human traits, and it is believed that the vast superiority of the new quick-acting Brake over the old "ordinary" form will fully compensate its users for the trouble of educating themselves to the new conditions, the attainment of which, we are quite sure, will not require the amount of patience found necessary when substituting the "ordinary automatic" for the "non-automatic" Brake. Local prejudices may be met with now, as then, against the new quick-acting Brake, but after a season they will be seen to be those usually encountered by any innovation, and will disappear with a better knowledge of the new apparatus.

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THE WESTINGHOUSE QUICK-ACTING BRAKE.

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Arrangement of the Brake Apparatus on Locomotives, Tenders and Vehicles.

Plate I. appended, illustrates the application of the Quick-Acting Westinghouse Brake to rolling stock.

The Locomotive is provided with a vertical double acting **Air Pump**, having a steam cylinder A, and an air cylinder B, with the usual valves and pistons. The pump is driven by steam, which is taken from the locomotive boiler and exhausted, after having done its work, through the pipe *i* into the smoke box. To regulate the flow of steam to the pump, and consequently to govern the work of the latter at the will of the Driver, a **Steam Cock** *P* is so arranged that it can be opened or closed from the Driver's cab. When the Steam Cock P is open, the pump will work, and force air through the Delivery Pipe *b* into the **Main Reservoir** *C*, usually fastened beneath the footplate. A separate pipe *c* leads from the top part of the Main Reservoir C to the **Driver's Brake Valve** *D*, placed in the cab of the engine, within easy reach of the Driver. This valve is also connected to the **Main Brake Pipe** *E*, which extends the whole length of the train, communicating with the brake apparatus on each vehicle through a Branch Pipe *e*. Air tight connections of the Main Pipe E between the vehicles of the train are formed by flexible rubber hose fitted with iron Coupling Heads K, so designed that they may readily be coupled or uncoupled. **Stop Cocks** *N* are placed in the Main Pipe at either end of each vehicle, in order to close the pipe at the ends of the train, and to prevent the action of the Brake when vehicles are detached. These cocks must be opened whenever the corresponding couplings K are united, and shut before the couplings are separated. On Tenders and Tank Engines a **Drip Cup** *t* is placed in the Main Pipe E, to catch any water or oil which might otherwise pass into the apparatus on the carriages. A **Duplex Gauge** *L* (or two ordinary gauges, as shown on Plate II) is attached to the Driver's Brake Valve on the engine, to indicate the pressure of air carried in the Main Reservoir C, and in the Main Pipe E.

Besides the parts already mentioned, the engine, tender, and braked vehicles are each provided with an apparatus which actually applies the brake force to the wheels, by means of levers and rods directly attached to it. The essential parts of this apparatus are:—

A **Brake Cylinder** *H*, containing a piston with rod, attached to the brake gear in such a manner, that the Brakes are applied when the piston is forced out by air pressure;

An **Auxiliary Reservoir** *G*, in which air, supplied from the Main Reservoir through the Main Pipe, is stored for applying the Brake on its own vehicle;

A **Triple Valve** *F*, which automatically admits compressed air from the Auxiliary Reservoir G to the Brake Cylinder H whenever the pressure in the Main Pipe is reduced, and discharges the pressure from the Brake Cylinder into the atmosphere when the original air pressure in the Main Pipe is restored.

The parts just mentioned are either combined in one piece, as applied to the carriage represented on Plate I; or they are arranged separately and connected by tubes, as shown on the tender. On locomotives the separate arrangement is always employed.

A **Release Valve** *J* is attached to the Auxiliary Reservoir G, and serves the purpose of releasing the corresponding Brake by hand, if necessary. On locomotives and tenders these valves are fixed in the cab within easy reach of the Driver; on carriages they are so arranged that they can readily be opened from either side of the vehicle by pulling a light wire connected to the valve handle. The Branch Pipes *e*, leading to the Triple Valves F, are each connected to the Main Pipe E by means of a **Dust Catcher** *W*, which contains a tube of wire gauze to arrest any dirt or grit which might find its way into the pipe.

Each Van is provided with a gauge indicating the air pressure in the main pipe; also with a cock, connected to the main pipe, by means of which the Guard can stop the train, if necessary, even against the will of the Driver.

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GENERAL PRINCIPLE OF ACTION.

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In the following descriptions reference is made to the annexed drawing, Plate II, on which the principal parts of the apparatus are represented in section. The arrangement of the parts as shown, is substantially the same as applied to the engine and vehicles of a train.

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The Westinghouse Quick-Acting Brake can more rapidly be applied and released, and will stop a train in less distance than any other Brake. Its action is practically instantaneous and simultaneous on all the vehicles of a train of any length.

The Brake is continuous throughout the train, and can be applied to all the vehicles, either by the Driver from the engine, or by the Guard from any part of the train. It affords also a ready means of communicating signals from the passengers to the Driver by a small apparatus which may be placed in each compartment.

The Brake is automatic in its action, and applies itself instantly with full force to every vehicle, if the train separates, or if a rupture of a vital part of the apparatus, the tubes, or hose pipes, should occur.

Air Pressure is the power employed for working the Brake.

An Air Pump A, B, driven by steam from the boiler of the locomotive, compresses air into a Main Reservoir C to a pressure of about 90 to 100 lbs. When the engine is coupled to the train the compressed air in the Main Reservoir is turned into the Main Pipe E, from which it also passes through the Branch Pipes, and fills on each vehicle an Auxiliary Reservoir G. Thus the Main Pipe E, the Triple Valves F and Auxiliary Reservoirs G, are all charged with equal pressure of about 70 lbs., but there is no compressed air in the Brake Cylinders H so long as the Brake is not in operation.

