(No Model.) 5 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr.

QUICK ACTION VALVE FOR AIR BRAKES.

No. 538,001. Patented Apr. 23, 1895.

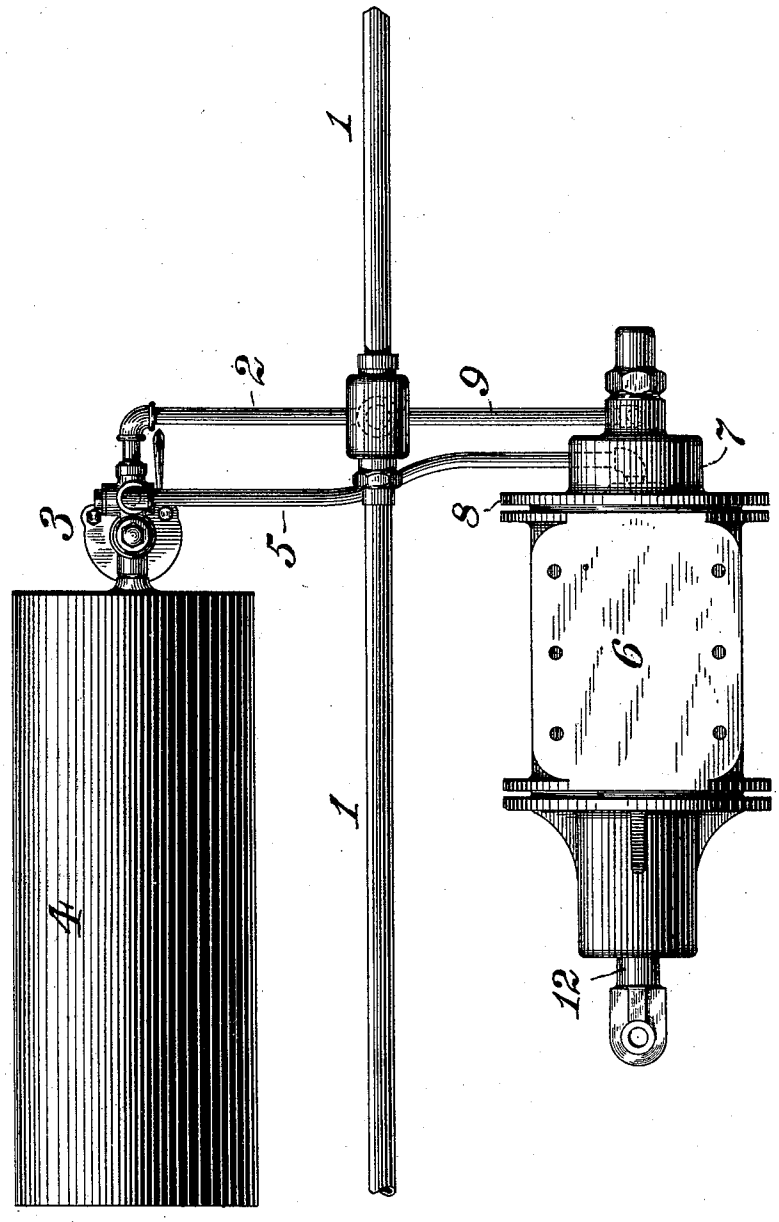


FIG. 1.

WITNESSES:

T. J. Hogan

F. E. Gaither

INVENTOR,

Geo. Westinghouse, Jr

By Jos. Rowden Bell,

Att'y.

(No Model.) 5 Sheets—Sheet 2.

G. WESTINGHOUSE, Jr.

QUICK ACTION VALVE FOR AIR BRAKES.

No. 538,001. Patented Apr. 23, 1895.

FIG. 3.

