2 Sheets--Sheet 1.

G. WESTINGHOUSE, Jr.

Air-Valve for Power Brakes.

No. 168,359. Patented Oct. 5, 1875.

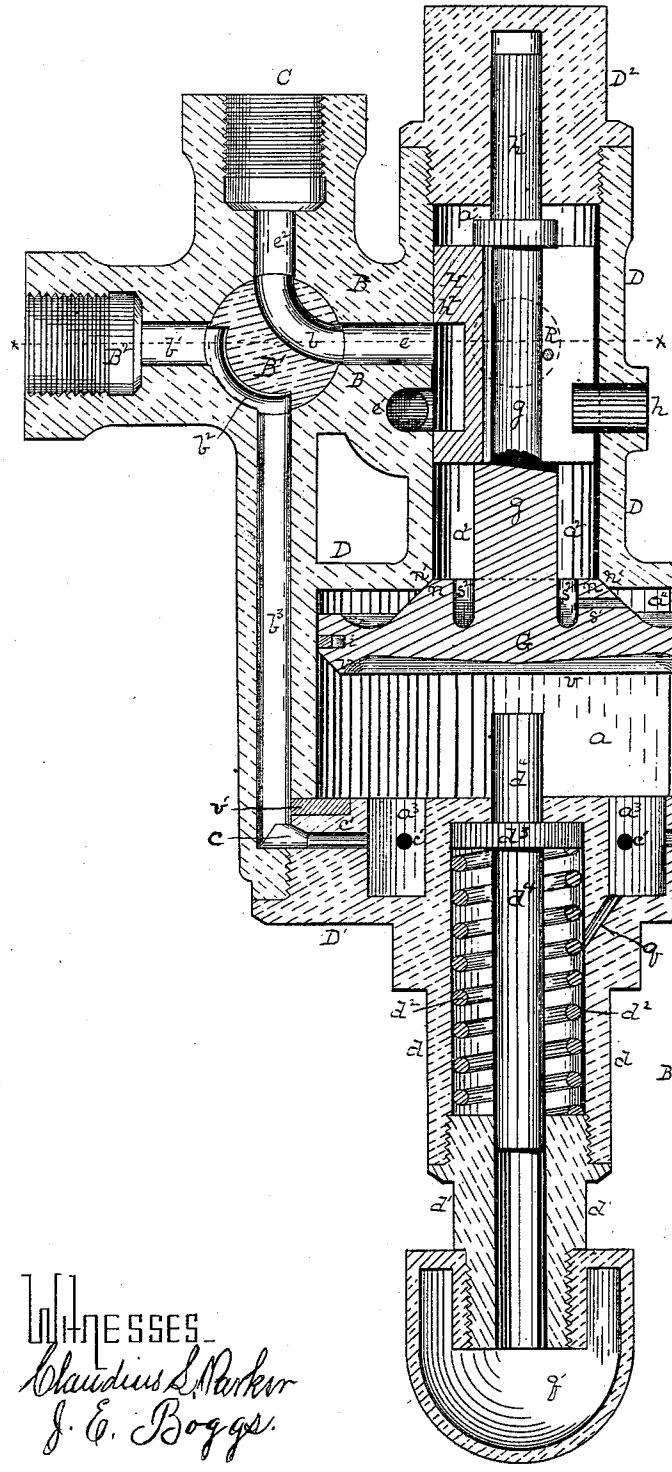

FIG. 1.

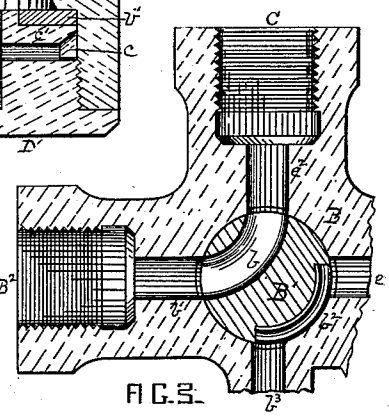

FIG. 2.

WITNESSES.
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INVENTOR.
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his Atty.

2 Sheets--Sheet 2.

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Air-Valve for Power Brakes.

