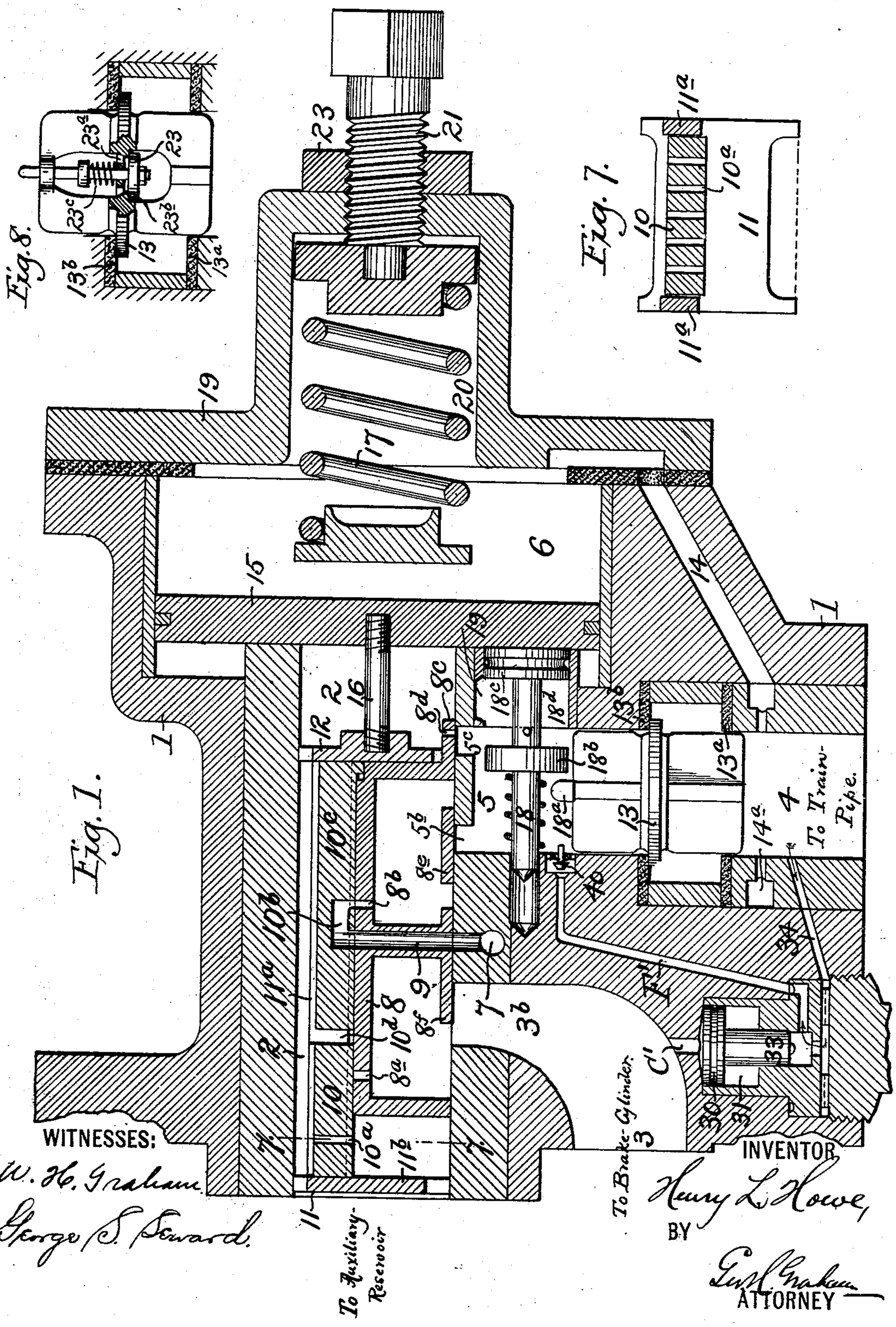
(No Model.)

4 Sheets—Sheet 1.

H. L. HOWE.

TRIPLE VALVE FOR AIR BRAKES.

No. 507,133. Patented Oct. 24, 1893.



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(No Model.)

4 Sheets—Sheet 2.

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TRIPLE VALVE FOR AIR BRAKES.