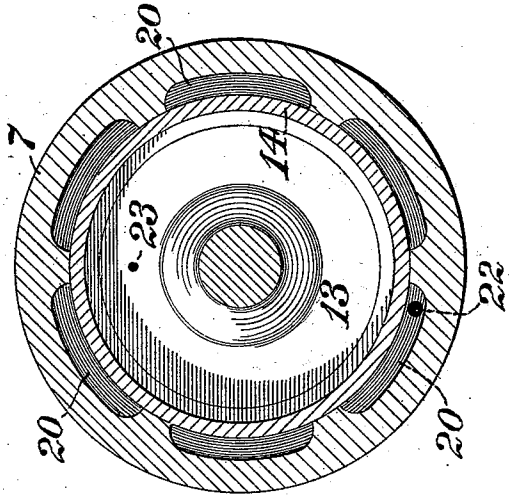
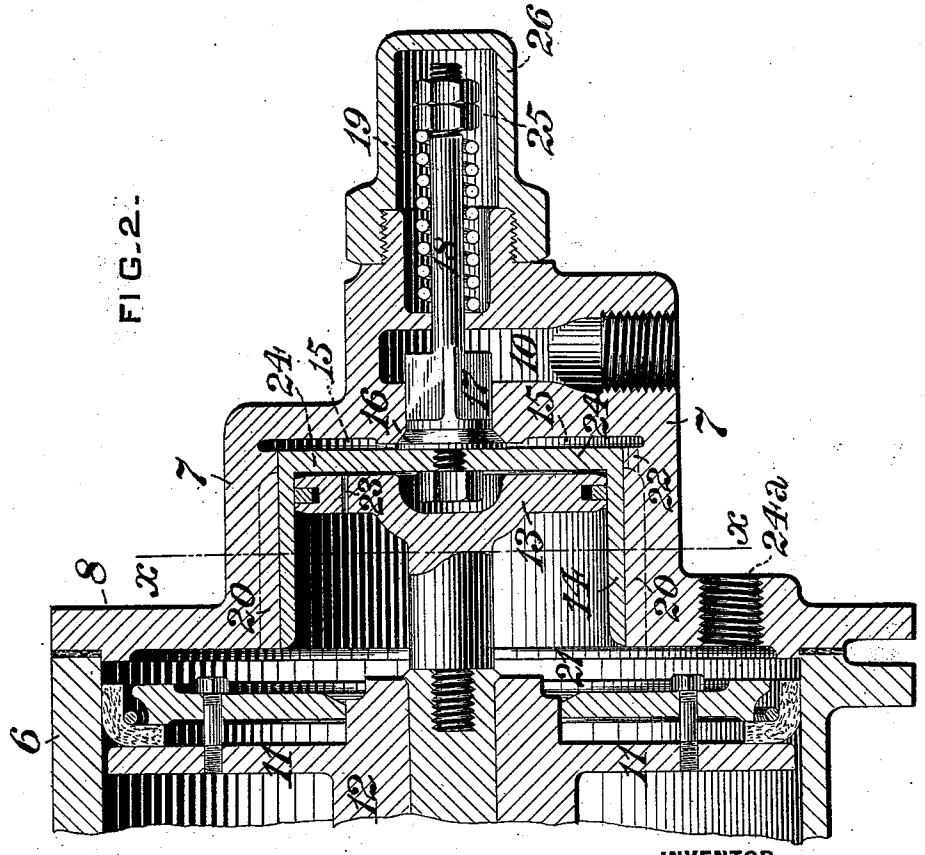


FIG. 2.



WITNESSES:

F. J. Hogan.

F. E. Gaither

INVENTOR,

Geo. Westinghouse, Jr

by J. Bowden Bell Att'y.

(No Model.) 5 Sheets—Sheet 3.

G. WESTINGHOUSE, Jr.

QUICK ACTION VALVE FOR AIR BRAKES.

No. 538,001. Patented Apr. 23, 1895.

FIG. 5.