The Brakes are applied to all the vehicles in the train by a reduction of pressure, purposely or accidentally produced in the Main Pipe *E*. In ordinary working this is effected by allowing air to escape by the Driver's Brake Valve D, but the same result follows on a train breaking in two, or on a rupture of an essential part of the apparatus on any vehicle.

If the air is allowed to exhaust slowly from the Main Pipe, as in an ordinary application of the Brake, the Westinghouse Quick-Acting Brake works in exactly the same manner as the "Ordinary" Westinghouse Automatic Brake. Each Triple Valve F then permits a portion of the compressed air stored in the Auxiliary Reservoir G to flow into the corresponding Brake Cylinder H and force its piston forward, pressing the brake blocks against the wheels, by means of the gear connected to the piston rod. The brake force thus produced corresponds to the reduction of pressure in the Main Pipe E; consequently the Driver can graduate the action of the

Brake at will, by regulating the discharge of air from the pipe.

If, however, the air is rapidly discharged from the Main Pipe E, as in an emergency application of the Brake, this will cause a sudden reduction of the main pipe pressure, and thereby instantly produce the rapid action of the Brake. The Triple Valves F then not only allow compressed air from the Auxiliary Reservoirs G to enter their Brake Cylinders H, but in addition open on every vehicle a large communication through which compressed air is also admitted from the Main Pipe E into the Brake Cylinders H. It will easily be understood that a double advantage is hereby gained, first in utilizing a considerable portion of the air in the Main Pipe to increase the available brake force in cases of emergency, and secondly in producing a rapid reduction of pressure in the whole length of the Main Pipe, which accelerates the action of the Brake with extraordinary rapidity, and ensures practically simultaneous action throughout trains of almost any length.

The Brakes are released by an increase of pressure in the Main Pipe, produced by admitting air from the Main Reservoir C through the Driver's Brake Valve D into the Main Pipe E. This restores the pressure in the Main Pipe, and causes the Triple Valves F to discharge the air from the Brake Cylinders H into the atmosphere, thus relieving the brake blocks from pressure. At the same time the Auxiliary Reservoirs G are re-charged.

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DESCRIPTION OF THE PRINCIPAL BRAKE PARTS.

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Air Pump.

The Westinghouse Air Pump, as shown on Plate II, consists of a Steam Cylinder A, and an Air Cylinder B, joined together by a centre piece which forms the bottom head of the one, and the top head of the other cylinder. The Main Steam Piston 3, and Air Piston 7, are both fastened to the same rod, and move together as one piece.

The pump is driven by steam taken from the boiler of the locomotive and admitted to the top Cylinder A. By suitably arranged valves, the steam is alternately introduced into this cylinder, above and below the Steam Piston 3, as hereafter fully described, thus forcing this piston upwards and downwards, and giving a similar movement to the Air Piston 7, by which air from the outside atmosphere is then alternately drawn into the lower Cylinder B, and forced from this cylinder into the Main Reservoir C.

When the Steam Cock P is opened, the steam from the boiler enters the Chamber *c* between the two pistons of the Main Valve 1, and also flows through a small port into the Chamber *d*, in the centre of the top cover, so that both chambers always contain steam of the same pressure. The ports at each end of the cylinder are opened for the admission and exhaust of steam by the movements of the Main Valve 1, which is so arranged that on admitting steam from the Chamber *c* to one end of the Cylinder A, it opens the exhaust port at the other end, from which the steam then escapes through the Exhaust Chamber *i* into the atmosphere. The Main Valve 1 consists of two pistons, mounted on the opposite ends of the same rod. The upper of the two pistons being of greater diameter than the lower, the tendency of the steam pressure in the Chamber *c* is always to raise the Valve 1, which, however, is held down by the larger Piston 2 above it, so long as steam from Chamber *d* can pass through the Port *e*, and exert pressure upon that piston.

In the position of the Main Valve 1, as shown on the plate, steam is entering the Cylinder A, past the lower Piston 1, and is forcing the Steam Piston 3 upwards. Towards the end of this stroke the Plate 4, screwed to the steam piston, presses against the shoulder of the Rod 5, and raises the rod with the Slide Valve 6, thus closing the Passage *e* in the top cover, and at the same time connecting the Exhaust Passages *f* and *g*, through which the steam from the top of the Piston 2 escapes into the atmosphere. This relieves the pressure on the Piston 2, and permits the steam in the Chamber *c* to raise the Main Valve 1 and enter the Cylinder A above the Main Piston 3. The latter is consequently forced downwards, whilst the steam from the lower end of the cylinder escapes into the atmosphere

through the exhaust port, which is now opened by the lower piston of the Main Valve 1.

When the main piston has nearly completed its downward stroke, the Plate 4 presses against the button at the end of Rod 5, and draws the latter with the Slide Valve 6 back into the position shown. The steam in the Chamber *d* then flows through the Passage *e*, forcing down the Piston 2, and with it the Main Valve 1, thus again reversing the stroke of the main piston.

The Air Piston 7 moves in exactly the same manner as the Steam Piston 3. At each upward stroke the former draws air from the outside atmosphere through the Lower Receiving Valve *a* into the bottom part of the Cylinder B, and delivers at the same time the air from the top part of this cylinder through the Upper Discharge Valve *b* into the Main Reservoir C. At each downward stroke of the Piston 7, this action is simply reversed, air being drawn in through the Upper Receiving Valve *a*, and simultaneously discharged from the opposite end of the cylinder through the Lower Discharge Valve *b* into the Main Reservoir C.

