

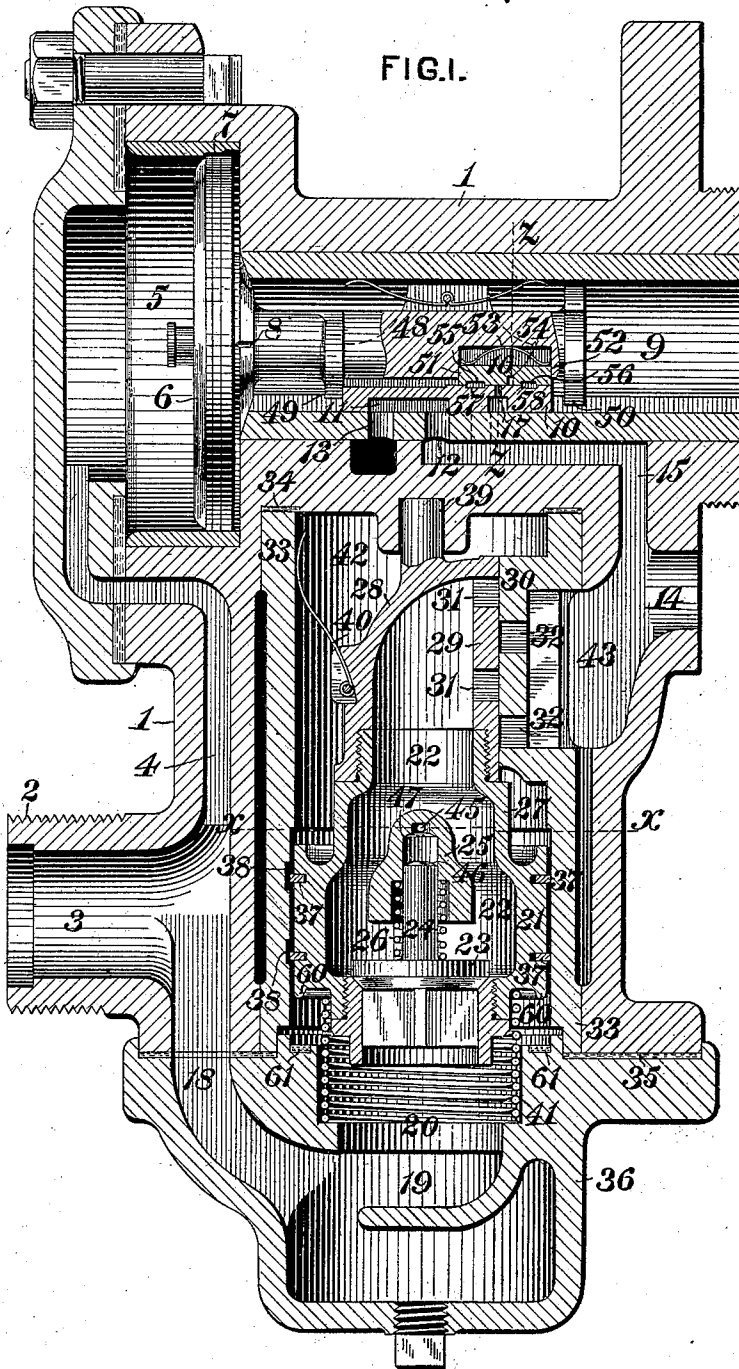
(No Model.)

3 Sheets—Sheet 1.

J. S. CUSTER.
AIR BRAKE.

No. 553,482.

Patented Jan. 21, 1896.



WITNESSES:
T. J. Hogan.
J. E. Gaither

INVENTOR,
John S. Custer
By J. Snowden Bell,
Att'y.