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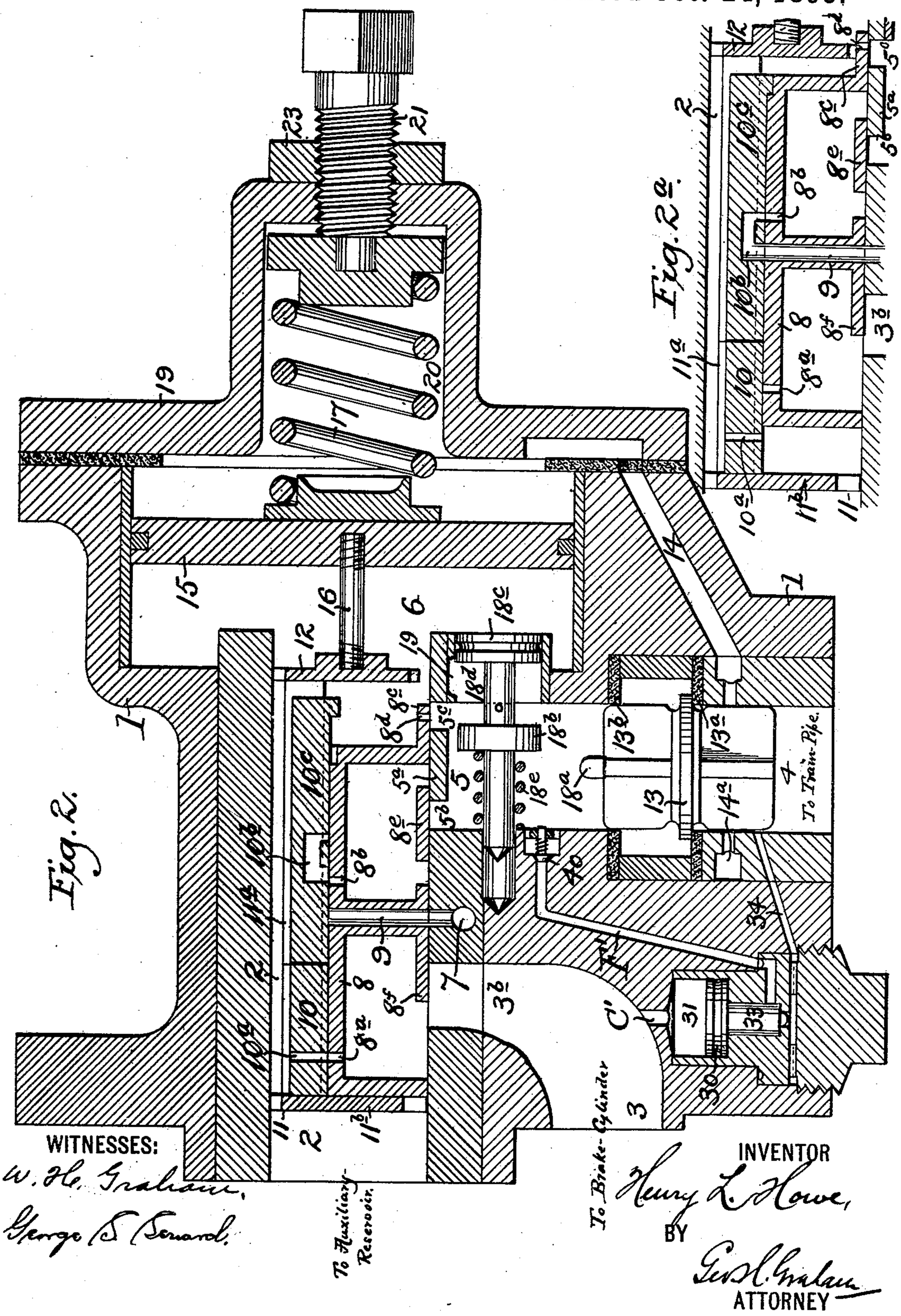

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(No Model.)

4 Sheets—Sheet 3.

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TRIPLE VALVE FOR AIR BRAKES.

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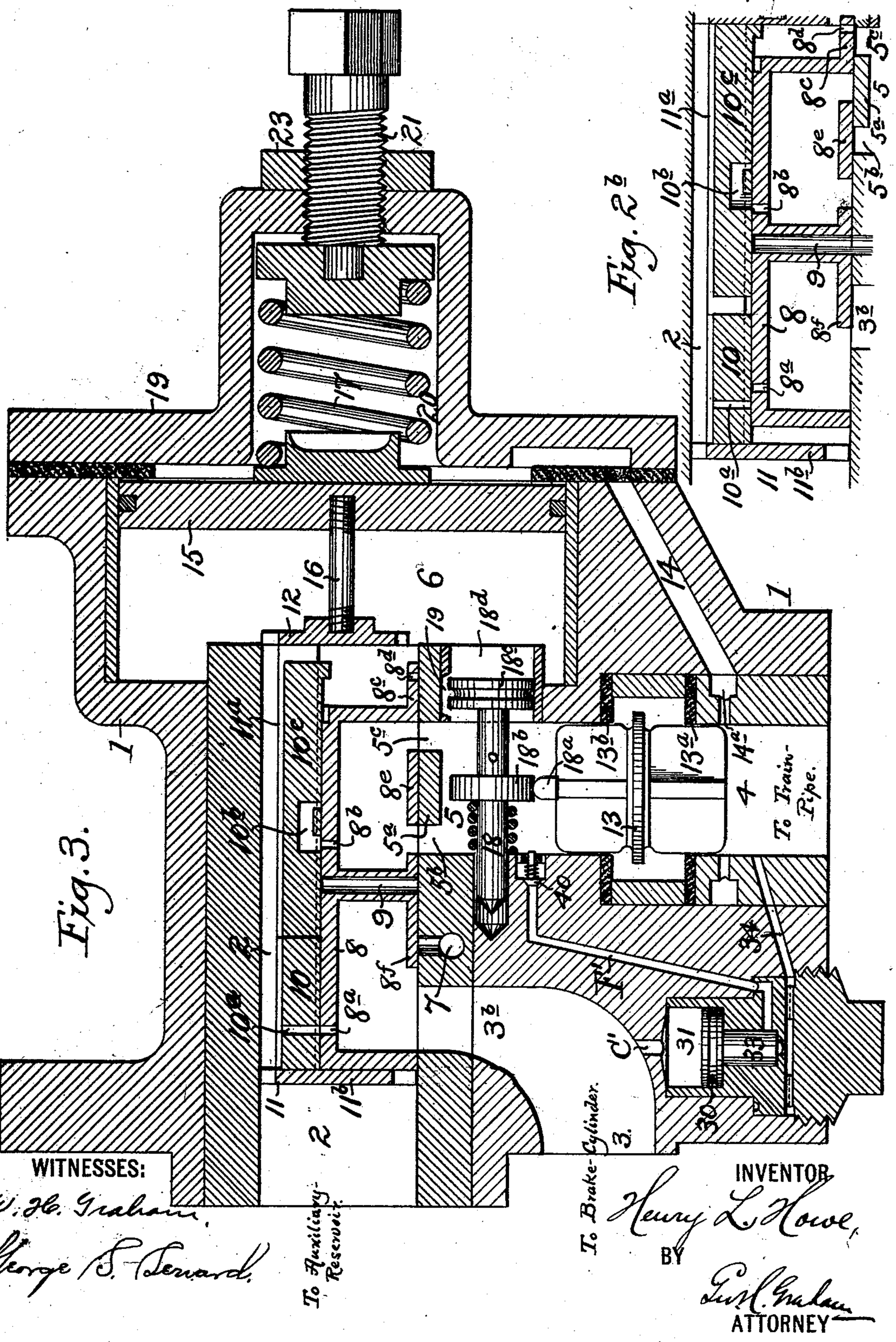