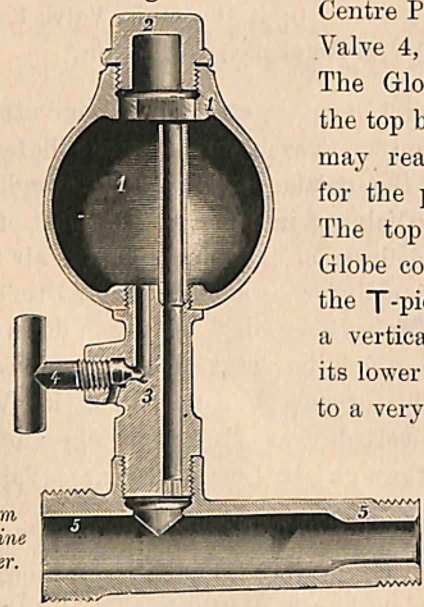
The air valves are of the ordinary description, and may be easily removed and examined. The lift of the discharge valves *b* should not exceed one thirty-second of an inch.

A small oil cup, with tap, is placed on the top of the air cylinder, and should exclusively be used for the purpose of lubricating the same. The lubricant must not be allowed to be sucked in through the air valves.

Ball Lubricator for Steam Cylinder of Air Pump.

Fig. 1 illustrates the Lubricator generally employed for the top, or steam cylinder of the Westinghouse Air Pump. Its essential parts are a Globe 1, a Centre Piece 3 with Plug Valve 4, and a T-piece 5. The Globe 1 is closed at the top by a Cap 2, which may readily be removed for the purpose of filling. The top portion of the Globe communicates with the T-piece 5 by means of a vertical tube which at its lower end is contracted to a very small passage.

Fig. 1



Before the pump is started the Globe 1 is filled with the lubricant. When steam is allowed to flow through the T-piece 5 to the pump, a small quantity of it passes through the vertical tube to the Globe 1, where it condenses. The water collects at the bottom of the Globe, raising the lubricating material, which then flows

into the vertical tube and through the small passage into the T-piece 5, where it is taken up by the steam on its way to the pump.

Pure tallow is a good lubricant for the steam cylinder, but pure mineral oil, as used for high pressure engines, is still better. If a proper lubricant is used, one filling of the Globe will last from 7 to 10 working hours of the pump. Before the Globe can be re-filled the water must be removed from it by opening the Plug Valve 4.

Main Reservoir.

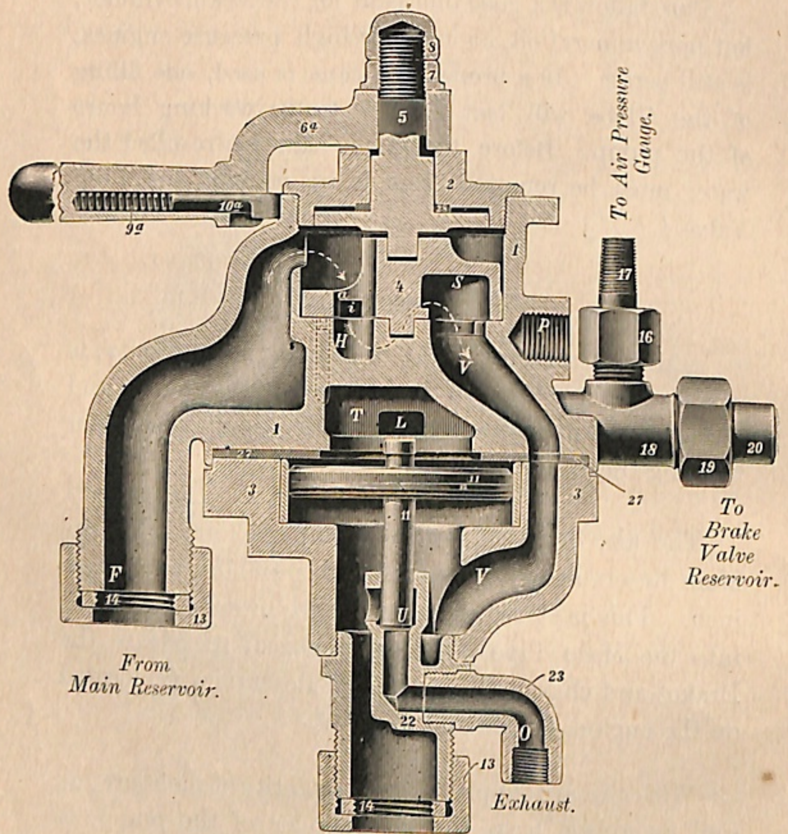
A Main Reservoir C, of 10 to 15 cubic feet capacity, is usually fastened beneath the foot plate of the engine, and serves as the main store for the air supply needed for working the Brakes.

The air, delivered by the pump, is forced into the Main Reservoir to a pressure of 90 to 100 lbs. per square inch. This is stored, and kept in readiness to be turned into the Main Pipe E, when required, to release the Brakes and charge the Auxiliary Reservoirs G, located on the engine, tender and vehicles.

With the air supply, a small quantity of moisture, as well as grease from the air cylinder of the pump, is frequently carried into the Main Reservoir and there deposited. To provide for the removal of such deposits, a suitable drain plug is placed in the bottom of the reservoir, which must be unscrewed at least once a week.

Fig. 2.

Equalizing Driver's Brake Valve



Equalizing Driver's Brake Valve.

This valve is placed in the cab of the engine within easy reach of the Driver. It forms the connection between the Main Reservoir C and the Main Pipe E, and serves to regulate the flow of air to and from the Main Pipe, either for the purpose of charging the Auxiliary Reservoirs, located on the engine, tender and vehicles, or of applying and releasing the Brakes at the will of the Driver.