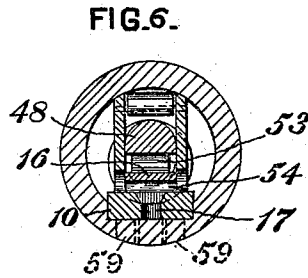
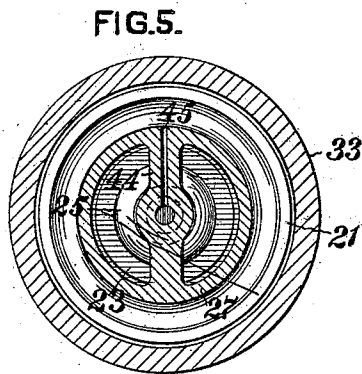
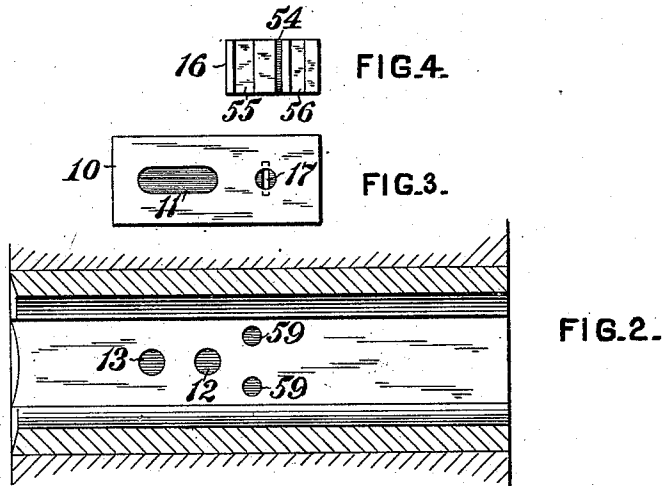
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3 Sheets—Sheet 2.

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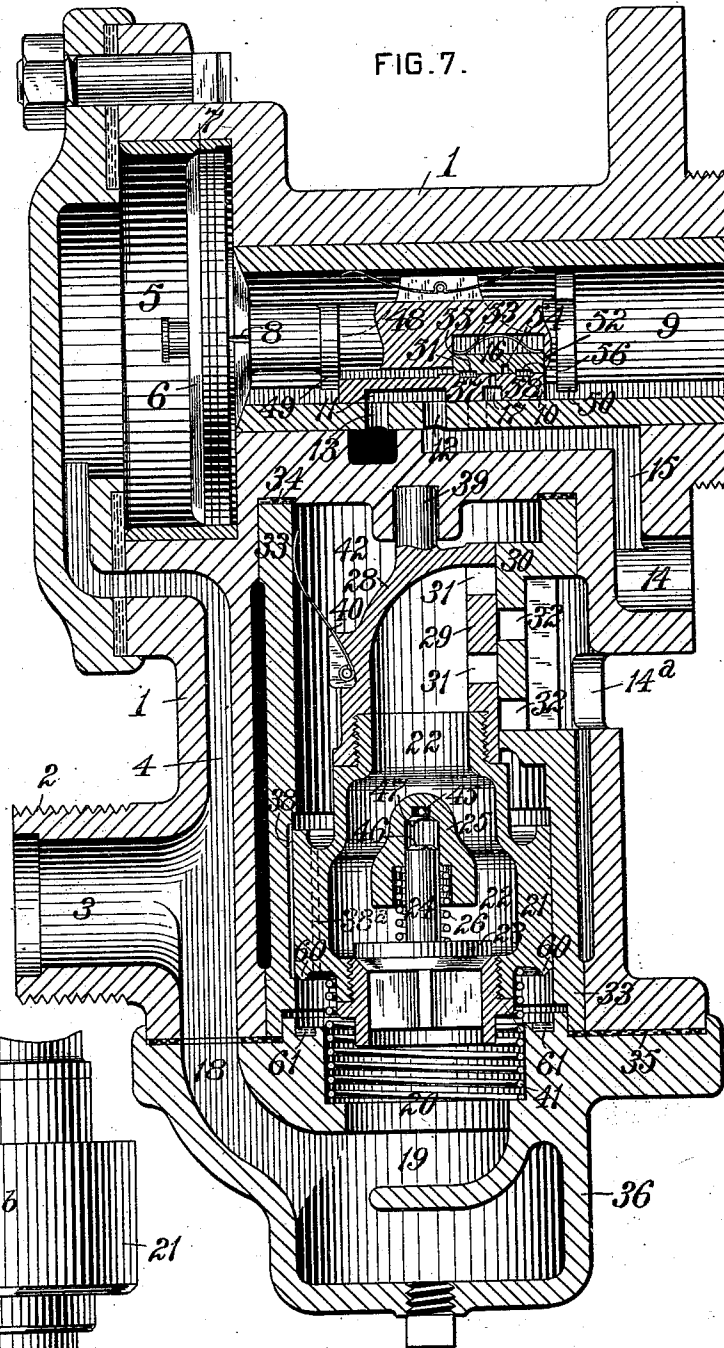
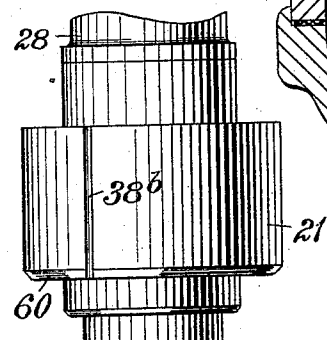


FIG. 8.



