(No Model.)

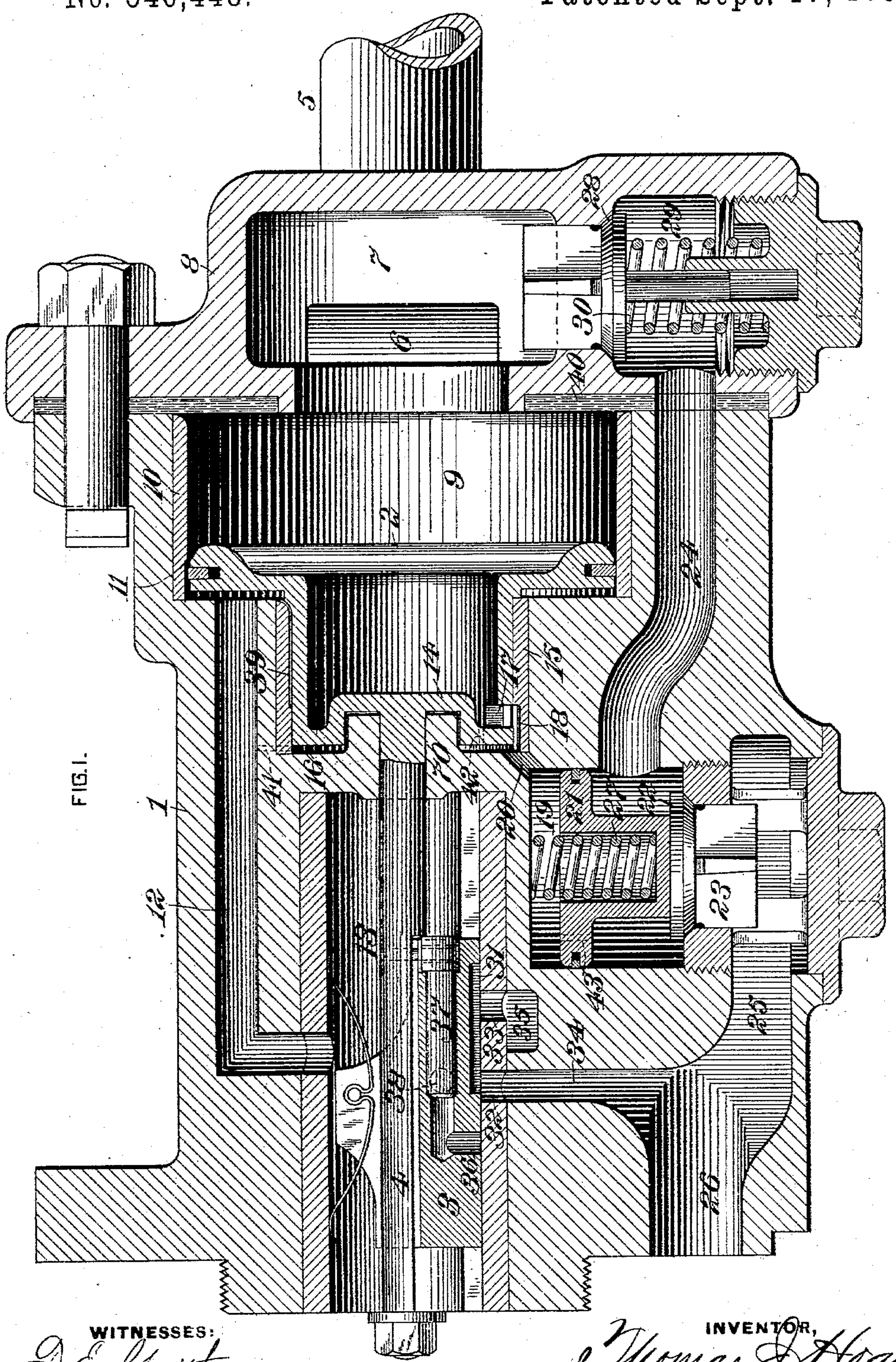
3 Sheets—Sheet 1.