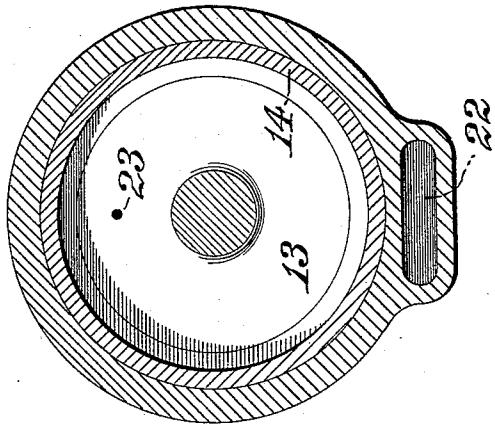
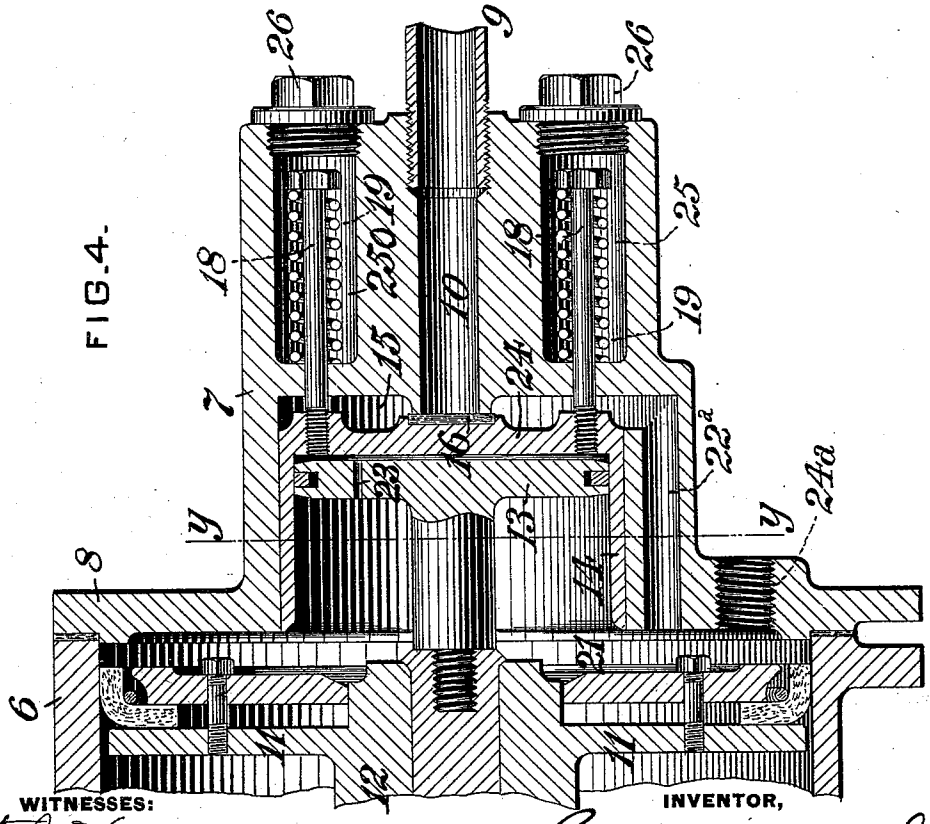


FIG. 4.



WITNESSES:

T. J. Hogan

F. E. Gaither

INVENTOR,

Geo. Westinghouse, Jr

By J. Stewardson Bell Att'y.

(No Model.) 5 Sheets—Sheet 4.

G. WESTINGHOUSE, Jr.

QUICK ACTION VALVE FOR AIR BRAKES.

No. 538,001. Patented Apr. 23, 1895.

FIG. 6.

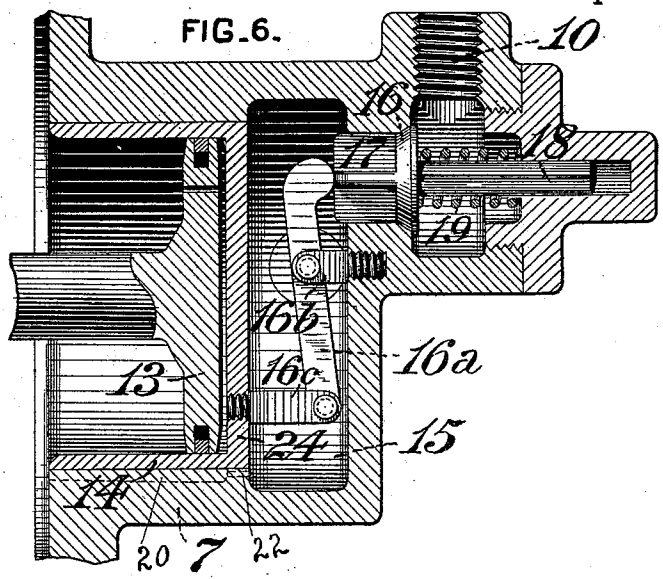
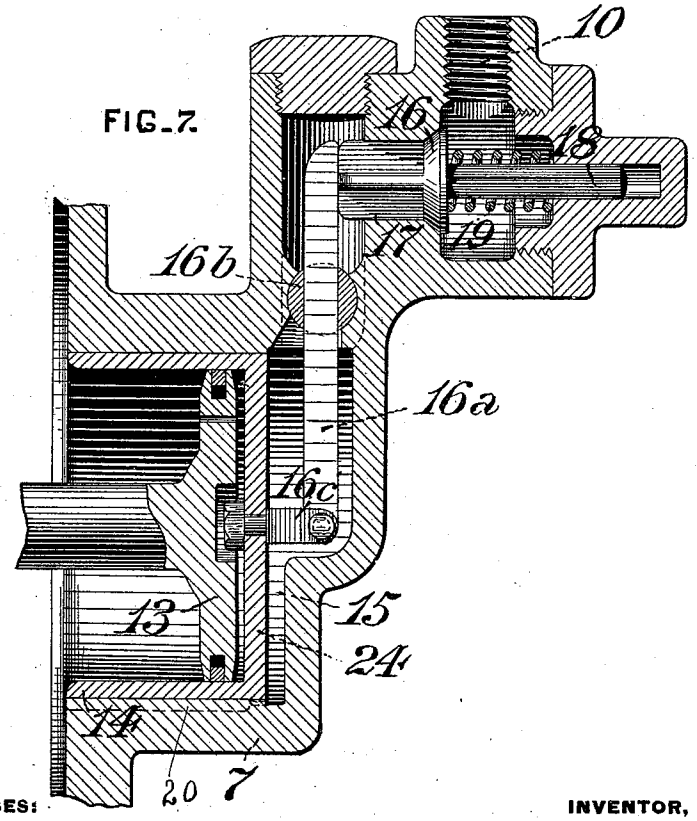