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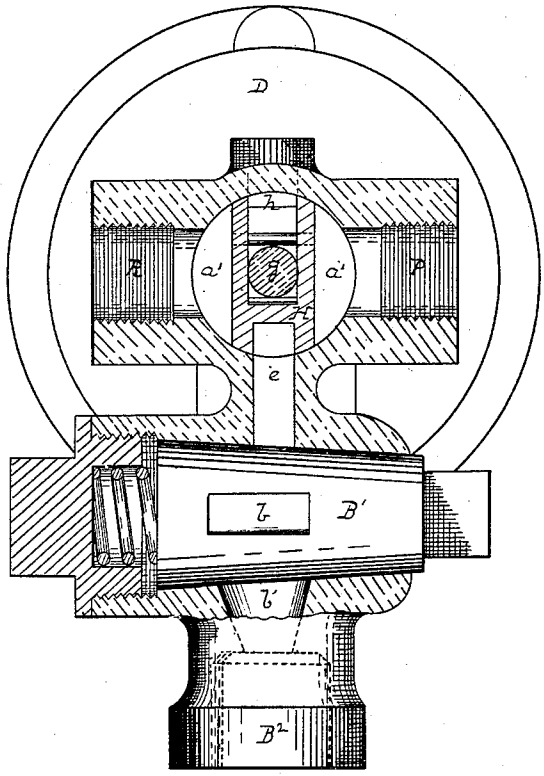

FIG. 2.

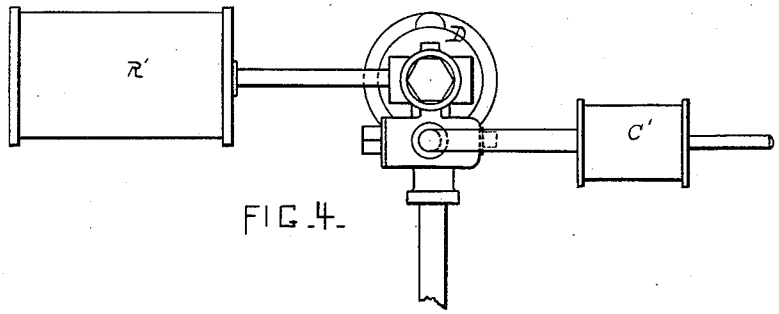

FIG. 4.

WITNESSES.

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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN AIR-VALVES FOR POWER-BRAKES.

Specification forming part of Letters Patent No. **168,359**, dated October 5, 1875; application filed August 19, 1875.

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Air-Valves for Power-Brakes; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a longitudinal and vertical sectional view of a valve-case, valves, connections, and ports, illustrative of my improvement. Fig. 2, Sheet 2, is a transverse section thereof through *x x*, Fig. 1. Fig. 3 Sheet 1, is a detached sectional view of the cock and connecting-ports; and Fig. 4, Sheet 2, illustrates in outline the arrangement of my improved valve device in a system of air-brake apparatus.

My present improvement is particularly designed for use as a part of a system of brake apparatus now generally known as the Westinghouse automatic brake, and consists of certain improvements in the devices by the agency of which the flow of the compressed air, both as to direction and amount to and from the auxiliary air-reservoirs and brake-cylinders, is effected and regulated; and it further consists in the incorporation of suitable devices, by means of which the parts peculiar to the automatic system of operation are thrown out of operation or cut off, so that the brakes shall be set or put on by the direct admission of air from the brake-pipe to the brake-cylinder.

The valve-case D is made of cylindrical form, for the most part, though of different diameters at different points, as shown. It incloses a piston-chamber, a, a valve-chamber, a^1, and a communicating passage, a^2. A screw-cap, D^1, closes its larger end. In the periphery of this cap I cut an annular air-groove, c, from which a series of radial air-ports, c', in any desired number, open into an annular space, a^3, which latter opens directly into the piston-chamber a. This cap has a tubular extension, d, into the outer end of which I screw a stem-guide or bush, d^1. The upper end of the bush affords a bearing for one end of a spiral spring, d^2, which latter, at its opposite end, bears against a collar, d^3, on the stem d^4, so as to hold the stem up when not depressed, as hereinafter described. One end of the stem d^4 passes through a suitable aperture in the cap D^1 and enters the piston-chamber a, and the other end is guided in the tubular aperture of the bush d^1.

From the valve-chamber a^1 a side port, R, leads by suitable pipe connections to an auxiliary reservoir, R′, of the usual or any suitable construction. In this chamber is a slide-valve, H, from beneath which a port, e, leads through a bracket-arm, B, in which is formed a cock-case, and through a cock, B′, arranged therein by a port or passage to a coupling, C, from which, by suitable connections, communication is effected with the usual brake-cylinder C′. Another port, e^1, leads from the valve-chamber a^1 to the external air, and these ports e e^1 are in such proximity at their valve-chamber ends that they may be brought into communication, or one cut off from the other, by the movement of the valve H. This valve is kept from revolving by means of a pin, h, entering a groove in its back or top, or by other suitable means, and is fitted with any desired known appliances for adapting it the better for its work.