T. J. HOGAN.

AIR BRAKE.

No. 546,448. Patented Sept. 17, 1895.

FIG. I.



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(No Model.) 3 Sheets—Sheet 2.

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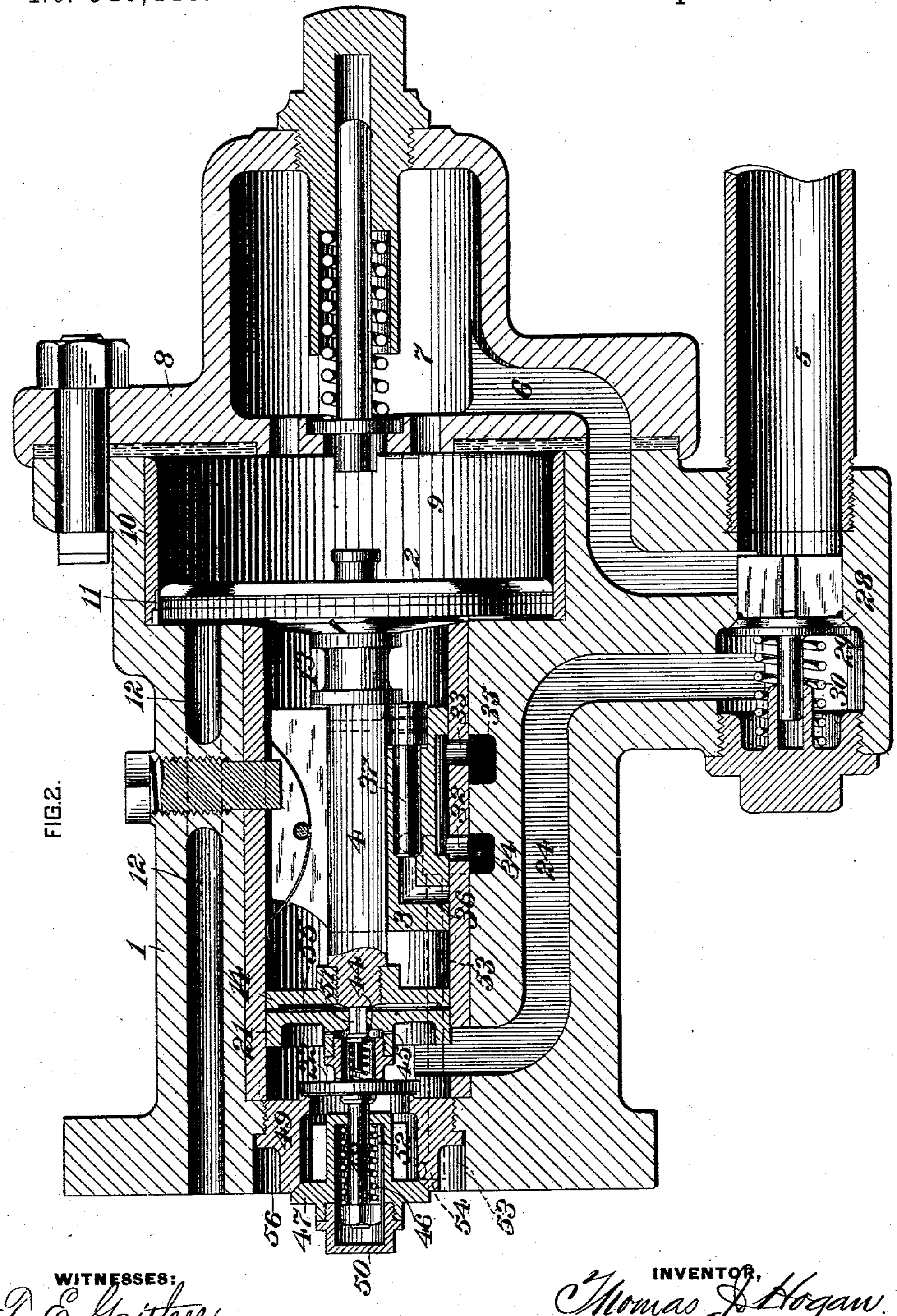

FIG. 2.