Fig. 3.

Fig. 2b.

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(No Model.) 4 Sheets—Sheet 4.

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TRIPLE VALVE FOR AIR BRAKES.

No. 507,133. Patented Oct. 24, 1893.

Fig. 5.

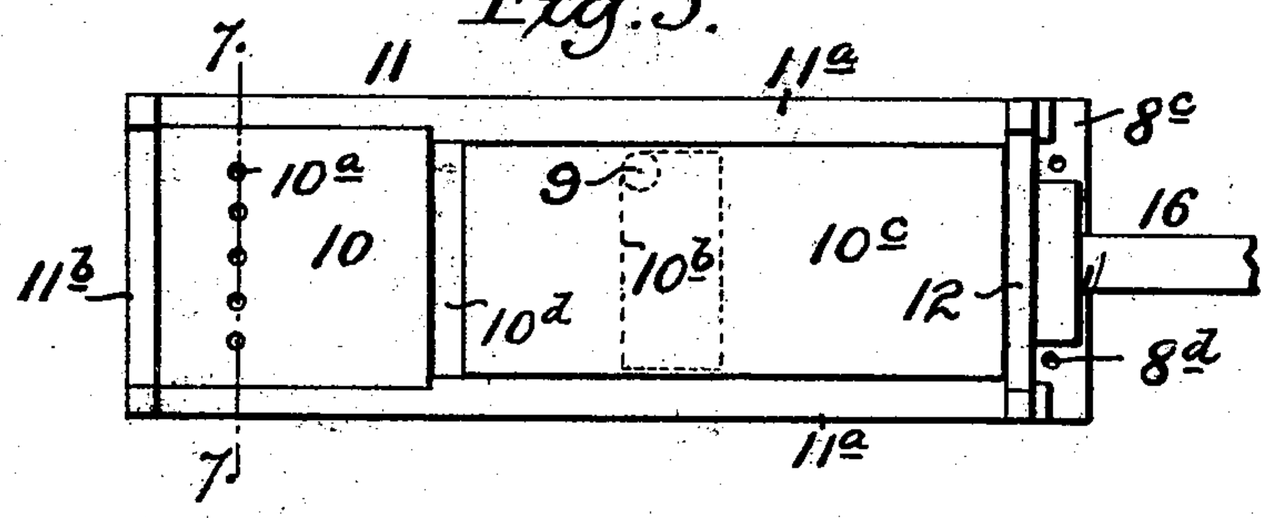


Fig. 6.