The Equalizing Driver's Brake Valve, represented in Fig. 2, has been specially designed to automatically assist the Driver in operating the Brake in the most perfect manner, and to provide for a difficulty which sometimes arises, particularly on long trains, when Brake Valves of other construction are carelessly or unskilfully handled in applying the Brakes for ordinary stoppages. To produce the most satisfactory action of the Brake, it is of importance that in such moderate applications the air be gradually discharged from the Main Pipe, and the exhaust be gently stopped when the necessary reduction of pressure has been effected. If, however, the air is rapidly discharged, and the exhaust abruptly cut off, the air flowing from the rear to the front of the train sometimes causes the release of the Brakes on the vehicles nearest the engine.

The new Equalizing Driver's Valve renders such occurrences impossible, as it is provided with a special device to automatically counteract the improper effects produced by rough and unskilful handling of the valve.

The principle of this improved Brake Valve is, not to allow the Driver in ordinary applications of the Brakes to discharge air directly from the Main Pipe, but from a small reservoir attached to Chamber T of the valve. The reduction of air pressure, thus effected in the reservoir, is then at once automatically and properly repeated for the Main Pipe by means of a small equalizing piston, placed between the air in the Chamber T, and that in the Main Pipe E. This piston moves in accordance with the variations in pressure above and below it, and governs an Exhaust Valve U in such a manner, that the air pressure in the Main Pipe must always become the same as that in the small reservoir connected to the Valve Chamber T. Even if the exhaust of air from the Brake Valve Reservoir is abruptly stopped by the Driver, the Discharge Valve U is always gradually closed by the piston when equilibrium of pressure is established throughout the train. The equalizing device, therefore, will under all circumstances provide for a uniform reduction of the pressure in the Main Pipe, thus insuring a uniform application of the Brakes to all the vehicles.

The construction of the Valve is shown in Fig. 2. The valve case contains in its upper part a Rotary Valve 4 which controls the passages leading from the Main Reservoir to the Main Pipe and Brake Valve Reservoir, as well as those leading from the Main Pipe and small Reservoir to the atmosphere. The Rotary Main Valve 4 is connected to the Valve Handle 6*a* by means of a Spindle 5, having on its under side a flat wing fitting in a corresponding groove on the top of the Main Valve 4.

It will thus be seen that the movement of the Valve Handle operates the Rotary Valve 4 on its seat, opening and closing the various ports as required.

The equalizing arrangement is located in the lower part of the valve case, and consists of a Piston 11, having a stem which terminates in a Valve U, and in the position shown closes the Exhaust Port O. When the piston moves upwards the Valve U will be raised from its seat, and so permit the escape of air from the Main Pipe through Port O to the atmosphere.

The several pipe connections from the Brake Valve to the pressure gauge and the Reservoirs are clearly shown on Plate II. If the engine is provided with a Communication Signal Valve this must also be connected to the Driver's Brake Valve by a tube screwed into the Boss P, (Fig. 2). If a Signal Valve is not employed the Boss P is closed by a blank cap.

There are five principal positions of the Valve handle for working the Brake, as indicated in Fig. 3 (page 24).

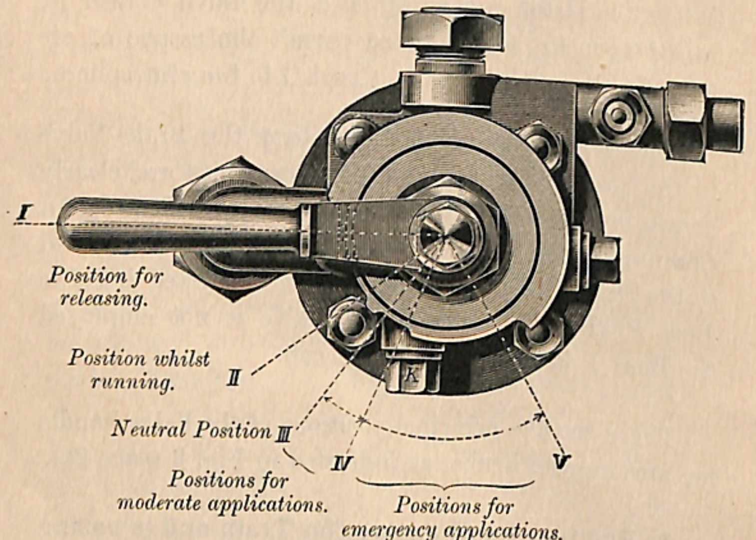
I. Position for charging the Train and releasing the Brakes.—When the valve handle is placed in this position, air from the Main Reservoir, entering the Brake Valve at F, passes through corresponding ports in the Rotary Valve 4 and the Valve Body 1, to the Chamber T, seats the Equalizing Piston 11, and feeds through L into the small reservoir attached to the Brake Valve. At the same time, compressed air, coming from the Main Reservoir, flows also through the Passage *a* of the

Rotary Valve 4, into a blank Cavity H in the Body 1. This, in the present position of the valve, communicates with the Cavity S in the valve face, and allows the air to pass through S into the Port V and the Main Pipe E.

Fig. 3.

PLAN OF EQUALIZING DRIVER'S BRAKE VALVE.

(*Showing principal positions of handle.*)



Thus a direct and free communication is established from the Main Reservoir to the Main Pipe, as well as to the Chamber T and the small reservoir attached to it. The Exhaust Valve U closes the Port O, and equilibrium of pressure exists on both sides of the Piston 11.