FIG. 7.



WITNESSES:

T. J. Hogan.
F. E. Gaither

INVENTOR,

Geo. Westinghouse Jr
by Dowdew Bell.
Att'y.

(No Model.) 5 Sheets—Sheet 5.

G. WESTINGHOUSE, Jr.

QUICK ACTION VALVE FOR AIR BRAKES.

No. 538,001. Patented Apr. 23, 1895.

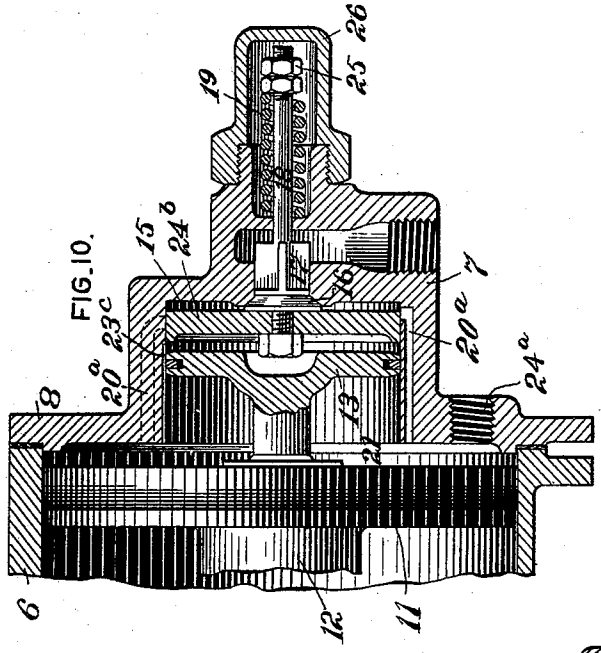


FIG. 10.

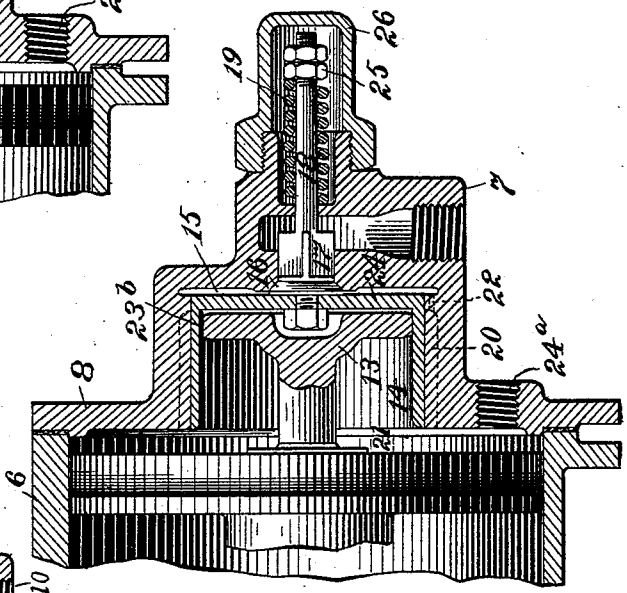


FIG. 9.