The piston-chamber a contains a piston, G, suitably packed by a leather or metallic ring or rings, i, such as will give a close joint and work with small friction. From its upper side a stem, g, leads to and carries the valve H, and the upper extended end h' of the stem is guided, if need be, in a tubular socket made in the upper cap D^2, which closes the upper end of the case D. Hence the valve H is operated by the piston G. The lower face of the piston has a V-shaped seat, v, which, at the lowest possible point of the downstroke of the piston G, seats on a rubber seat, v'. On the upper side of the piston G I make an annular valve, n, and a seat, n', on the case, so that these shall come together and close direct through-communication, or prevent leakage when the piston G is at its highest point of stroke. When in this position, however, it uncovers a port, s, which is made in the case

D, so as to make an open communication from one side of the piston to the other. The air passing through this port then enters the space a^4 above the piston, and thence passes by one or more radial ports, s^1, into the annulus s^2, and thence along the communicating passage a^2, and out by the port R, to the auxiliary reservoir R′.

The introduction of compressed air from the brake-pipe is effected by suitable pipe-connection through the coupling B^2. A port, b^1, leads thence by a groove, b^2, in the face of the plug B^1 to an air-passage, b^3, made along the side of the case D, which passage b^3 opens into the annular groove *c*. The plug or cock B^1 is made to revolve in its case or seat, for purposes presently to be explained. The arrangement of its communicating passages being shown, its construction in other respects is such as is well known in the art. The coupling-port shown at P is simply made for convenience, and is to be closed by an ordinary screw-plug.

The devices thus described are arranged on each car with an auxiliary air-reservoir, R^1, for containing compressed air stored up and ready for use, and also with a brake-cylinder, C^1, for applying the power by the usual piston and stem. When used as a part of the automatic apparatus the cock B^1 is kept in the position shown. The engineer by his pump keeps up the desired air-pressure, and allows this pressure to be transmitted back, so that entering the coupling B^2 it shall pass, by the ports and passages b^1 b^2 b^3 *c* c^1 a^3, into the piston-chamber *a*, and by its pressure on the under side of the piston G shall seat it upward, as shown, and at the same time bring the valve H into the position shown. The compressed air, while still holding the valve G up, will pass, by the ports and passages *s* a^4 s^1 s^2 a^2 R, into the auxiliary reservoir R^1, so as to charge it and keep it charged at a working pressure. The valve H at the same time covers the ports *e* e^1, so that none of the compressed air thus introduced can escape through either; but such ports *e* e^1 being then and thereby brought into communication, any air in the brake-cylinder C′ above atmospheric pressure will escape, by C e^2 *b* *e* e^1, to the external atmosphere. The brakes will then be off, and the train in running condition.

Now, to apply the brakes with full force, the engineer, by opening a cock or valve in the brake-pipe, reduces the air-pressure therein, say, fifteen pounds per square inch, more or less. The pressure is then reduced in chamber *a* to a corresponding amount. Back pressure from auxiliary reservoir R^1 then depresses the piston G, so as to pass and cut off the supply-port *s*, and shifts the valve H, so that it shall uncover the port *e*, but cover e^1. Then the stored-up air in R^1 will pass the end of the valve H, and, by the ports and passages *e* *b* e^2 C, will go to the brake-cylinder C′, and by shifting the piston therein apply the brakes in the usual way. By restoring the pressure in the brake-pipe the engineer shifts the piston G up again to its upper seat, so as to reopen the line of supply-ports, and shifts the valve H to the position shown, so as to cut off communication from the auxiliary reservoir to the brake-cylinder, but open communication from the latter to the external atmosphere, as already described. The brakes are thus released. When the engineer wishes to apply the brakes with less than the maximum power he reduces the air-pressure in the brake-pipe a correspondingly less amount.

The position of the piston G in its chamber *a* is regulated chiefly by variations of air-pressure on its opposite sides, and by lessening or increasing slightly the air-pressure in *a* below the piston the position of the piston may be changed at pleasure, and with it, of course, the valve H.

It will be observed that the valve H has at h^2 a length and breadth of face such that it may entirely cover the port *e*. Hence the piston G may be brought down so that while entirely closing the supply-port *s* it shall bring the valve H to a position where it shall uncover only a small part of the port *e*, or any desired part. Then as soon as the desired amount of air-pressure has passed through *e* to the brake-cylinder a slight upward movement imparted to the piston G will cause the valve-face h^2 to cover entirely the port *e*, and remain in that position, so that the air already thus admitted to the brake-cylinder will be retained there, and the brakes will be held to the wheels with a corresponding force. By again lowering the piston G and with it the valve H this force may be increased by an additional charge of compressed air; or by a farther upstroke the ports *e* and e^1 may be brought into communication, and the brakes so be released.