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UNITED STATES PATENT OFFICE.

JOHN S. CUSTER, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WEST-
INGHOUSE AIR BRAKE COMPANY, OF SAME PLACE.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 553,482, dated January 21, 1896.

Application filed May 25, 1894. Serial No. 512,431. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. CUSTER, 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 Air-Brakes, of which improvement the following is a specification.

My invention relates to automatic fluid-pressure brake apparatus for railroads; and it consists in an improved quick-action valve mechanism for releasing fluid under pressure from the train-pipe, and in certain improvements in triple-valve mechanism and in the construction and combination of parts, all as hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a central vertical section through a triple-valve and quick-action valve mechanism embodying my invention; Fig. 2, a horizontal section through the bushing of the valve-chamber of the triple valve, showing the seat of the main valve of the triple-valve device in plan view; Fig. 3, a view of the face of the main valve of the triple-valve device; Fig. 4, a view of the face of the graduating-valve of the triple-valve device; Fig. 5, a section through the quick-action valve device on the line $x x$ of Fig. 1; Fig. 6, a section through the main valve and graduating-valve of the triple-valve device on the line $z z$ of Fig. 1; Fig. 7, a central vertical section on the same plane as Fig. 1, but showing the passages controlled by the emergency-valve opening to the atmosphere, and showing a modification of the passages by which fluid may pass from one side to the other of the emergency-piston; and Fig. 8 an elevation of the emergency-piston, showing a groove in the piston for the passage of fluid from one side to the other of the piston.

The triple-valve device and the quick-action valve mechanism are, in this instance, shown as located in the same casing, but my invention is not limited to such specific construction, for the reason that the quick-action valve mechanism is independent of the movements of the triple-valve device, and may, therefore, be located in a separate casing having an independent connection with the train-pipe, and the passage through which

the fluid under pressure is released from the train-pipe may have an independent connection to the brake-cylinder, or, if preferred, it may communicate directly with the atmosphere.

As shown in Fig. 1 a screw-threaded nozzle 2 is formed on the main casing 1 for the purpose of connecting with the main train-pipe or with a branch therefrom. Fluid from the train-pipe enters through the passage 3 and flows through the passage 4 into the piston-chamber 5 of the triple-valve device, where it acts on the movable abutment or piston 6 and moves it to the right, to the position shown in Fig. 1. When the piston 6 is in this position, which is its normal one when the system is charged with fluid under pressure and the brakes are off, the feed-port 7 is open and fluid under pressure passes around the piston to the right and through the groove 8 into the valve-chamber 9, and thence to the auxiliary reservoir, which is always in open communication with the chamber 9, at the right-hand end thereof.

When the piston 6 and the main valve 10 are in their normal positions, communication between the auxiliary reservoir and the brake-cylinder is closed and the exhaust-cavity 11 in the main valve 10 connects the brake-cylinder port 12 with the exhaust-port 13 leading to the atmosphere, so that the brake-cylinder is open to the atmosphere through the passages 14 15, port 12, cavity 11, and port 13. At the same time the graduating-valve 16 covers and closes the port 17 in the main valve 10. The stem 48 of the main piston 6 of the triple-valve device has two shoulders 49 and 50 formed on it, between which the main valve 10 is located, the distance between the shoulders being somewhat greater than the length of the valve 10, so that the piston may have a slight movement independent of and unaffected by the resistance of the main valve.

The graduating-valve 16 of the triple-valve device is closely fitted between shoulders 51 and 52 on the stem 48, and is provided with a spring 53, which tends to hold it to its seat on the back of the main valve 10. On the face of the graduating-valve 16 is formed a transverse groove 54, (see Figs. 1 and 4,) which registers with the port 17 in the main

valve when the shoulder 50 on the piston-stem 48 bears against the end of the main valve 10 and forms a communication between the chamber 9 and the port 17. Two similar, but broader, transverse grooves 55 and 56 are also formed in the face of the graduating-valve, one on each side of the passage or groove 54, and these grooves 55 and 56 register with similar grooves 57 and 58 on the back of the main valve 10 when the parts are in their normal positions.

The object of the grooves or cavities 55, 56, 57, and 58 is to admit fluid-pressure to the under side of the graduating-valve for the purpose of counterbalancing the fluid-pressure on its back. It will be seen that when the graduating-valve is moved from its normal position to the left the surface on the under side of the valve which is thus exposed to fluid-pressure is increased, so that the valve is almost perfectly balanced.