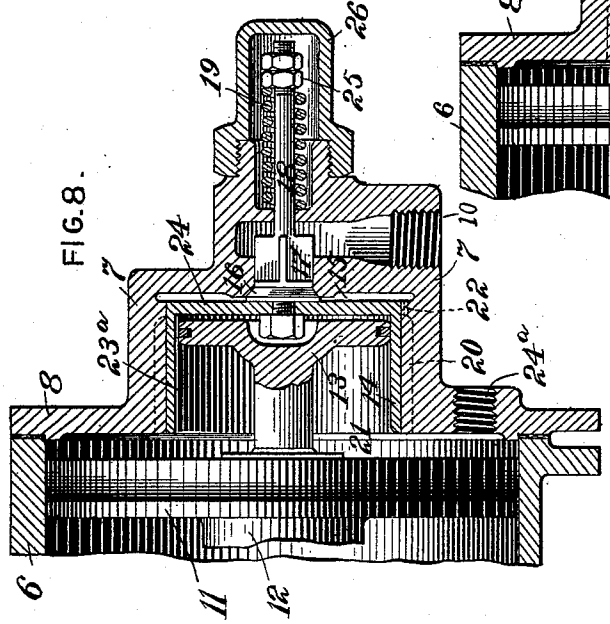


FIG. 8.

WITNESSES:

T. J. Hogan.

F. E. Gaither.

INVENTOR,

Geo. Westinghouse, Jr.

by Johnson Dell.

Att'y.

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

QUICK-ACTION VALVE FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 538,001, dated April 23, 1895.

Application filed March 21, 1892. Serial No. 426,748. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Quick-Action Valves for Air-Brakes, of which improvement the following is a specification.

The object of my invention is to provide means whereby the brakes on railway trains may be applied with great force and rapidity and practically simultaneously on all the cars of a train.

To this end, my invention, generally stated, consists in certain novel devices and their combination with an automatic fluid pressure brake system whereby a rapid reduction of train pipe pressure and a consequently rapid, powerful, and nearly simultaneous application of the brakes may be obtained.

The improvement claimed is hereinafter fully set forth.

My invention is adapted to be operated in connection with an ordinary triple valve, that is, a valve controlling the passage of air from the train pipe to the auxiliary reservoir, from the auxiliary reservoir to the brake cylinder, and from the brake cylinder to the atmosphere; the triple valve being connected, as usual in an automatic brake system, with an auxiliary reservoir, and, by means of a line of pipe, with the engineer's valve.

My improvement applied in an ordinary automatic system provides a quick acting brake system which operates to produce substantially the same results as are obtained by the employment of the quick acting devices shown and described in my Letters Patent No. 360,070, dated March 29, 1887; No. 376,837, dated January 24, 1888, and No. 448,827, dated March 24, 1891.

A car fitted with my present improvement may be operated in connection with other cars in a train having any of the above quick action devices, or which are fitted with the ordinary triple valve without quick action devices.

In the accompanying drawings, Figure 1 is a plan or top view of the fluid pressure brake apparatus of a car with my improvement forming a part thereof; Fig. 2, a central longitudinal section through my improvement and a portion of the brake cylinder; Fig. 3, a transverse section, at the line x, x, of Fig. 2; Fig. 4, a longitudinal central section of a modification of my improvement; Fig. 5, a transverse section at the line y, y, of Fig. 4; Figs. 6 and 7, longitudinal central sections of modifications in which I employ a lever for opening the valve; Figs. 8 and 9, central sections showing slight modifications of Fig. 2, and Fig. 10 a similar section, showing a modification in which the supplemental piston is formed without a trunk.

In the brake apparatus illustrated, the train pipe, 1, is connected, as usual in automatic brake systems, by the branch pipe, 2, with the triple valve, 3, and through the triple valve with the auxiliary reservoir, 4; the triple valve being connected by the pipe, 5, with the brake cylinder, 6. These are the usual connections of an automatic brake apparatus in which a plain triple valve is employed.