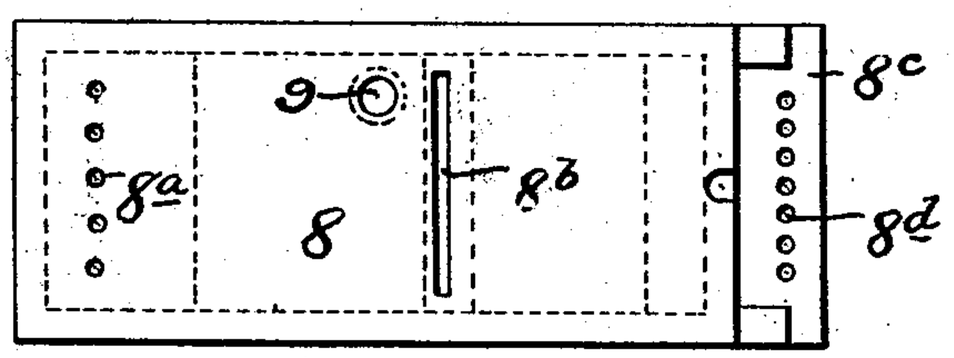
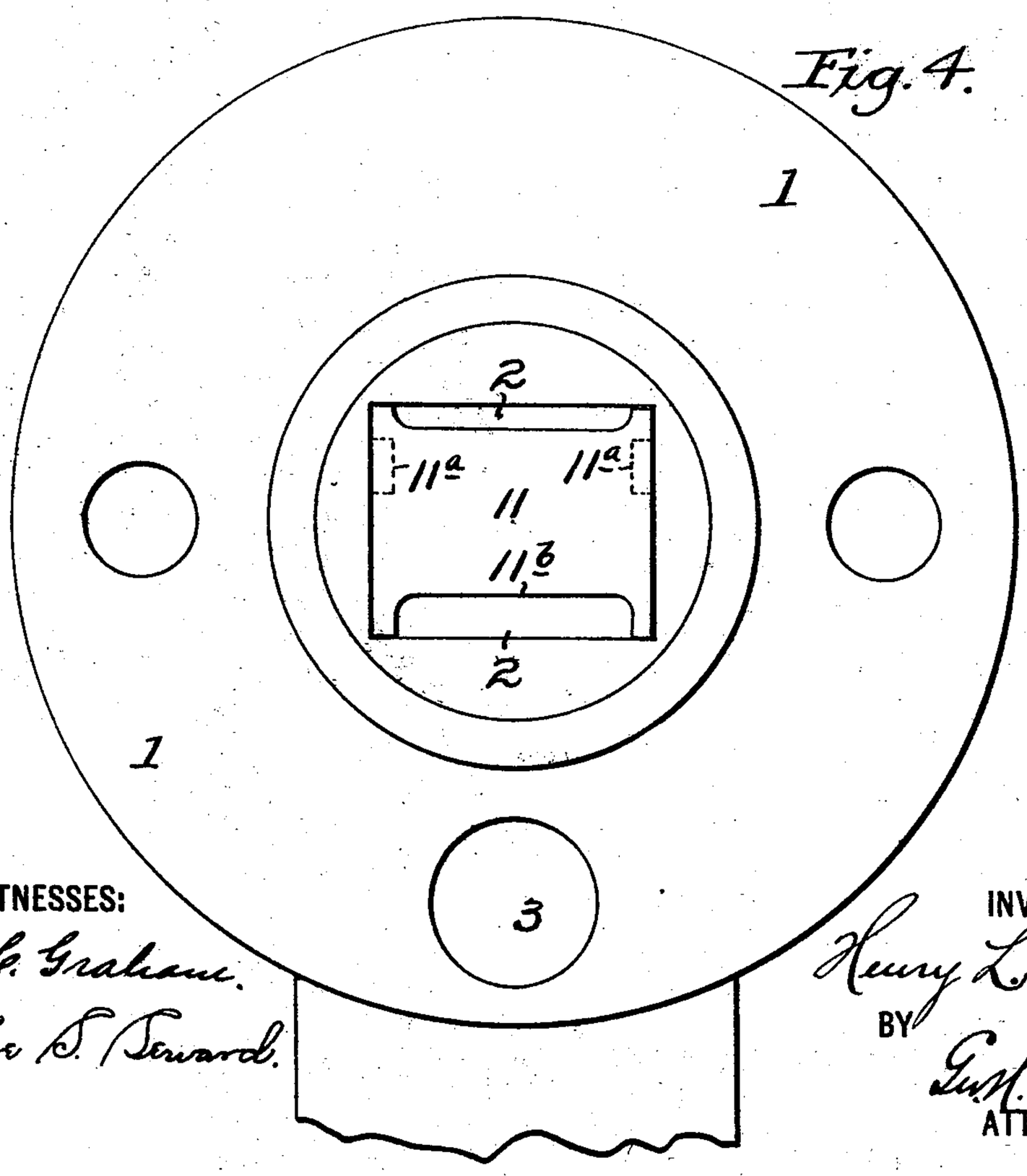


Fig. 4.



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UNITED STATES PATENT OFFICE.

HENRY L. HOWE, OF CANANDAIGUA, NEW YORK.

TRIPLE VALVE FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 507,133, dated October 24, 1893.

Application filed November 11, 1892. Serial No. 451,649. (No model.)

To all whom it may concern:

Be it known that I, HENRY L. HOWE, a citizen of the United States of America, residing at Canandaigua, county of Ontario, and State of New York, have invented certain new and useful Improvements in Triple Valves for Air-Brakes, of which the following is a specification.

This invention relates generally to that class of valves now commonly known as triple-valves for air brakes, that is to say, a valve capable of controlling three different air passage connections, as for instance the connection between a supply or train-pipe and an auxiliary reservoir, between an auxiliary reservoir and an operating or brake-cylinder, and a direct connection between the supply or train pipe and the operating or brake-cylinder.

The invention, however, relates more particularly to a construction of the valves for controlling the exhaust of the brake cylinder to the atmosphere and the communication between the auxiliary reservoir and the brake-cylinder and also to an automatic means for keeping the train-pipe open during the direct supply of pressure from said pipe to the brake cylinder on the application of such pressure for the emergency stop.

In another application filed by me in the United States Patent Office February 6, 1892, Serial No. 420,496, there is shown and set forth a novel construction and arrangement of cooperating slide-valves and piston with proper ports and passages by which the triple valve action is effected by variations of the pressure in the train-pipe, and the present improvements are supplementary to and adapted to the structure shown and described therein. A further improvement on this same class of triple-valve is also set forth in another application filed by me in the United States Patent Office June 6, 1892, Serial No. 435,735, which is shown combined herewith.