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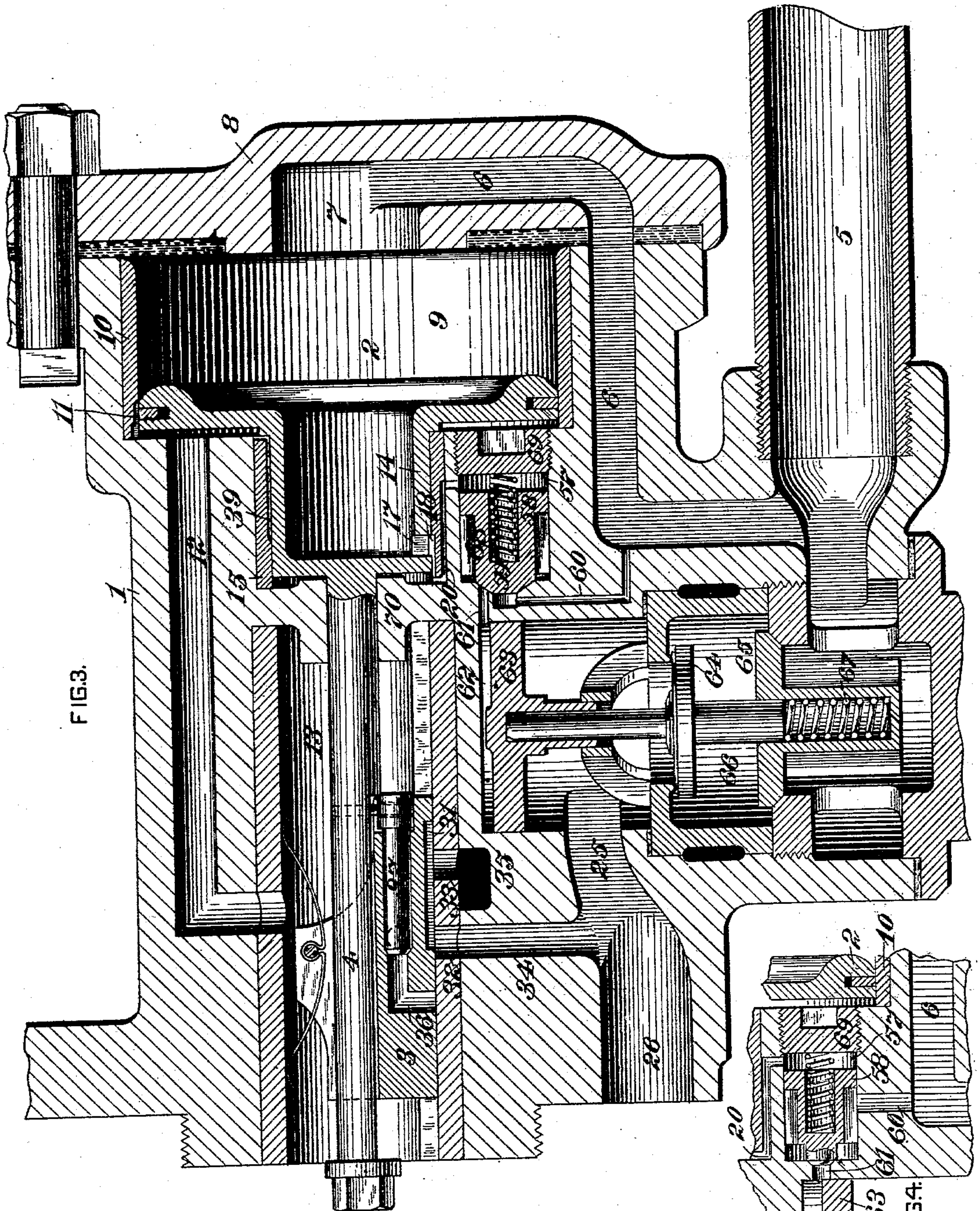

FIG. 3.