As shown in Figs. 1, 2, and 4, my quick acting device is arranged within a casing, 7, formed on the head, 8, of the brake cylinder, 6; and the casing 7 is connected with the train pipe, 1, by a branch pipe, 9, which is attached to the outer end of a passage 10 in the casing. Within the brake cylinder, 6, is the usual brake piston, 11, the piston rod, 12, of which is connected to the mechanical devices for moving the brake shoes. Attached to the brake piston, 11, is a smaller piston, 13, fitting the interior of a cylindrical shell 14, which fits in a chamber, 15, formed in the casing or projection 7 on the cylinder head 8.

As shown in Fig. 2, the cylindrical shell 14 is open at its inner end toward the brake cylinder and is closed at its outer end by a head 24 which forms a partition between the piston 13 and the head of chamber 15. The head 24 is connected to, or has formed on it, a valve, 16, which controls a port, 17, between the passage 10 and the chamber 15. The head 24 is in reality a supplemental piston with a trunk 14 formed on it, which may be omitted, or a diaphragm may be substituted for it. The stem 18 of the valve extends into a chamber 25 covered by a cap 26 and is surrounded by a spring, 19, the outer end of which bears

against a nut or shoulder on the end of the stem, the tension of said spring acting to keep the valve closed against the pressure in the train pipe when the brakes are off or when a service application of the brakes is made. Grooves, 20, are formed in the cylindrical wall of the chamber 15 and extend from the brake cylinder space, 21, into which they open, nearly to the outer end of the chamber 15, with which they communicate, in the normal position of the apparatus, through the small opening 22.

In the normal condition of the apparatus, that is, when the brakes are released, the parts are in the positions shown in Fig. 2, and the brake cylinder piston 11, the piston 13, and the cylindrical shell 14, are then exposed to atmospheric pressure only. The brake cylinder is in communication with the atmosphere through the opening 24^a, branch pipe 5, and the exhaust port of the triple valve. The outer end of the chamber 15 is in communication with the brake cylinder through the port 22 and groove 20; and the space on the outer side of the piston 13 is in communication with the brake cylinder through the small passage 23 formed in the piston. The passage or chamber 10 is exposed to the pressure in the train pipe with which it is connected by the branch pipe 9.

An ordinary service application of the brakes is made, as usual, by means of a moderate and gradual reduction of train pipe pressure, caused by releasing air from the train pipe through the proper openings in the engineer's valve. The air from the auxiliary reservoir passes through the triple valve, branch pipe 5, and opening 24^a, to the brake cylinder, and moves the brake piston 11 to the left, and with it the small piston, 13. At the same time, a portion of the air that has been admitted to the brake cylinder passes through the groove 20, and passage 22 to the outer end of the chamber 15, and through the passage 23 to the outer side of the piston 13. The port 23, through the piston 13, is limited in size, but as the movement of the pistons in making a service application of the brakes is not very rapid, the port 23 is of sufficient capacity to permit a practical equalization of the pressures on its opposite sides, or, at least, to prevent the production of more than a slight degree of vacuum between the piston 13 and the head or piston 24 of the cylindrical shell 14; and as the brake cylinder is in communication with the outer end of the chamber 15 by means of one of the grooves 20 and the passage 22, a practical equilibrium of pressures is maintained on the opposite sides of the piston 13 and of the head or piston 24 of the cylindrical shell 14 during the movement of the piston 13.

When it is desired to make an emergency application of the brakes a sufficiently great and rapid reduction of train pipe pressure, made either through the engineer's valve or by the parting or rupture of the train pipe, causes the triple valve to open a passage for air from the auxiliary reservoir to the brake cylinder of such capacity that the pistons 11 and 13 are moved more rapidly than in making service applications of the brakes, and a partial vacuum is thereby formed between the piston 13 and the head 24 of the cylindrical shell 14; the passage 23 being too small to permit a sufficient flow of air to prevent the formation of this vacuum when the piston 13 is moved rapidly away from head 24. The head or piston 24 of the shell 14 is then exposed on its inner side to a very low pressure and on the outer side to the pressure in the brake cylinder which communicates through one of the grooves 20, and the passage 22 with the outer end of chamber 15. This difference of pressures together with the train pipe pressure acting on valve 16 forces the cylindrical shell 14 to the left, unseats the valve 16 and permits air from the train pipe to flow into the chamber 15 and, through the grooves 20, the outer ends of which have been uncovered by the shell 14, into the brake cylinder, increasing the force with which the brakes are applied and causing a great and rapid reduction of train pipe pressure which quickens the action of the brakes on the next succeeding car, and so on throughout the train. As the stroke of the pistons is considerably greater than the depth of the cylindrical shell 14 or the chamber 15, the piston 13 before it reaches the end of its stroke, is drawn entirely out of the shell 14, and the air in the brake cylinder then rushes into the shell 14, effecting an equalization of pressures on the two sides of the head 24 and the spring 19 then closes the valve 16.