II. Position whilst running.—When the valve handle is turned into the second position, the air flowing

through the Passage *a* of the Rotary Valve, feeds into the Cavity H in the valve seat, but can no longer pass to the Main Pipe E, as the communication between the Cavities H and S is now cut off. In this position, however, another passage in the Main Valve 4 corresponds with a port in the Body 1, leading to a small Feed Valve which is enclosed by the Cap K (Fig. 3), and held to its seat by a spring, having a resistance equal to about 25 lbs. per sq. inch. The air, coming from the Main Reservoir, opens this Feed Valve, and flows through a small port to the Passage V and the Main Pipe E. From the Port V air passes also through the Cavity S and a port in the body to the Valve Chamber T, thus equalizing the pressure above and below Piston 11. The Feed Valve is returned to its seat as soon as the air pressure in the main pipe, in addition to the resistance of the Feed Valve spring, balances the pressure in the Main Reservoir. A pressure of about 25 lbs. in excess of that in the Main Pipe and the Auxiliary Reservoirs, is thus retained in the Main Reservoir C, and will, when discharged into the train pipe, insure a quick release of the Brakes.

III. Neutral Position.—When the valve handle is placed in this position, all ports in the Rotary Valve 4, as well as in its seat are closed, and all communication to or from the Main Pipe E, the Chamber T, and the Brake Valve Reservoir is cut off.

IV. Position for moderate applications of the Brake.—To apply the Brakes with moderate force, the

Valve handle is turned to the position IV, when air from the Chamber T and its reservoir is allowed to escape into the atmosphere through a port in the Body 1, a recess in the Rotary Valve, and an exhaust opening in the valve seat (not shown in Fig. 2). This causes a reduction of pressure on the top of the Piston 11 ; the excess of pressure, now acting on the under side of this piston, forces it upwards, unseating the Discharge Valve U, and allowing air to escape from the Main Pipe E through the Exhaust Port O, until the pressure in the Pipe throughout the Train is equal to that yet remaining in the Chamber T. When equilibrium of pressure is thus established the piston is moved back, and the Valve U returned to its seat, closing the Exhaust Port O, and preventing further escape of air.

V. Position for emergency applications of the Brake.—When the valve handle is turned beyond the Position IV towards the right, a wide and direct communication between the Main Pipe and the atmosphere is established through the Port V, the Cavity S in the Rotary Valve 4, and an exhaust opening in the seat of that Valve ; the air, therefore, escapes from the Main Pipe E with great rapidity, causing the instantaneous application of all the Brakes with full power.

Brake Valve Isolating Cock.

When two engines are coupled to a train, the Brakes should be entirely under the control of the Driver of the front engine, and the Main Reservoir of the second engine must then be isolated from the main pipe of the train. For this purpose it is necessary to have in the cab of each engine a cock placed in the pipe leading from the Main Reservoir C to the Driver's Brake Valve D, as shown on the annexed plates.

In ordinary working, this cock (called " Brake Valve Isolating Cock ") should always be open, but whenever two engines are employed for working a train, the Isolating Cock on the second engine must be kept closed as long as the Driver of the leading engine is in charge of the brakes. When the pilot is removed, the cock must, of course, immediately be re-opened. If this should be forgotten, the omission will only effect the release, but in no way interferes with the application of the brakes.

The Brake Valve Isolating Cock is provided with a special handle, marked with the letters " B.V." (Brake Valve). The handle is parallel with the pipe when the cock is open, and at right angles to the pipe when the cock is shut. In the lower part of the body a screwed hole will be found for the connection to the gauge indicating the pressure in the main reservoir.

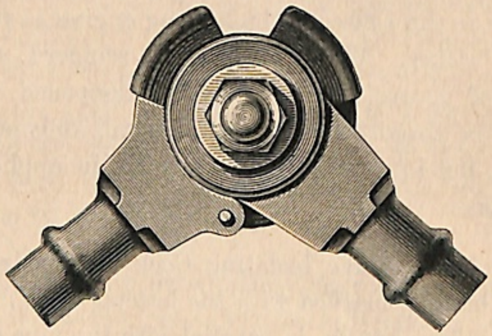
Main Pipe and Hose Couplings.

The Main Pipe E extends from the Driver's Brake Valve D to both ends of the train, communicating by branch pipes with the brake apparatus on the engine, tender and each vehicle. For ordinary passenger trains the Main Pipe is of one inch internal diameter, but on vehicles intended to run in goods and other trains of great length the diameter is increased to 1¼ inch.

Air tight connections of the Main Pipe E are made between the vehicles by flexible rubber hose, attached to the iron pipes, and fitted with metallic Coupling Heads K, suitably arranged to be readily coupled or uncoupled.

Fig. 4.

POSITION OF COUPLING HEADS BEFORE THEY CAN BE UNITED.



The couplings between two vehicles are united by placing their heads face to face nearly at right angles, as represented in Fig. 4, and then turning the projecting piece of the one into the corresponding groove of the other.

The two Coupling Heads are exactly alike, each being provided with a rubber packing ring, so arranged that whenever two Couplings are united, these rings face against each other. The air pressure in the Main Pipe tends to force the rings together, thus forming an air tight joint, which becomes tighter with increase of pressure.

If these Couplings be forcibly drawn apart by

a separation of the train, the Brakes are applied with full force, but no damage is done to the Couplings, as the rubber rings are pressed back into their respective cases sufficiently far to permit the projecting pieces to disengage from their grooves.

When the Couplings are disconnected they should invariably be attached to the dummy couplings, to avoid dust and sand collecting in them.

The main pipe of every vehicle is also provided at either end with a Stop Cock N, located near the connection with the Hose Coupling K. These Coupling Cocks are for the purpose of retaining the air pressure, stored in the brake apparatus of vehicles temporarily detached from a train.

If the Main Pipe is bent upwards at the ends of the vehicles, as represented on the annexed plates, the Coupling Cocks N are of the straight pattern. These Cocks are open when their handles are at right angles to the pipes, as shewn in Fig. 5, and closed when the handles are parallel with the pipes, as represented in Fig. 6.