Briefly stated, the present improvements consist in a slide valve made in two independent parts, both connected to a single operating piston and adapted to control ports and passages in an underlying or adjacent slide valve which in itself is normally stationary but at certain times is movable to control other passages entirely distinct from those controlled by the two part slide valve. In the present instance, one of these parts of the two part slide valve controls the opening and closing of the exhaust port between the brake-cylinder and the atmosphere; and the other part of this two part slide valve controls the ports between the auxiliary reservoir and the brake-cylinder. The two parts of this slide valve are arranged to provide a certain lost motion between them, that is to say, that one part shall move a certain distance before the other part is moved whereupon they will both move together as a single piece. This permits a slightly longer travel of the operating piston to effect the service stop, holding the brake-cylinder open to the atmosphere until just before the ports register which allows the auxiliary reservoir pressure to pass into the brake cylinder, and thereby rendering the operating piston more sensitive and more easily started in its movement upon a slight reduction in pressure in the train-pipe for the service stop because of having to move in the first instance a valve of much less size. This sensitive movement of the piston also saves the pressure, it not requiring so much of a reduction to effect its movement; and it furthermore is important in that in prior structures requiring a considerable reduction in pressure to effect the service stop, where used on a long train, there might be a tendency for the triple valve nearest the engine to move farther than needed to effect said service stop. This same lost motion between the two parts of the two part slide valve also renders the operating piston more delicate, when, after a service stop an equilibrium of air pressure is established on both sides of said operating piston to permit the spring stop to move said piston back slightly to close communication between the auxiliary reservoir and the brake-cylinder to hold the air pressure in the brake-cylinder. The underlying slide valve which controls the direct communication between the train pipe and the brake cylinder for the emergency stop is also modified over the previous structure to enable the further stroke of the operating piston (from service stop position to emergency stop position) to be shortened and thus this latter stop be effected with greater rapidity. In lieu of the rigid arm in

the prior structure projecting from and carried by the operating piston to prevent the seating of the double check valve in the train pipe opening against its upper seat during the supply of pressure from the train pipe direct to the brake-cylinder for emergency stop, there is employed in the present case an independent piston which carries a finger or stop for contact with the double check valve. The opposite sides of this piston are exposed,—one to the auxiliary reservoir pressure at all times, and one normally to the train pipe pressure; and normally the independent piston and its finger occupy such positions as to not obstruct the upper seating of the double check valve, but on the emergency stop, the pressure on the train-pipe side of the piston has been so reduced by having expanded into the brake cylinder, that the auxiliary reservoir pressure on the other side of the piston is sufficient to move it over suddenly, so that its finger or stop will obstruct the said check valve and hold it from its upper seat. This independent piston is also made the means of uncovering a passage between the auxiliary reservoir and the brake-cylinder at emergency stop position, so that the pressure from the auxiliary reservoir may be free to pass to the brake-cylinder independent of any movement of the slide valves.

As a better understanding of the invention may be had by a detailed description thereof, such description will now be given, reference being had to the accompanying drawings, in which—

Figure 1, is a vertical sectional elevation of a triple valve provided with the improvement, the parts being shown in the exhaust or charging position. Fig. 2, is a similar view, showing the parts in "service-stop" position. Fig. 2^a, is a view of the slide valves after a partial movement of the operating piston. Fig. 2^b, is a view of the slide valve after a partial return movement of the operating piston for recharging the reservoir while the brakes are on or without opening the brake-cylinder to the exhaust. Fig. 3, is a like view with the parts in "emergency-stop" position. Fig. 4, is an end elevation of the valve shell looking from the left of Figs. 1, 2 and 3. Fig. 5 is a plan view of the slide valves removed from the slide valve chamber, said valves being in the position shown in Fig. 1. Fig. 6 is a plan view showing the upper face of the underlying slide valve. Fig. 7 is a cross section on the line 7, 7 of Figs. 1 and 5. Fig. 8, is a sectional elevation of a modified form of check valve.

As the general construction and arrangement of the triple valve is the same as that set forth in my said first application, corresponding parts will be lettered and numbered and called alike.

The valve shell 1, is provided with a valve chamber 2, having an opening for communication with an auxiliary reservoir; a duct 3^b, leading to a brake-cylinder opening 3; ports 5^b and 5^c communicating with a passage 5 leading to the train-pipe opening 4, said valve chamber being also open to the piston-cylinder 6; and furthermore having a passage in communication with the exhaust port 7.