As in my several Letters Patent before referred to, my present improvement operates to locally exhaust air from the train pipe to cause a great and rapid reduction of train pipe pressure, and this effect is not dependent on the subsequent disposition of the air, as it may be permitted to escape to the atmosphere, to a separate chamber, or to the brake cylinder. There is, however, a great advantage obtained by exhausting the train pipe air into the brake cylinder because the final pressure obtained in the brake cylinder, after the auxiliary reservoir and brake cylinder pressures have equalized, is much greater than it would be if the air from the auxiliary reservoir flowed into an empty brake cylinder. Not only is the final pressure in the brake cylinder greater but the accretion of pressure therein is more rapid and the brake pistons are consequently moved outward with greater speed and force.

In Figs. 4 and 5 I have shown a modification of my improvement in which the operation is substantially the same as before described, but which differs slightly in specific construction from that illustrated in Fig. 2. The grooves 20 are, in this case, omitted, and the brake cylinder space, 21, communicates with the outer end of the cylinder 15 through

the passage 22ª only. The branch pipe 9 from the train pipe opens into the passage 10 which is closed by the valve, 16, said valve being, in this case, formed on the head or piston 24 of the shell 14. The valve 16 is not provided with a stem, as in Fig. 2, but there are two stems, 18, surrounded by springs, 19, which abut at one end against a head or nut on the outer ends of the stems and at the other end against the casing. These stems are screwed into the head 24 of the shell 14 and are acted on by the springs to resist the movement of the shell 14 to the left and the unseating of the valve. The springs 19 and the outer ends of the stems 18 are inclosed in the chambers 25 the ends of which are closed by screw caps 26.

The passage 23 through the piston 13 may be omitted and a groove 23ª in the inner surface of the shell 14 may be employed, as shown in Fig. 8, or the piston 13 may be sufficiently loose in fit to permit the necessary flow of air around it, or a groove, 23ᵇ, may be formed in the edge of the piston 13, as indicated in Fig. 9. Further the piston 13 may, if preferred, be fitted to move in the cylinder 15 instead of in the shell 14 and a piston or diaphragm 24ᵇ to the right of piston 13 may take the place of the shell or trunk, 14, and its head 24, as shown in Fig. 10, in which case the passage 23 through the piston 13 may be employed, or a passage 23ᶜ may be formed in the casing in lieu of the passage 23 through the piston.

When the construction shown in Fig. 10 is employed passages 20ª take the place of the grooves 20 shown in Figs. 2 and 3. The passages 20ª open into the brake cylinder at one end and into the cylinder 15 at the other, or outer, end, but their outer ends are normally closed by the piston 24, except that one of them extends a little beyond the piston 24, and they are opened only to permit the passage of train pipe air to the brake cylinder in making emergency applications of the brakes.

In Figs. 6 and 7 I have shown two modifications in which the valve 16 is so arranged that the train pipe pressure tends to hold it to its seat. Instead of opening toward the chamber 15 it opens in the opposite direction against the spring 19 and the train pipe pressure. In order to accomplish this, instead of connecting the valve directly to the head 24 of the shell 14, I employ a lever which is connected at one end to the head 24 of the shell 14 and at its other end bears on the winged stem 17 of the valve 16, the fulcrum 16ᵇ being between the ends of the lever so that the valve 16 and the head 24 move in opposite directions. In Fig. 6 the valve 16 opens directly into the cylinder 15, the opposite end of the lever being connected by the bifurcated stud 16ᶜ to the head 24 to one side of its center. In Fig. 7 the valve 16 opens into a passage at one side of the cylinder 15, and between this passage and the cylinder 15 is fitted a slotted cylindrical bearing through which the lever passes and which oscillates with the lever. The end of the lever in this instance is connected to the center of the head 24.

The several structural modifications of my improvement above specified involve no variation of principle or operation and it will be obvious to those skilled in the art that the construction may be varied in other particulars, without departing from the spirit of my invention.