On vehicles intended to be employed for very long trains it is preferable not to use swan necks in the Main Pipe. In this case Coupling Cocks of the bent pattern are screwed to the ends of the Main Pipe below the buffer beams. These bent Cocks are open when their handles stand parallel with the pipes, as shown in Fig. 7, and closed when the handles stand across the pipes as represented in Fig. 8.

Straight Coupling Cock.

Fig. 5.

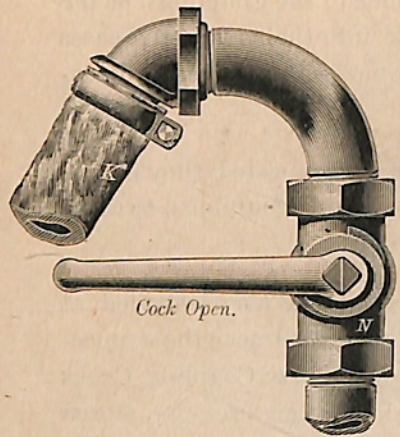
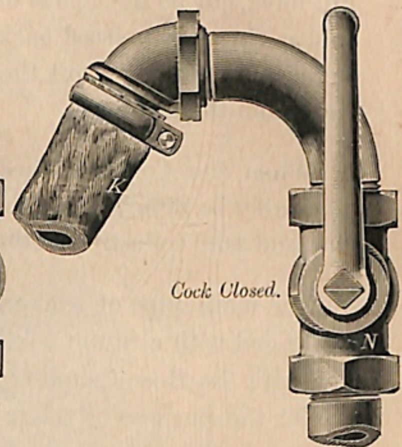


Fig. 6.



Bent Coupling Cock.

Fig. 7.

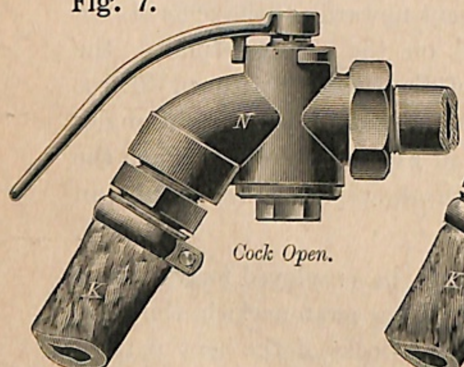
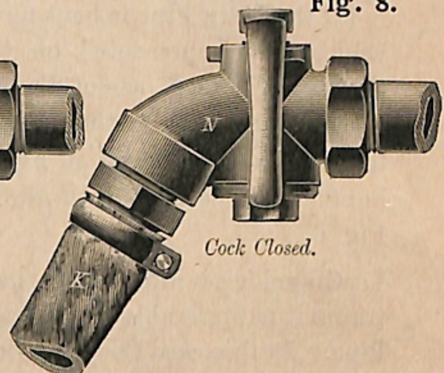


Fig. 8.



Whenever two Couplings are united, the corresponding Cocks must at once be opened to allow a free communication of air through the Main Pipe. Before the Couplings are separated the corresponding cocks must always be closed.

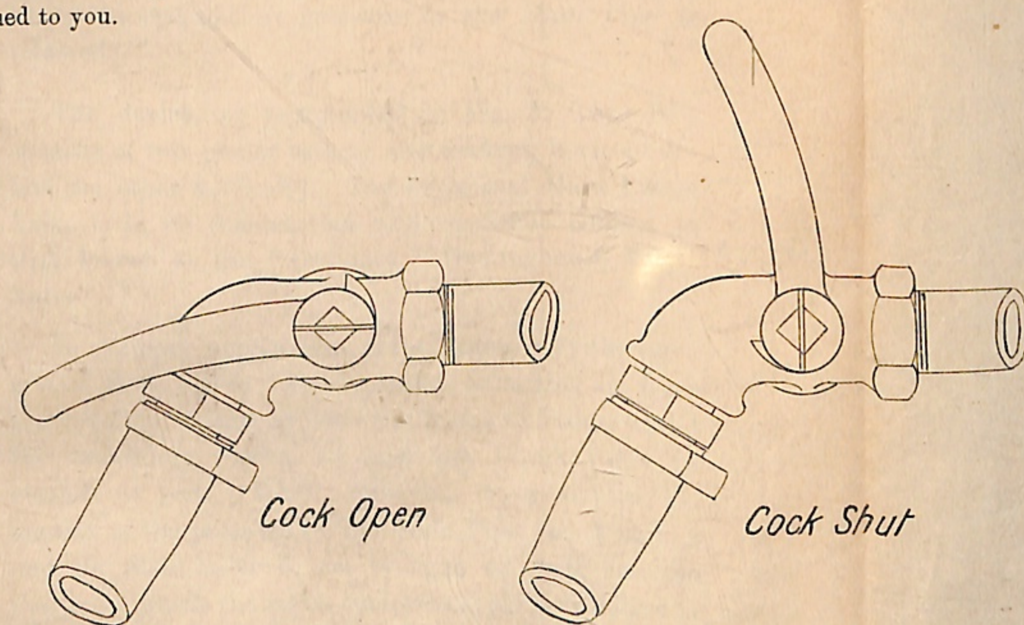
NEW SOUTH WALES GOVERNMENT RAILWAYS.

Chief Mechanical Engineer's Office,
Eveleigh, *3rd August*, 1894.

No. 1,000.

NOTICE TO ALL CONCERNED.

The Staff are hereby informed that an improved pattern of Coupling Cock (as illustrated below), for use in the train pipe of Westinghouse Brake, is now being supplied in place of that illustrated by figures 7 and 8, on page 30 of the Westinghouse Instruction Book, recently issued to you.



You will notice that the cock is open when the handle is parallel with the pipe, and closed when at right angles to the same.