FIG. 4.

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UNITED STATES PATENT OFFICE.

THOMAS J. HOGAN, OF PITTSBURG, ASSIGNOR TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF WILMERDING, PENNSYLVANIA.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 546,448, dated September 17, 1895.

Application filed October 12, 1894. Serial No. 525,697. (No model.)

To all whom it may concern:

Be it known that I, THOMAS J. HOGAN, 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.

The object of my invention is to provide an improvement in automatic fluid-pressure-brakes for railway-cars; and to this end my invention consists in a new and improved quick-action device for locally venting the train-pipe of an automatic fluid-pressure brake system for the purpose of securing a quick and as nearly as possible a simultaneous action of the brakes on all of the cars of a train. The fluid under pressure which is released from the train-pipe may be allowed to escape to the atmosphere, or to the brake-cylinder, or to a reservoir or chamber which is separate from the brake-cylinder; but I have shown my improvement in connection with ports and passages for releasing to the brake-cylinder.

In the practice of my invention I employ a train-pipe release-valve and a movable abutment or piston whose movement causes the opening of the valve, the release-valve being normally closed, and remaining closed, or being opened according to the less or greater rapidity of movement of the abutment or piston. The movable abutment and release-valve may be separate from or combined with a triple-valve device, so that the abutment or piston controlling the opening of the release-valve may have a movement independent of the movement of the triple valve and its piston, or it may have a movement coincident with the movement of the triple-valve piston, as shown in the drawings. The release-valve device is provided with a supplemental piston or diaphragm, which is normally exposed to fluid under pressure, tending to hold the valve closed, and this fluid is contained in a chamber or space having one of its sides or walls or a portion of one of its sides or walls movable, whereby the volume of the fluid may be increased and its pressure decreased in accordance with the rapidity of increase of the volume. In the drawings the variation in the volume of the space or chamber and of the fluid is effected by the movement of a controlling piston or abutment, which forms the movable wall of the space or chamber, and the construction is such that a sufficiently rapid movement of the controlling-piston will cause a sudden reduction of pressure and cause the opening of the release-valve. If the movement of the controlling-piston and the corresponding increase in the volume of the fluid is sufficiently gradual to permit a certain amount of fluid to flow into the expanding-chamber through ports or passages arranged for the purpose or by means of leakage the reduction of pressure will not be sufficient to cause the opening of the release-valve. Therefore, as the reduction of pressure in the expanding-chamber depends entirely on the rapidity of movement of the controlling-piston, the opening of the release-valve will also depend on the rapidity of movement of the piston, and when the controlling-piston is moved slowly by a gradual reduction of train-pipe pressure the release-valve will remain closed; but when a sufficiently great and rapid reduction of train-pipe pressure is made the controlling-piston moves with corresponding rapidity and the release-valve is opened.

In the accompanying drawings, which illustrate an application of my invention, Figure 1 is a central longitudinal section through a triple-valve device which is provided with my improvement; Figs. 2 and 3, similar sections showing modifications of my improvement, and Fig. 4 a sectional view showing a modification of part of the construction shown in Fig. 3.

In the drawings I have shown my improvement in connection with a triple-valve device located in a casing 1 and having a piston 2, a slide-valve 3, and a stem 4, by means of which movement of the piston may be communicated to the slide-valve. The train-pipe 5 is connected to the casing 1, and a passage 6 forms a communication between the train-pipe and a chamber 7 in the head 8 of the triple-valve casing. The chamber 7 is in open communication with the piston-chamber 9, which is provided with a bushing 10, within which the piston 2 is fitted to slide. Fluid from the train-pipe passes into the chamber 9, which is normally in open communication with the train-pipe, and through the feed-passage 11 into the passage 12 and chamber 13, both of which are in open communication with the auxiliary reservoir.