The balancing of the graduating-valve and the fact that its movement relative to the main valve is entirely independent of the resistance to movement of the main valve makes the graduating-valve very sensitive to and very easily moved by slight variations of the fluid-pressures which act on the main piston 6, and its movement is controlled and effected by such pressures or variations of pressure only, independent of any other means.

The construction and relation of the port or passage 54 in the graduating-valve and of the port 17 in the main valve is such as to diminish the liability to clogging of these passages by dust or dirt, the passage 54 being protected above from the settling of dust or dirt, and being open at both sides of the valve, and the port 17 having an elongated form at its upper end where it registers with passage 54, as shown in Fig. 3, which form of opening has been found by experience to be less liable to be obstructed by dust or dirt than a circular opening of the same capacity. Further, the narrow and comparatively long rectangular form of these ports provides a passage of sufficiently large capacity with a minimum travel of the graduating-valve.

When fluid under pressure passes from the train-pipe through the passage 3, a portion of it flows through the passage 18, chamber 19, and passage 20 to the under side of the supplemental movable abutment or piston 21, which forms a part of the quick-action apparatus. The supplemental piston 21 is provided with a central passage 22, in which is located a check-valve 23, having a stem 24, fitted in a guide 25. A spring 26, which bears on the guide 25 at one end and on the valve 23 at the other end, surrounds the stem 24 and tends to hold the valve 23 to its seat. A tubular extension 27, formed on the piston 21, has a screw-threaded connection with a hollow or tubular portion 28, on which is formed a slide-valve 29, adapted to slide on the seat 30, and having ports 31, which are adapted to register with ports 32 in the valve-

seat 30. The tubular or hollow portion 28 may, if preferred, be formed integral with the extension 27 or it may be directly connected to the piston or movable abutment 21.

The bushing 33, within which the piston 21 is fitted, and on which the valve-seat 30 is formed, is removable for the purpose of permitting access to the valve-seat 30. Leakage around the bushing is prevented by a packing or gasket 34 at one end and by a gasket 35 at the other end, which gasket also serves to pack the joint between the casing 1 and the cap 36.

As shown in the drawings, Fig. 1, the supplemental piston 21 is provided with packing-rings 37, which serve to prevent the passage of any appreciable quantity of fluid from one side of the piston to the other, except when the piston is in the position shown in Fig. 1. The ends of the cavities or feed-grooves 38 are then uncovered by the rings 37 and fluid under pressure may pass around the rings through the passages 38. If preferred, the rings 37 may be dispensed with and the piston 21 be fitted closely in the bushing, a feed passage or groove being formed in the bushing, as shown in Fig. 7, of sufficient length to extend from one side of the piston to the other when the piston is in the position shown in Figs. 1 and 7 of the drawings. The same function may be equivalently performed by a small feed-passage 38^a, formed through the piston, as shown in dotted lines in Fig. 7, or by a groove 38^b, formed in the edge of the piston, as shown in Fig. 8. A stem 39, formed integral with the portion 28, acts as a guide for the quick-action device and also as a stop to limit its movement in an upward or inward direction. A spring 40, which bears against the bushing 33 and against the tubular or hollow portion 28, tends to hold the valve 29 to its seat. Another spring 41 bears against the under or outer side of the piston 21 at one end and against a shoulder on the cap 36 at the other end and tends to hold the piston 21 and the valve 29 in position to close the ports 31 and 32 when the system is not charged with fluid under pressure or when the train-pipe pressure is equal to or somewhat less than the pressure in the chamber 42 above the piston 21. The ports 32 in the valve-seat 30 open into a passage 43, connecting with the brake-cylinder passage 14; but, if preferred, they may open directly to the atmosphere, as shown in Fig. 7, through a port or passage 14^a.

The guide 25 for the check-valve stem 24 is formed by a central enlargement of a web or bridge 44, which extends across the passage 22, and which is formed integral with the tubular extension 27 and the piston 21. A passage 45 in the bridge 44 forms a communication between the chamber 42 and the passage or chamber 22 within the piston 21, the stem 24 being so fitted as to permit the passage of fluid by or around it when the check-valve 23 is seated. The communica-

tion thus formed between the chamber 42 and the chamber or passage 22 permits an equalization of the pressures in these chambers when the check-valve is on its seat or when
 5 the check-valve is not raised to the limit of its stroke. When the check-valve is lifted from its seat by train-pipe pressure in making emergency applications of the brakes, communication between the chamber 42 and
 10 the passage or chamber 22 is cut off by the seating of the conical valve 46, which is formed on the end of the stem 24 and which when the valve is fully open bears on the valve-seat 47. The chamber or passage 22
 15 within the piston and its hollow extension are normally charged with fluid under the same pressure as the fluid in chamber 42, the supply to the chamber or passage 22 being effected by means of the passage 45 only, or
 20 through the passage controlled by the check-valve 23, or through both of these passages.