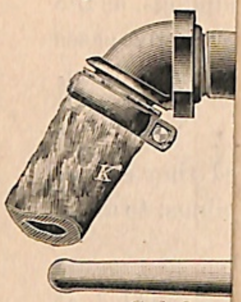
These new cocks are made of brass, and the handle being at the side, instead of on top, as on the old ones, is less liable to become broken.

NOTE.—This Circular to be pasted in the Westinghouse Instruction Book, recently issued to Drivers and Guards.

W. THOW,
Chief Mechanical Engineer.

S

Fig. 5.



Cock Open.

Fig. 7.

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Quick-Acting Triple Valve.

This Valve forms the essential part of the Quick-Acting Westinghouse Brake apparatus. It is operated by the variations of pressure in the Main Pipe, in such a manner, that it automatically admits compressed air to the Brake Cylinder of the vehicle to which it is attached whenever the pressure in the Main Pipe is reduced, and discharges the compressed air from the Brake Cylinder, when the original air pressure in the Main Pipe is restored.

The device, as represented in Fig. 9, (page 32), consists of two piston valves, one working horizontally and the other vertically. The horizontal Main Piston Valve is in its construction and operation similar to that known as the "Ordinary" Westinghouse Triple Valve.

In ordinary applications of the Brake, only the horizontal Main Piston Valve operates, admitting air from the Auxiliary Reservoir into the Brake Cylinder, whilst the Secondary Piston 13, and the Check Valve 18 remain at rest. When, however, on a sudden reduction of the pressure in the Main Pipe, the Piston 5 and its Slide Valve 6, are brought to their extreme position towards the right, compressed air is admitted to the upper side of the Secondary Piston 13, which, being driven down, opens the Check Valve 18, thus admitting compressed air from the Main Pipe to the Brake Cylinder, which at the same time, is also charged with compressed air, admitted by the Slide Valve 6, from the Auxiliary

Fig. 9.

Quick-Acting Triple Valve.

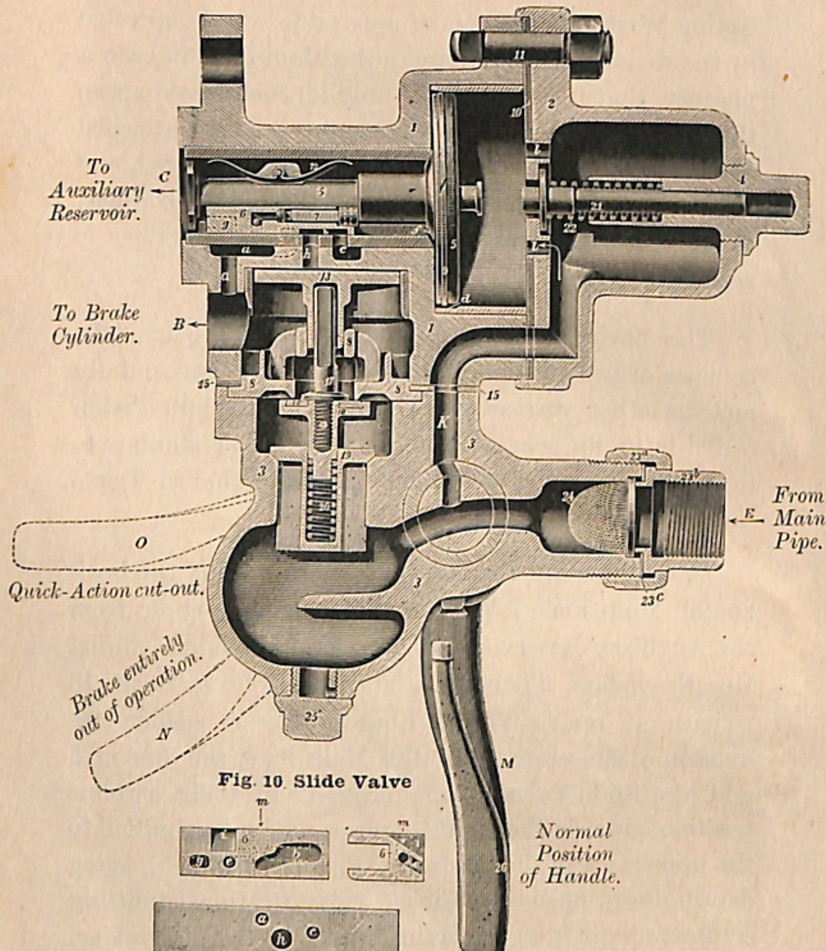

Fig. 10. Slide Valve

Fig. 11. Slide Valve Seat.

Reservoir. This discharge of air from the Main Pipe into the Brake cylinders, has the effect of reducing the pressure in the Main Pipe with great rapidity, which causes a practically simultaneous action of the Brakes, even on the longest goods trains.

The construction and action of the Quick-Acting Triple Valve may be fully described as follows :—

Enclosed in a Case 1 is a Piston 5, carrying with it a Slide Valve 6, which covers the Ports *a*, *c* and *h*, in the Valve Case 1.

When compressed air is allowed to flow from the Main Reservoir, through the Driver's Brake Valve to the Main Pipe, it enters the Triple Valve on each vehicle at E, flows through the passages K and *l*, forces the Piston 5 with the Slide Valve 6 to the position shown, and feeds past the grooves *d* and *f* into the Auxiliary Reservoir connected to C, which is thus charged with an air pressure of about 70 lbs. per square inch. In this position of the Piston 5 the Brake Cylinder is closed to the compressed air in the Auxiliary Reservoir by the Slide Valve 6, and to the air in the Main Pipe by a Check Valve 18 which is held to its seat by the pressure in the pipe. The same pressure now exists on both sides of the Piston 5, and the brake is released; the Brake Cylinder being in connection with the atmosphere through the passages B and *a*, the Cavity *b* in the Slide Valve, and the Exhaust Port *c*.