I claim as my invention and desire to secure by Letters Patent—

1. In an automatic fluid pressure brake system, the combination, with a train pipe, of a release valve for releasing fluid under pressure from the train pipe, a piston whose movement causes the opening of the release valve, and means whereby a slow movement of the piston may be made without opening the release valve, while a rapid movement of the piston will effect the opening of the release valve, substantially as set forth.

2. In an automatic fluid pressure brake system, the combination, with a train pipe, of a release valve for releasing fluid under pressure from the train pipe, and a piston which has substantially the same traverse in both service and emergency applications of the brakes, and which is adapted to move with a moderate degree of speed without opening the release valve, but which, by a rapid movement, causes the opening of the release valve, substantially as set forth.

3. In an automatic fluid pressure brake system, the combination, with a train pipe, of a release valve for releasing fluid under pressure from the train pipe, a piston whose movement causes the opening of the release valve, and a small or contracted port for the admission of fluid to, and its release from, one side of the piston, so as to cause variations of pressure whereby a slow movement of the piston may be made without opening the release valve, while a rapid movement of the piston will effect the opening of the release valve, substantially as set forth.

4. In an automatic quick action train brake mechanism, a release valve for venting the train pipe air, an operating piston, operative in ordinary service action by a slow movement, resultant upon a moderate or slow reduction of train pipe pressure, and operative by a quick movement in an emergency application resultant upon a quick reduction of train pipe pressure, and a release piston operative on the release valve when, and only when, the operating piston makes a quick or emergency stroke or motion, substantially as set forth.

5. In an automatic fluid pressure brake apparatus, a two part or compound piston, one part or member of which is capable of movement independently of, as well as coincidently with, the other part or member, and a small or contracted air supply to the space between the two parts or members of the compound piston, in combination with a train pipe release valve opened by, and only by, the con-

joint movement of both parts or members of the compound piston, substantially as set forth.

6. In an automatic fluid pressure brake apparatus, a two part or compound piston, one part or member of which is capable of movement independently of, as well as coincidently with, the other part or member, and a small or contracted air supply to the space between the two parts or members of the compound piston, in combination with a train pipe release valve opened by, and only by, the conjoint movement of both parts or members of the compound piston, and a variable, but controllable, air pressure by which to operate, at pleasure, one or both members of the compound piston, substantially as set forth.

7. The combination, with an automatic fluid pressure brake system, of an exhaust port or passage communicating directly with the train pipe, a quick action valve device controlling the exhaust port, and an attachment to the brake cylinder piston for operating said quick action valve device, by and only by a rapid movement of said piston substantially as set forth.

8. The combination with a train pipe, an auxiliary reservoir, a triple valve, and a brake cylinder, of a passage leading from the train pipe to the brake cylinder and a valve operated by the movement of the brake cylinder piston and controlling the passage from the train pipe to the brake cylinder, substantially as set forth.

9. The combination with an automatic fluid pressure brake system of a brake cylinder, a train pipe provided with a local exhaust passage for releasing fluid under pressure directly from the train pipe, an exhaust valve controlling said passage, and a supplemental piston which is disconnected from but actuated by the movement of the brake cylinder piston to open the exhaust valve, substantially as set forth.

10. In an automatic fluid pressure brake system, the combination of a local exhaust valve for releasing air from the train pipe to the brake cylinder, and a piston connected thereto and operated by variations of fluid pressure produced by the movement of the brake cylinder piston, substantially as set forth.

11. In an automatic fluid pressure brake system the combination of a local exhaust valve for releasing air from the train pipe, a piston connected thereto and operated by variations of fluid pressure, and a piston connected to the brake cylinder piston and adapted by its movement to effect the opening of the exhaust valve, substantially as set forth.

12. In an automatic fluid pressure brake system, the combination of a brake cylinder, a train pipe which is normally closed to the brake cylinder, and a local exhaust valve for releasing fluid under pressure from the train pipe and which is actuated by the movement of the brake cylinder piston, substantially as set forth.

13. In an automatic fluid pressure brake system, the combination of a brake cylinder, a train pipe which is normally closed to the brake cylinder and a local exhaust valve controlling a passage from the train pipe to the brake cylinder and which is actuated by the movement of the brake cylinder piston, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEO. WESTINGHOUSE, JR.

Witnesses:
WM. G. WATT,
T. J. HOGAN.