In the valve chamber 2 is arranged a pair of slide valves 8 and 10. The underlying valve 8 is a recessed valve and controls the duct 3^b, the passage to the exhaust port 7, and the ports 5^b and 5^c leading to the passage 5 and thence to the train-pipe, and has an independent exhaust duct 9 extending across its chamber which at the proper time coincides with the passage to the exhaust port 7; and it also has openings 8^a and 8^b through one of its walls. The valve 8 is also provided with a flange 8^c having an opening or series of openings 8^d through it and a cross-bar 8^e; the flange 8^c with its openings 8^d normally holds the communication between the train-pipe passage by port 5^c open with the auxiliary reservoir by the valve chamber 2, and the cross-bar 8^e is adapted at certain times to overlie and close the port 5^b to the train-pipe passage 5 and thus cuts off communication between the train pipe and the brake cylinder until the slide valve 8 is moved into emergency position. The cross-bar 8^f of this valve is arranged to close the exhaust port 7, when said valve is in emergency stop position, see Fig. 3. The other or overlying slide valve 10 is formed in two parts or has another part 10^c both of which rest upon and slide over the upper face of the underlying slide valve 8, and said two parts are both adapted to move when in certain positions independent of one another as well as in unison, and also independent of the underlying slide valve 8. The two parts of the overlying slide valve are carried within a yoke 11, consisting of two parallel side bars 11^a and two end plates 11^b and 12, which latter are in position to meet the respective ends of the underlying slide valve 8 to cause a movement of said valve 8 to and from emergency position. The part 10 of the overlying slide valve is seated in a recess in the side bars 11^a of the yoke, see Fig. 5, so that whatever movement the yoke may have the said part 10 will move with it; and this part has a port or series of ports 10^a adapted to register with the port or series of ports 8^a in the slide valve 8. The other part 10^c of the overlying slide valve is shorter than the distance between the adjacent end of the part 10 and the end plate 1, so that in the normal or charging position of the triple valve, there is formed a space 10^d between the adjacent ends of the two parts 10 and 10^c. This part 10^c of the valve has an inner recess 10^b adapted to open communication between the recess of the underlying valve 8 through port 8^b and the exhaust port 7 through duct 9. The flange 8^c of the underlying slide valve preferably completely covers the train-pipe port 5^c to the slide valve chamber 2, but is provided as before explained, with a series of openings 8^d which establish communication

between the train pipe and the auxiliary reservoir through said chamber 2, and are so arranged in the flange 8^c that almost immediately after the slide valve 8 is moved for the emergency stop the train pipe opening is shut off from the valve chamber and reservoir.

The three valves 10, 10^c and 8, are all moved by a connection with a piston 15 arranged in the cylinder 6 through a stem 16, leading from the end plate 12, of the yoke 11. The movement of the piston 15 and the slide valves in one direction is yieldingly opposed by a suitable spring 17, arranged in a recess 20 in the head 19 of the valve shell 1, its pressure being regulated and held by an adjusting screw 21, and lock nut 23. The spring, however, is of such length as to allow the piston 15 and with it the slide valves 10 and 10^c to move from their normal or running positions a short distance in one direction unopposed by said spring as will be noticed on referring to Fig. 1.

The passage 5 to the train-pipe is provided with a double seated check valve 13, working in an enlargement between upper and lower valve seats 13^b and 13^a, the wings of the valve fitting and being guided by the walls of the passage 5. The passage 5 is constantly in communication by an annular channel 14^a and piston duct 14, with the piston cylinder 6 in rear of the piston 15, the piston not acting to restrict or cut off such communication.

Instead of mounting a stopping finger for the double check valve with the piston 15, as in said prior applications for Letters Patent, the stop or finger 18^b in the shape of a disk or collar is carried by a rod 18 having at its inner end a piston 18^c fitting a short open-ended cylinder 18^d in the shell 1, between the passage 5 and cylinder 6. A spring 18^e may hold the finger and piston 18^c in their normal inactive positions shown in Figs. 1 and 2. The stop or finger 18^b is so arranged that when the piston 18^c is moved by the pressure as hereinafter described, it will meet the projection 18^a of the double check valve 13 and hold it from its upper seat 13^b. The valve shell is also provided with a by-pass F′ opening at one end into the train-pipe passage 5, above the upper seat of the double check valve 13, and there, or otherwise controlled by a small check valve 40, and at its other end connecting by a passage 34 with said passage 5, or train pipe opening 4 below the upper seat of said double check valve. The opening and closing of this passage F′ is controlled by the smaller end 33, of a differential piston that is mounted to reciprocate in a chamber 31, which is in communication with the brake cylinder passage 3, through a duct C′. The large area 30, of the differential piston is thus always exposed to the pressure from the brake cylinder, while its smaller area 33, is exposed to that from the train pipe.

When the parts are in the position shown in Fig. 1, and the triple-valve is in its exhaust and charging position, and it is desired to charge the auxiliary reservoir, the pressure in the train-pipe has caused the check-valve 13, to be seated against its upper seat 13^b cutting off the train pipe passage from the auxiliary reservoir; but such pressure at the same time has acted upon the small area 33 of the differential piston against but little pressure on the large area,—assuming that the pressure in the brake cylinder has become reduced sufficiently for the purpose,—and moved said piston to open the passage F′ so that the fluid may pass from the train pipe through said passage into the valve chamber 2, and thence to the auxiliary reservoir to charge the same.