In order to render this operation of graduating the air-pressure in the brake-cylinders more easy and certain I employ the stem d^4 and spring d^2, with a degree of power in the spring approximately equal to the weight and friction of the piston and valve, and so arranged that when the desired amount of air-pressure has passed into the brake-cylinder through the port *e*, and the air-pressure on the piston G is about the same above and below, the spring and stem will almost instantly shift the valve H so as to cover the port *e* and retain the pressure in the brake-cylinder. For practical purposes I deem it best that the stem d^4 should be of such length that the piston will engage it when the slide-valve H covers the port *e*, so as to cut off the supply of compressed air to and exhaust from the brake-cylinder. This pressure may then be increased or decreased at pleasure in the manner already described.

As water is sometimes condensed in the operations described, I provide for getting rid of it by a drain-port, *q*, and a drip-cup, *q′*, screwed onto the lower end of the bush d^1.

As it sometimes happens that a car fitted

up with the automatic apparatus is on a connecting line, made up into a train, the other cars of which are furnished with apparatus substantially such in some or all material features as that described in patent granted me April 13, 1869, it is important to convert the former into the latter. For this purpose I use the cock B^1. By turning it, as in Fig. 3, so that the port or groove b shall communicate at its opposite ends with the ports e^2 and b^1, it will be seen that all the rest of the apparatus will be effectually cut off, and a direct passage-way be made from the brake-pipe to the brake-cylinder. The compressed air is then turned on and turned off in applying and releasing the brakes in the manner generally practiced in that system of apparatus. Also, as it sometimes happens that the brake apparatus of a car will get out of order, so as to to be inoperative, I provide for cutting off such car in such emergency by bringing a full side of the cock B′ opposite the port b^1, which will prevent all ingress of compressed air; and in detaching a car from a train where the automatic brake is in use I provide against the application of the brakes by leakage or escape of the air from the chamber a by means of the same cock B′. For this purpose I shift it to the position shown in Fig. 3, or to any other position which will prevent the air in the reservoir R′ from being charged into the brake-cylinder C′; and for the purposes described any suitable form of four-way cock may be substituted, in combination with the same, or a substantially-like arrangement of ports.

The forms of the valves, ports, and communicating-passages, and to a certain extent their arrangement, may be changed, and all such modifications of the apparatus described as include a piston and slide-valve, operated by air-pressure, for charging alternately and successively an auxiliary air-reservoir and brake-cylinder, and do not materially depart in their combinations and modes of operation from what is above set forth and hereinafter claimed, I hereby include as within the scope of my invention. Also, the reversible cock B′, with an arrangement of ports substantially such as described, may be used in connection with the automatic triple valve now in common use, or other like apparatus, the combination and function remaining in this respect substantially the same.

One reason for using and preferring a slide-valve, H, which may be of any known suitable construction, instead of a piston-valve, is that the former does not require any packing, and may be worked with less friction. I have found that any considerable amount of friction interferes seriously with that ready, accurate, and certain motion of the valve which is required in this kind of a device for the purpose set forth.

I claim as my invention—

1. In an air-brake apparatus, a moving piston arranged in the line of air communication, operated by air-pressure, and a slide-valve, H, connected therewith, in combination with suitable air ports and passages leading to an auxiliary reservoir and brake-cylinder, whereby such reservoir and cylinder will be charged with compressed air alternately and successively by the throw or motion of the piston and valve, substantially as set forth.

2. The port s, in combination with air-chamber a, piston G, slide-valve H, and auxiliary reservoir and brake-cylinder ports, arranged substantially as set forth.

3. The slide-valve H, in combination with an air-reservoir and brake-cylinder, arranged and operative substantially as set forth.

4. In combination with the piston G, a suitable line of ports and passages, $s\ a^4\ s^1\ s^2\ a^2$, for supplying compressed air to the auxiliary reservoir while the piston is on its upper seat, substantially as set forth.

5. In combination with a piston, G, operated by air-pressure, a stem, d^4, and spring d^2, substantially as set forth.

6. The port q in an apparatus substantially such as described, for draining off the water of condensation from the air chambers or spaces to a drip-cup, q'.

7. A reversible four-way cock, in combination with a single line of charging-pipe and supply-port therefrom, a brake-cylinder port, and ports leading to and from suitable automatic devices, substantially as set forth, whereby either of the modes described of operating the brakes may be employed at pleasure without changing the port of supply.

8. An arrangement of ports $b\ b^1$ in the cock B′, ports b^3 and e, communicating with the automatic apparatus, and ports $b^1\ e^2$, communicating with the brake pipe and cylinder, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEORGE WESTINGHOUSE, JR.

Witnesses:
JOHN D. MORELAND,
S. HOWARD SPRAGUE.