When the Brakes are to be moderately applied, as in ordinary stops, the "Quick-Acting" Triple Valve operates in exactly the same way as the "ordinary"

Westinghouse Triple Valve, the action being as follows:—

Upon a slight reduction of pressure being made in the Main Pipe, the Piston 5, owing to the excess of pressure in the Auxiliary Reservoir, will move towards the right, thereby closing the feed groove *d*, and at the same time unseating the Graduating Valve 7, which thus admits air through a side aperture *m* (Fig. 10.) to the passage *e*. The Piston 5 then takes with it the Slide Valve 6, thus closing the communication from the Brake Cylinder to the atmosphere, and opening the passage *e* of the Slide Valve to the Port *a* leading to the Brake Cylinder, into which compressed air from the Auxiliary Reservoir immediately flows and applies the Brake. The further movement of the Piston 5 and Slide Valve 6 is arrested by the decrease of pressure on the left side of the piston, caused by the discharge of air from the Reservoir into the Brake Cylinder. So soon as the pressure in the Reservoir is thus reduced a little below that in the Main Pipe, the Piston 5 moves slightly back to the left, and closes the Graduating Valve 7, while the Slide Valve 6 retains its position.

By simply regulating the reduction of pressure in the Main Pipe, and causing the motion of the Piston 5 and Graduating Valve 7 to be repeated, the Driver can gradually introduce any desired pressure into the Brake Cylinder, from zero up to full power.

When, however, it is necessary to apply the Brakes quickly and with full force, a rapid and considerable reduction of pressure is made in the Main Pipe, which

causes the Triple Valve Piston 5 and its Slide Valve 6 to move to the limit of the stroke, the Piston seating itself on the leather 10, and air from the Auxiliary Reservoir is admitted through the passage *h* to the secondary Piston 13, which is thus moved down, forcing the Valve 18 off its seat. The air pressure in the Main Pipe then lifts the Check Valve 19 and flows through the open Valve 18, and passage B, into the Brake Cylinder. This has the double advantage of utilizing the air from the Main Pipe in the Brake Cylinders, and also, by the rapid reduction in the main pipe pressure, of accelerating the application of the Brakes to all the vehicles of the train with extraordinary rapidity, so as to ensure practically simultaneous action throughout trains of almost any length.

In the quick-acting position of the Piston 5, just described, the passage *g* in the Slide Valve is in communication with the passage *a*, thus also admitting a flow of air from the Auxiliary Reservoir through the Port *a* into the Brake Cylinder, whilst that from the Main Pipe to the Cylinder takes place through the Valves 19 and 18. As soon as the pressure in the Brake Cylinder is equal to that in the Main Pipe, the Check Valve 19 is closed by the Spring 20, thus preventing a return of air to the Main Pipe.

In order to release the Brakes, compressed air from the Main Reservoir is admitted by means of the Driver's Valve into the Main Pipe, whence it enters the Triple Valve by the passages K and *l*, and forces Piston 5 and Slide Valve 6 to their original position. In the course of this movement the exhaust cavity *b* of the Slide Valve first connects the passage *h* to the exhaust port *c*, relieving the pressure from the top side of the Piston 13, which is returned to the position shown in Fig. 5 by the air pressure in the Brake Cylinder, whilst the Spring 20 closes the Valve 18. As the Slide Valve 6 completes its leftward movement, the cavity *b* also opens the passage *a* to the exhaust port *c*, which discharges the air from the Brake Cylinder and releases the Brakes. The Auxiliary Reservoir is again charged as before described, through the grooves *d* and *f*.

A Wire Gauze Strainer 24 is inserted to prevent dirt or grit entering the Valve.

To secure the simultaneous release of the Brakes, a nipple, having an aperture corresponding to the size of the Brake Cylinder with which it is used, is inserted in the mouth of the exhaust port of the Triple Valve.

By means of the cock in the lower part of the Triple Valve, the whole apparatus on a vehicle, or simply the quick action, may be put out of use without in any way affecting the action of the Brakes on other vehicles of the same train. In the vertical position M of the Cock Handle, the quick action is in use; by turning it to N the Brake is entirely put out of operation; whilst by turning still further to the position O, the quick action only is taken away, and the apparatus works in precisely the same manner as the "Ordinary" Westinghouse Brake.

Auxiliary Reservoir.

Every locomotive, tender and braked vehicle is provided with an Auxiliary Reservoir G, in which compressed air (supplied from the Main Reservoir C on the locomotive) is stored, ready to be used for applying the Brake on the vehicle to which the Reservoir G is attached.

The flow of air from the Main Pipe E to the Auxiliary Reservoir G, and from the latter to the Brake Cylinder H is controlled by the corresponding Triple Valve F, as fully explained on pages 33 to 35. The air pressure in the Auxiliary Reservoir should be about 70-lbs. per sq. inch when the Brake is in readiness for operation.

In the standard Quick-Acting Brake Apparatus, the Auxiliary Reservoir G, Triple Valve F, and Brake Cylinder H, are bolted together to form one piece, as represented on Plate II. The Reservoir G of this apparatus is made of cast iron, and contains a brass tube connecting the Triple Valve with the Brake Cylinder. The Reservoir is also provided on either side with a boss prepared to receive the Release Valve (see page 42), so that the valve may be placed on the side which is clear of the brake gear.

If for convenience of installation the Auxiliary Reservoir, Brake Cylinder and Triple Valve are separately arranged (as on engine and tender shown on Plate I), a welded wrought iron Reservoir G is employed, and connected to the corresponding Triple Valve F by means of an iron steam pipe of ½-inch internal diameter.