In Fig. 1 of the drawings I have shown a controlling-piston 14, which is formed on or secured to the triple-valve piston 2 and which is fitted to work in a bushing 15 in a chamber 16. When the piston 14 is in the position shown in the drawings, a port 17 in the piston registers with a groove or passage 18 in the bushing 15, and the passage 18 is in open communication with a piston-chamber 19, either directly or through a short passage 20. Within the chamber 19 is a supplemental piston 21, operatively connected with a valve 22, controlling a passage 23, which forms a communication between a passage 24, leading from the train-pipe, and a passage 25, leading to the brake-cylinder port 26. The valve 22 is normally held to its seat by means of a spring 27 and the fluid-pressure acting on the upper side of the piston 21. A check-valve 28 is located in a chamber 29 in the head 8 of the triple-valve casing and is provided with a spring 30, which tends to hold the check-valve to its seat. The check-valve acts as a non-return valve between the passage 24 and the train-pipe and opens to permit fluid from the train-pipe to flow into the passage 24 and into the piston-chamber 19.

When the train-pipe is charged with fluid under pressure and the triple-valve piston is moved to the position shown in the drawing, fluid under pressure passes through the passages 17, 18, and 20 into the chamber 19 above the piston 21. At the same time fluid under pressure from the train-pipe unseats the check-valve 28 and flows through the passage 24 into the piston-chamber 19 below the piston 21. On account of the pressure of the spring 27 and the preponderance of the fluid-pressure above the piston 22 over that below it the valve 22 will be held to its seat, so as to close communication between the passage 24 and the passage 25. The slide-valve 3 of the triple valve will then be in the position shown in Fig. 1, with the exhaust-cavity 31 connecting the ports 32 and 33, by which the brake-cylinder port 26 and passage 34 are put in communication with the atmosphere through the passage 35.

In making an application of the brakes by means of slight and gradual reductions of train-pipe pressure the pistons 2 and 14 are moved slowly to the right, the graduating-valve 37 is unseated, and the position of the slide-valve 3 is shifted so as to close communication between the ports 32 and 33 and to open communication between the auxiliary reservoir and the passage 34 through the passages 38 and 36 in the slide-valve. Fluid from the auxiliary reservoir will then flow through the passages 34 and 26 to the brake-cylinder. As the controlling-piston 14 moves to the right it closes communication between the port 17 and the passage 18 and uncovers the end of a small groove or passage 39 in the bushing 15. One end of the groove 39 is always open to the auxiliary-reservoir fluid, and when the other end is uncovered by the piston 14 the chamber 16 is put in communication with the auxiliary-reservoir space, and the gradual movement of the piston 14 does not cause a sufficient reduction of pressure to cause the movement of the piston 21 and the valve 22 from their normal positions. In such an application of the brakes the movement of the brake-cylinder piston is therefore caused by fluid from the auxiliary reservoir only, and no fluid from the train-pipe is admitted directly to the brake-cylinder.

When a sufficiently great and rapid reduction of train-pipe pressure is made, either accidently or intentionally, to cause an emergency application of the brakes, the pistons 2 and 14 are moved to the right with such velocity that the full expansion of the fluid in the chambers 16 and 19 takes place before any considerable amount of fluid can enter through the passage 39, and the consequent reduction of pressure above the piston 21 permits the fluid under pressure on the other side of the piston 21 to shift the piston and open the valve 22. Fluid under pressure from the train-pipe then lifts the check-valve 28 and flows through the passages 24, 23, 25, and 26 to the brake-cylinder. At the same time the triple-valve device operates as before, the graduating-valve and the slide-valve being shifted to open communication from the auxiliary reservoir to the brake-cylinder through the passages 38, 36, 32, 34, and 26.