The spring 41 will be sufficient to hold the piston 21 in the position shown in the drawings when the system is not charged with fluid
 25 under pressure, so that the first charging of the train-pipe will also charge the chamber 42. In recharging the train-pipe after an emergency application of the brakes the train-pipe pressure and the spring 41 act together
 30 to return the piston 21 to its normal position.

In making service applications of the brakes a comparatively slight reduction of train-pipe pressure will permit the auxiliary-reservoir pressure in the chamber 9 to move the triple-
 35 valve piston 6 to the left, and with it the graduating-valve 16, the main valve 10 remaining stationary until the shoulder 50 on the piston-stem comes in contact with it, when both valves will be moved together to the left.
 40 When the shoulder 50 is in contact with the end of the valve 10, the passage 54 registers with the port 17, and as the valves move together farther to the left communication between the ports 12 and 13 is cut off and the
 45 port 17 registers with the brake-cylinder port 12. Fluid under pressure from the chamber 9 and from the auxiliary reservoir then flows through passage 54, port 17, port 12, and passages 15 and 14 to the brake-cylinder. This
 50 flow to the brake-cylinder will continue until the pressure in the auxiliary reservoir and chamber 9 becomes slightly less than the pressure in the train-pipe, when the piston 6 and the graduating-valve 16 will be moved to
 55 the right until the shoulder 49 on the stem 48 comes in contact with the end of the main valve 10 and further movement is prevented by the friction of the main valve. This return movement of the piston 6 causes the graduating-valve 16 to close the port 17 and cut off communication between the auxiliary reservoir and the brake-cylinder. If an additional admission of fluid under pressure to the brake-cylinder is desired, a further reduction
 60 of train-pipe pressure will again permit the auxiliary-reservoir pressure to move the piston 6 and the graduating-valve 16 to the

left, thereby causing the passage 54 to register with the port 17, and again opening communication between the auxiliary reservoir and the brake-cylinder. This may be repeated
 70 as often as desired or until the auxiliary-reservoir pressure and the brake-cylinder pressure have equalized.

In order to release the brakes the train-pipe
 75 pressure is increased sufficiently to move the piston 6 and the main and graduating valves into the positions shown in Fig. 1, in which communication between the auxiliary reservoir and the brake-cylinder is cut off, and the
 80 brake-cylinder port 12 is connected with the exhaust-port 13 by means of the cavity 11 in the main valve 10.

During the service applications of the brakes the quick-action device remains in the
 85 position shown in Fig. 1, its movement being prevented by the resistance of the spring 41 and the frictional resistance of the valve 29, the difference in pressure on the opposite sides of the piston 21 not being sufficiently great
 90 to overcome these resistances. Continued slight reductions of train-pipe pressure, although they may result in a very considerable total reduction, do not effect the movement of the piston 21, as the grooves or passages
 95 38 permit the pressure in the chamber 42 to equalize with the pressure in the train-pipe.

When a sufficiently great and rapid reduction of train-pipe pressure is produced, for the purpose of making an emergency appli-
 100 cation of the brakes, the triple-valve piston 6 is moved to the limit of its stroke to the left by the auxiliary-reservoir pressure in the chamber 9. The first part of this movement puts the port 54 of the graduating-valve in
 105 communication with the port 17 in the main valve, and the main and graduating valves then move together to the end of the stroke, and the port 17 registers with the brake-cylinder port 12. Fluid from the auxiliary
 110 reservoir then flows to the brake-cylinder through ports 17 and 12 and through the passages 15 and 14. When the triple-valve piston 6 is suddenly moved to the limit of its stroke to the left, as in making emergency
 115 applications, the momentum of the main valve may cause it to continue moving after the piston 6 has stopped, so that when the piston has made its full stroke the main valve is in contact with or very near the shoulder 49 on the
 120 stem of the triple-valve piston. The position of the main valve relative to the graduating-valve will then be the same as it is when the parts are in position to release the brakes, as shown in Fig. 1, and the port 17 will be closed
 125 by the graduating-valve, but the port 59 will be uncovered by the extra travel of the main valve and the fluid from the auxiliary reservoir will then flow to the brake-cylinder through the ports 59 and passages 15 and 14.
 130 At the same time that the piston 6 is moved to the left the pressure in the chamber 42, above the supplemental piston 21, moves the piston 21 down against the resistance of the