When a service stop is needed, the pressure in the train pipe is slightly reduced permitting the excess of pressure above the double check valve 13 to cause the latter to seat against its lower seat 13^a, preventing any leakage from the auxiliary reservoir into the train pipe, and the operating piston 15 to move over toward the yielding stop formed by the spring 17. In so doing the piston 15 has drawn the yoke 11 forward and with it the part 10 of the slide valve leaving the other part 10^c at rest, still in exhaust position, so that the parts assume the position shown in Fig. 2^a. The piston 15, continuing to move now moves both the valves 10 and 10^c in unison until the parts reach the position shown in Fig. 2, having compressed the spring 17, as fully as the reduction in pressure in the train pipe and in rear of the piston 15, will permit. The exhaust port 7, has thus been cut off from the brake cylinder and the auxiliary reservoir pressure is opened to the brake cylinder by coincidence of the ports 10^a and 8^a, thereby effecting the service stop. At this time the pressure in the brake cylinder or in its passage 3 is sufficient to cause the differential piston 30, to have seated to close the by-pass F′ so that no pressure passes from the train pipe around the double check valve 13. This putting on of the brake causes a reduction of pressure in the auxiliary reservoir and in the valve chamber 2 and in front of the piston 15, the air having expanded into the brake cylinder, so that automatically the operating piston 15 moves under the force of the spring 17 slightly toward its normal position. In this movement, said piston 15 will through the yoke 11, have moved the valve 10, as in Fig. 2^b, sufficiently to close the opening through the ports 10^a and 8^a and thus cuts off the auxiliary reservoir pressure from the brake cylinder, whereupon if it be desired to recharge the auxiliary reservoir the pressure in the train pipe will be slightly increased to raise the double check valve 13, from its lower seat 13^a so that said pressure may pass around it (without moving it to its upper seat 13^b) and thence by the valve chamber 2 pass into the auxiliary reservoir to recharge it. A further increase in pressure in the train-pipe will cause the double check

valve to seat against its upper seat and acting through the duct 14 will move the piston 15 back to its normal position, returning the parts to the exhaust position shown in Fig. 1.

Should it be desired to effect an emergency stop whether the parts be in either of the positions above described, a sudden and heavy reduction in pressure in the train-pipe causes the double check valve to seat on its lower seat, thus preventing any leakage from the auxiliary reservoir into the train-pipe, and also causes the operating piston 15 to move to the limit of the forward stroke, as in Fig. 3, compressing the spring 17 to its fullest extent, and the end plate 11^b of the yoke having met the end of the underlying valve 8 has moved that valve bodily over, bringing the ports of said valve into coincidence with the ports 5^b, 5^c and the passage 3^b thereby opening the direct communication between the train-pipe opening 5, and the brake cylinder through the recess in said valve 8. Upon the sudden reduction in the train-pipe pressure to effect this emergency stop, the auxiliary reservoir pressure in the valve chamber 2 and cylinder 6 acting upon the back of the piston 18^c will, owing to the pressure on its opposite side having passed to the brake-cylinder, immediately cause said piston to move toward the train-pipe opening and place its finger 18^b in position to be met by and obstruct the projection 18^a on the end of the double check-valve 13, so that as soon as the double check-valve rises, which it almost immediately does, by reason of the reduction in pressure above it, (the air having expanded into the brake cylinder) the double check-valve will be held suspended or from seating against its upper seat 13^b, by the finger 18^b, so that the train-pipe pressure may pass around the double check-valve 13, directly into the brake cylinder. In this emergency stop movement, the position of the overlying valves 10 and 10^c with respect to the ports and ducts in the valve 8, has not been changed from that assumed in effecting the service stop before described. Hence said valves 10 and 10^c perform no function in providing the direct train-pipe connection with the brake-cylinder. Because of the coincidence of the ports 10^a and 8^a and their remaining in coincidence during the movement of the valve 8, the direct train-pipe pressure is supplemented by that from the auxiliary reservoir passing through said ports 10^a and 8^a, and this communication may be further increased by arranging the independent piston 18^c to uncover a passage 19 in its cylinder 18^d so that the auxiliary reservoir pressure in the cylinder 6 may pass to the brake cylinder by train-pipe passage 5, 5^b, 5^c, and the recess of the valve 8, as is shown in Fig. 3. When the pressures are equalized in train-pipe and brake-cylinder, the double check-valve will fall to its lower seat, and when the pressures of brake-cylinder and auxiliary reservoir are equalized, the spring 18^e will return piston 18^c to its normal position, thus allowing the double check-valve to seat on its upper seat without obstruction, whenever the train-pipe pressure is increased for the purpose.

While the double check-valve is held from its upper seat in the emergency stop, in addition to the train-pipe pressure passing directly into the brake cylinder, straight air may be applied by the engineer without disturbing the emergency position of the triple valve, thus supplementing the auxiliary reservoir and train-pipe pressure with an added supply of air from the main reservoir or directly from the air-pump.

Instead of actually holding the double check-valve 13 from seating against its upper seat 13^b during the direct supply of pressure from the train-pipe to the brake-cylinder on the emergency stop, or at any other time should it be deemed desirable, there may be provided a supplemental check-valve 23, see Fig. 8, which is arranged when held from its seat by the interposition of the stop or finger 18^b to keep a passage 23^a past the double check valve open for the pressure to pass from the train-pipe into the brake-cylinder. As herein shown, this supplemental check valve 23 is carried by the double check valve 13, the passage 23^a being formed through its stem with a seat 23^b at its lower end. This valve 23 has its stem projecting upward through the passage with its end similar to the projection 18^a of the double check valve 13 extending in position to be met by the stop or finger 18^b. This valve 23, also, is held to its seat by a suitable spring 23^c, against the pressure of which said valve 23 is opened. With this construction it will be observed that the double check valve 13, in the emergency stop, for instance, will seat against its upper seat 13^b, as at any other time should the pressure be varied in the train-pipe, but the supplemental check valve 23 will at such time be met by the stop or finger 18^b and be depressed from its seat, so that the train pipe pressure may pass by the passage 23^a onward. So far as this supplemental check valve 23 is concerned the stop or finger as 18^b may be of any proper form and moved into position to hold said valve 23 open by any suitable means and at any position of the piston 15. Said supplemental check valve 23 is shown as carried by the double check valve 13 simply because its position in the train-pipe in the present structure is convenient, and prevents other complications.