In every application of the brakes the travel of the triple-valve piston is the same, the movement to the right being limited by the gasket 40, against which the piston 2 bears when at that end of its stroke. It will be seen that the opening of the release-valve 22 depends only on the velocity with which the piston 14 is moved to the right and is entirely independent of the exact position of the piston 14—that is, the controlling-piston 14 may move the whole length of its stroke without reducing the pressure above the supplemental piston 21 sufficiently to cause the opening of the valve 22, or it may move with such a velocity as to cause the required reduction only by moving its full stroke, or it may move with a still greater velocity and effect the required reduction when its has moved only a part of its stroke. This variation in effect is due to the fact that the area of the piston 14 and the increase of volume due to its movement are so proportioned to the normal volume of the fluid above the piston 21 that if there were no passage 39 and no leakage around the piston 14 a sufficient reduction of pressure above the piston 21 would be effected by moving the piston 14 about one-half the length of its stroke, or a little more; but in order to allow for the admission of fluid through the passage 39 and for leakage it is necessary to give the piston 14 a greater stroke than would be necessary if no such admission took place.

While I have shown the groove 39 in order to clearly illustrate the method of operation, such a groove or passage may not always be essential, since the piston 14 or the piston 21 may be so fitted as to make it unnecessary. The position and form of the passage may be varied. For example, instead of the groove 39 I may employ a passage 41 through the wall of the casing, connecting the passage 12 with the chamber 16, as shown by the dotted lines in Fig. 1; or a passage 42 or 43 may be formed through either of the pistons 14 or 21, as shown by the dotted lines.

In the construction shown in Fig. 2 of the drawings the piston 14 is connected to the end of the stem 4, and both of the pistons 14 and 21 are located in a continuation of the slide-valve chamber of the triple valve and are so fitted as to permit of the necessary leakage around one or both of them; but either or both of them may be provided with passages through or around them. The expanding chamber or space is in this instance the space between the pistons 14 and 21, and in order to insure the proper admission of fluid under pressure thereto when the train-pipe and the passage 24 are charged I provide a small valve 44 on the piston 21, which controls an admission-port 51 and which is normally held open by the end of the stem 4. Fluid is admitted to the chamber of the valve 44 through the ports 45 and to the chamber or space 16 through the passage 51, where it acts on the piston 21. The release-valve 22 is held to its seat by the pressure in the chamber 55 between the pistons 14 and 21 and by the spring 46, which is located in a central chamber of the check-valve 47. The spring 46 bears at one end against a nut on the end of the stem 48, projecting from the valve 22, and at its other end against the end wall of the chamber 52, in which it is located. The check-valve 47 normally closes the passage 49, so as to prevent brake-cylinder pressure from acting on the valve 22 in service applications of the brake, and the chamber 52 in the check-valve is closed by a screw-cap 50, which prevents leakage through the valve.

Fig. 2 shows the triple-valve device so constructed that it may effect an admission of fluid under pressure from the auxiliary reservoir to the brake-cylinder when the slide-valve 3 is in either of two positions—that is, when the port 36 registers with the port 32 or when the port 32 is uncovered by the end of the slide-valve. The opening of the release-valve is, however, in no manner dependent on this peculiarity of the triple valve, and, if preferred, a triple-valve device similar to that shown in Fig. 1 may be employed in which the slide-valve has but one application position, which it occupies in both service and emergency applications. In each case the opening of the release-valve 22 is effected only when a sufficiently rapid movement of the piston 21 takes place. In Fig. 2 the passage 34, into which the port 32 opens, extends some distance to one side of the port 32 and connects with a passage 53, (shown in dotted lines,) which opens into the space 56 at the end of the valve. The space 56 registers with a port in the brake-cylinder head, (not shown,) through which fluid under pressure is admitted to the brake-cylinder from the auxiliary reservoir through the port 54 and from the train-pipe through the passage 49.