spring 41 until the beaded edge 60 of the piston bears on the seat 61. The ports 31 of the slide-valve 29 then register with the ports 32 in the valve-seat and the fluid under pressure in the chamber or passage 22 is released to the brake-cylinder through the ports 31 32 and passages 43 and 14. The reduction of pressure thus effected in the passage 22 permits the train-pipe pressure to lift the check-valve 23 from its seat, and the fluid under pressure in the train-pipe then flows through the passage 22 and through the ports and passages 31, 32, 43, and 14 to the brake-cylinder. As soon as the brake-cylinder and train-pipe pressure have equalized, or a little before, the check-valve 23 returns to its seat and prevents a return flow of fluid from the brake-cylinder to the train-pipe. The release of fluid from the train-pipe to the brake-cylinder is almost instantaneous, but the flow from the auxiliary reservoir to the brake-cylinder continues some time after the closing of the check-valve 23, and until the auxiliary-reservoir pressure equalizes with the brake-cylinder pressure. The quick-action valve 29 remains open until the train-pipe pressure is again increased for the purpose of releasing the brakes, so that during the time the pressure in the chambers 42 and 22 is the same as the brake-cylinder pressure.

When the train-pipe is recharged for the purpose of releasing the brakes, the triple-valve device and the quick-action device will be returned to the positions shown in Fig. 1 of the drawings, in which positions the triple-valve device closes communication between the auxiliary reservoir and the brake-cylinder and opens communication between the brake-cylinder and the atmosphere and between the train-pipe and the auxiliary reservoir, and the slide-valve 29 of the quick-action device closes the ports 31 and 32.

When the train-pipe is recharged for the purpose of releasing the brakes, if the quick-action device does not return promptly to its normal position, the release of pressure from the brake-cylinder, effected by the triple valve, will reduce the pressure in the chamber or passage 22 and in the chamber 42 through the passage 45, and thereby diminish the resistance to the train-pipe pressure and the pressure of the spring 41, both of which tend to return the device to its normal position.

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

1. In a triple valve device, the combination, with a main slide valve, of a graduating slide valve fitting on the back of the main valve,

and having a transverse groove in its face adapted to register with a port in the main valve, through which fluid under pressure is admitted from the auxiliary reservoir to the brake cylinder, substantially as set forth. 65

2. In an automatic fluid pressure brake system, the combination, with a train pipe, an auxiliary reservoir, and a triple valve device, of a supplemental movable abutment, or piston, which is independent of the movement of the triple valve piston, a release passage from the train pipe through the supplemental abutment, and a valve operated by the supplemental abutment and controlling the release of fluid from the train pipe, substantially as set forth. 70 75

3. In an automatic fluid pressure brake system, the combination, with a train pipe, an auxiliary reservoir, and a brake cylinder, of a movable abutment, exposed on one side to train pipe pressure and on the other side to pressure in a chamber which is independent of and unconnected with the auxiliary reservoir, a release passage through the movable abutment from the train pipe, and a valve operated by the movable abutment and controlling the release of fluid from the train pipe through the release passage, substantially as set forth. 80 85

4. In an automatic fluid pressure brake system, the combination, in a quick action device for releasing fluid from the train pipe, of a movable abutment, exposed on one side to train pipe pressure and on the other side to pressure in a chamber which is separate from the auxiliary reservoir, a tubular extension connected to the abutment, a release passage through the movable abutment and through the tubular extension, and a slide valve on the tubular extension controlling the release passage, substantially as set forth. 90 95 100

5. In an automatic fluid pressure brake system, the combination, in a quick action device, for releasing fluid under pressure from the train pipe, of a movable abutment exposed on one side to train pipe pressure and on the other side to pressure in a chamber which is separate from, and unconnected with, the auxiliary reservoir, a release passage through the movable abutment, a valve controlling the passage of fluid from the train pipe through the movable abutment, and a check valve in the release passage, substantially as set forth. 105 110

In testimony whereof I have hereunto set my hand.

JOHN S. CUSTER.

Witnesses:

F. E. GAITHER,
T. J. HOGAN.