What is claimed is—

1. In a triple valve for fluid pressure brakes, the combination with the valve chamber having connections with the auxiliary reservoir, brake-cylinder and train-pipe, of a two part valve, 10, 10^c,—one part capable of movement independent of the other, and one part having ports controlling the admission of pressure to the brake-cylinder and the other part controlling the exhaust from the brake-cylinder, and an underlying valve

holding the brake-cylinder constantly open, substantially as described.

2. In a triple valve for fluid pressure brakes, the combination with the valve chamber having connections with the auxiliary reservoir, brake-cylinder and train-pipe, of a two-part slide-valve 10, 10^c, adapted to control the admission of pressure to and the exhaust from the brake-cylinder, and a single piston with connections for moving one part of the slide-valve in advance of the other part, and an underlying valve holding the brake cylinder constantly open, substantially as described.

3. In a triple valve for fluid pressure brakes, the combination with the valve chamber having connections with the auxiliary reservoir, brake-cylinder and train-pipe, of a two part valve 10, 10^c adapted to control the admission of pressure from the auxiliary reservoir to the brake cylinder and the exhaust from the brake-cylinder and one part movable independent of and at another period in unison with the other, and another valve for controlling the direct connection between the train-pipe and brake-cylinder, and holding the brake cylinder constantly open, substantially as described.

4. In a triple valve for fluid pressure brakes, the combination with the valve-chamber having connections with the auxiliary reservoir, brake-cylinder and train-pipe of two valves for controlling the admission of pressure from the auxiliary reservoir to the brake cylinder and the exhaust from the brake-cylinder, another valve controlling the direct connection between the train-pipe and the brake-cylinder, and a single piston and connections with the three valves for moving them, substantially as described.

5. The combination with the underlying valve 8 of the overlying two part valve 10, 10^c, a yoke connected to one part of said two part valve, and an operating piston connected to the yoke, substantially as described.

6. The combination with the valve chamber of a triple valve having openings leading to the train pipe, auxiliary reservoir and brake-cylinder, of a valve 8, adapted to place the train-pipe and brake-cylinder openings in direct connection and having a flange restricting the train-pipe opening leading to the valve chamber, substantially as described.

7. The combination with the valve chamber of a triple valve having openings leading to the train-pipe, auxiliary reservoir and brake-cylinder, of a valve controlling the direct communication between the train-pipe and brake-cylinder, an operating piston for said valve, a valve in the train-pipe and a finger movable independent of the operating piston for holding the check-valve from one of its seats, substantially as described.

8. The combination with the valve chamber of a triple valve having openings leading to the train-pipe, auxiliary reservoir and brake-cylinder, of valves controlling said openings, an operating piston for moving said valves, a valve in the train-pipe, and an automatically operative finger independent of the operating piston for holding the check valve from one of its seats, substantially as described.

9. The combination with the necessary valves controlling the train-pipe, auxiliary reservoir, and brake-cylinder openings of a triple valve, of a valve in the train-pipe opening, and a piston independent of the triple valve exposed to the train-pipe pressure and auxiliary reservoir pressure having a finger for holding the valve from its seat, substantially as described.

10. The combination with the necessary valves controlling the train-pipe, auxiliary reservoir and brake-cylinder openings of a triple valve, of a double seated check valve controlling the train-pipe opening, a supplemental valve also controlling said opening and a movable stop or finger for holding said supplemental valve from its seat at the desired time, substantially as described.

11. The combination with the necessary valves controlling the direct communication between the train-pipe and brake-cylinder openings of a triple valve, of a double seated check valve in the train-pipe opening, a supplemental valve and its seat carried by the double check valve from its seat, substantially as described.

12. In a triple valve for fluid pressure brakes, the combination of a valve controlling communication between the train-pipe and the auxiliary reservoir and the train-pipe and the brake-cylinder, a double seated check valve in said train-pipe, a finger movable independent of the triple valve for holding the check valve from one of its seats and a piston connected with the finger one side of which piston is constantly exposed to the auxiliary reservoir pressure, substantially as described.

13. In a triple valve for fluid pressure brakes, the combination with the triple valve controlling the communication between the train-pipe and the brake cylinder, of another and independently movable valve or piston opening a communication between the auxiliary reservoir and the brake-cylinder, substantially as described.

14. The combination with the necessary valves controlling direct communication between the train-pipe and the brake-cylinder openings of a triple valve, of a check valve in the train-pipe opening, an independently movable piston and finger for holding the check valve from its seat and a passage between the auxiliary reservoir and the brake-cylinder controlled by said piston, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two witnesses.

HENRY L. HOWE.

Witnesses:
MAX C. BEARD,
JAMES A. ROBSON.