The operation of my improvement as shown in Fig. 2 is substantially the same as that shown in Fig. 1. When the triple-valve piston 2 moves to the right, the piston 14 also moves to the right, and the port 51 in the piston 21 is closed as soon as the end of the stem 4 is moved out of contact with the valve 44. If the movement of the piston 14 is sufficiently rapid, the reduction of pressure between the pistons 14 and 21 will permit the pressure on the left of piston 21 to open the valve 22 and release fluid under pressure from the train-pipe to the brake-cylinder; but if the piston 14 moves slowly a sufficient reduction of pressure in the space between the pistons 14 and 21 will not be effected on account of the leakage around the pistons 14 and 21 from the slide-valve chamber and from the left side of piston 21. Instead of fitting the pistons so as to permit leakage around them they may be provided with packing-rings, and the fluid admitted to compensate for expansion in the space between the pistons may enter through a passage around the edge of either or both of the pistons or through a passage extending through one or both pistons.

In Fig. 3 of the drawings I have shown a controlling-piston 14, which is formed and located like the piston 14 in Fig. 1, and is provided with a port 17, through which fluid from the train-pipe is admitted to passages 18 and 20 and to a chamber 57 when the piston 14 is in its normal position. Within the chamber 57 is a piston 58, which has a valve 59 operatively connected to it and controlling passages 60 and 61, through which fluid under pressure may be admitted from the train-pipe to a chamber 62. A piston 63 is located in the chamber 62 in position to open the valve 64 by a downward movement. A check-valve 65 is located between the valve 64 and the train-pipe 5 and adapted to be opened by train-pipe pressure to admit fluid under pressure to the chamber 66. The valve 64 is normally held to its seat by the spring 67 and the fluid-pressure in chamber 66. The valve 59 is held to its seat by the combined action of the spring 68 and the fluid-pressure acting on the larger area of the piston 58, and the release of fluid from the train-pipe takes place when the piston 14 moves with sufficient rapidity to make the required reduction of pressure in the chamber 57. The piston 58 is so fitted as to permit the leakage of fluid under pressure from one side to the other, and when the required reduction of pressure is made in chamber 57 to the right of piston 58 the pressure on the left of piston 58 and on the end of the valve 59 acts to open the valve 59 and admit fluid under pressure from the train-pipe through the passages 60 and 61 to the chamber 62, where it acts on the piston 63 and unseats the valve 64. Fluid under pressure from the train-pipe then lifts the check-valve 65 and flows through the chamber 66 and the passages 25 and 26 to the brake-cylinder. At the same time the slide-valve 3 and the graduating-valve 37 of the triple-valve device operate to open communication between the auxiliary reservoir and the brake-cylinder through the passages 34 and 26.

In the construction shown in Fig. 4, which is a modification of a part of that shown in Fig. 3, the passage 60 is always in open communication with the chamber 57 and forms a permanently-open communication between the chamber 57 and the train-pipe passage 6. With this construction it is not necessary to permit leakage around or through the piston 58 to charge the space on the left of that piston.

The constructions illustrated in Figs. 1 and 2 show more direct means of releasing the fluid from the train-pipe than are shown in Figs. 3 and 4; but the latter constructions will permit the employment of a comparatively small controlling-piston, and the piston 58 and valve 59 shown in Figs. 3 and 4 may be much smaller and lighter than the piston 21 and valve 22 shown in Figs. 1 and 2.

In the constructions shown in Figs. 3 and 4 the screw-plug 69 is made adjustable for the purpose of varying the volume of the space on one side of the piston 58, so that in case of wear of the parts, tending to alter the action of the device, compensation may be effected by varying the volume of the space and of the fluid to be expanded. In Fig. 2 a similar adjustment may be effected by making the screw-thread on the end of the stem 4 of such a length that the position of the piston on the stem 4 may be shifted to enlarge or decrease the volume of the space between the pistons, or in both of the constructions shown in Figs. 1 and 2 this object may be attained by making the pistons 21 adjustable on their stems by means of a screw-threaded connection.

It will be seen that with my improvement the release of fluid from the train-pipe is effected by means of a controlling piston or abutment which has no mechanical connection with the release-valve or with the supplemental piston which actuates the release-valve, and the controlling-piston does not admit fluid to or release it from the supplemental piston in effecting the opening movement of the release-valve. The controlling-piston and release-valve may be entirely separate from a triple-valve device; but this construction is so obvious a modification that it is not shown in the drawings. To make this clear, it may be supposed that in either of the figures 1, 2, or 3 the ports 32 and 33 of the triple-valve device are plugged up, and the slide-valve 3 retained or omitted. The plugging of the ports 32 and 33 is equivalent to suppressing the triple-valve device, but it in no way affects the operation of the train-pipe release-valve.

While the ports or passages 17 and 39 are shown in Figs. 1 and 3 in connection with the controlling-piston 14, it will be clear that they are not essential adjuncts to the controlling-piston itself, as they may be omitted or differently arranged in other parts of the structure, as already suggested, or their functions performed by other means. For example, as shown in Fig. 2, the piston 14 may be so constructed or arranged as to have no control of such ports or passages, or the piston 14 may be arranged as shown in Fig. 2 and fitted with a packing-ring, so as to make it air-tight and prevent any passage of air around or through it.

The stem 4 of the triple-valve device, as shown in Figs. 1 and 3, is fitted air-tight, or as nearly so as possible, in a long bearing in the partition 70, and, if necessary, the bearing may be furnished with packing.

I disclaim, broadly, the combination, in an automatic fluid-pressure brake system, 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, said subject-matter being set forth in the patent to George Westinghouse, Jr., granted April 23, 1895, No. 538,001.

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 and a triple valve device, of a release valve, for releasing fluid under pressure from the train pipe, a piston whose movement causes the operation of the release valve and which is normally exposed to fluid under pressure in a chamber on one side of the piston, a controlling piston which is exposed to the same fluid under pressure in the chamber and whose movement effects variations in the fluid under pressure in the chamber by varying the volume of the chamber between the pistons, and means whereby the release valve will be opened by a rapid movement only of the controlling piston, 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, a piston whose movement causes the opening of the release valve and which is located in a chamber normally charged with fluid under pressure, and means for varying the volume of the chamber, and of the fluid under pressure therein, whereby the pressure of the fluid may be reduced by

expansion, without release of the fluid, to effect 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 which is located in a chamber normally charged with fluid under pressure, a controlling piston whose movement enlarges the volume of the chamber and effects a reduction of pressure without release of the fluid therein, and means for permitting a limited admission of fluid to the chamber, whereby a sufficient reduction of pressure in the chamber to cause the opening of the release valve will be effected only when the controlling piston moves rapidly, substantially as set forth.

4. In an automatic fluid pressure brake system, the combination with a train pipe, of a triple valve device, a release valve, for releasing fluid under pressure from the train pipe, whose opening is effected independently of the main or slide valve of the triple valve device, a controlling piston on the stem of the triple valve device for controlling the release of fluid from the train pipe, and means whereby the controlling piston is adapted to move the full length of its stroke without opening the release valve when the train pipe pressure is slowly, or gradually, reduced, and whereby the opening of the release valve is effected only when the controlling piston is moved rapidly on a rapid reduction of train pipe pressure, substantially as set forth.

5. 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 which is located in a chamber normally charged with fluid under pressure, and a controlling piston whose movement effects opening movement of the release valve independently of the operation of any other valve, substantially as set forth.

6. The combination, in an automatic fluid pressure brake system, of a train pipe, a triple valve device whose piston has the same traverse in both service and emergency applications of the brakes, and a release valve for releasing fluid under pressure from the train pipe and which is opened by the movement of the triple valve piston independently of the main valve of the triple valve device, substantially as set forth.

7. 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 passage leading from the train pipe to the brake cylinder and controlled by the release valve, a piston whose movement causes the opening of the release valve and which is located in a chamber normally charged with fluid under pressure, and a controlling piston whose movement independent of the operation of any other valve effects opening movement of the release valve, substantially as set forth.

In testimony whereof I have hereunto set my hand.

THOMAS J. HOGAN.

Witnesses:
J. SNOWDEN BELL,
F. E. GAITHER.