(No Model.) 4 Sheets—Sheet 1.

H. L. HOWE.

TRIPLE VALVE FOR FLUID PRESSURE BRAKES.

No. 507,134. Patented Oct. 24, 1893.

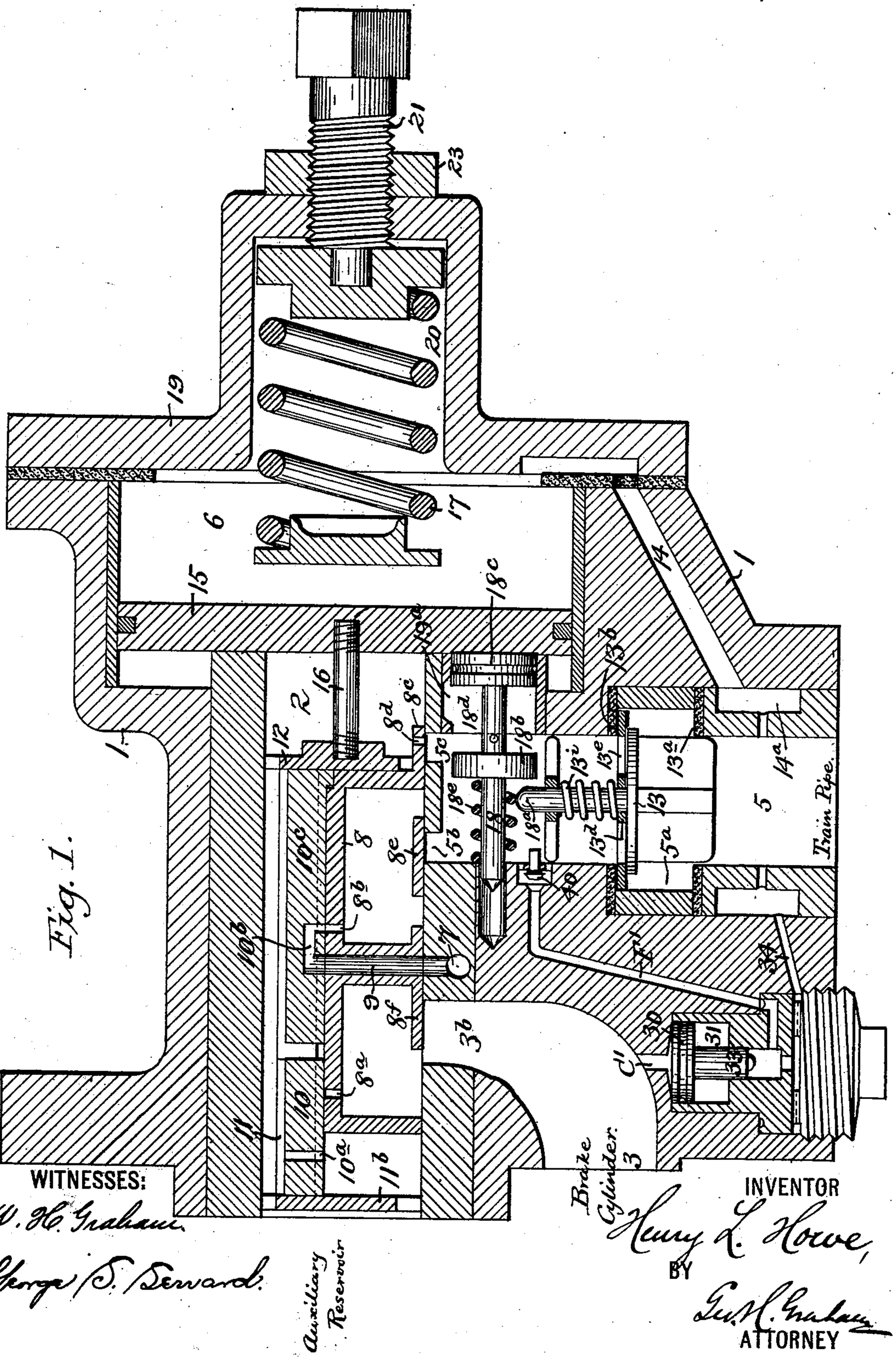

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

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TRIPLE VALVE FOR FLUID PRESSURE BRAKES.

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Fig. 1a.

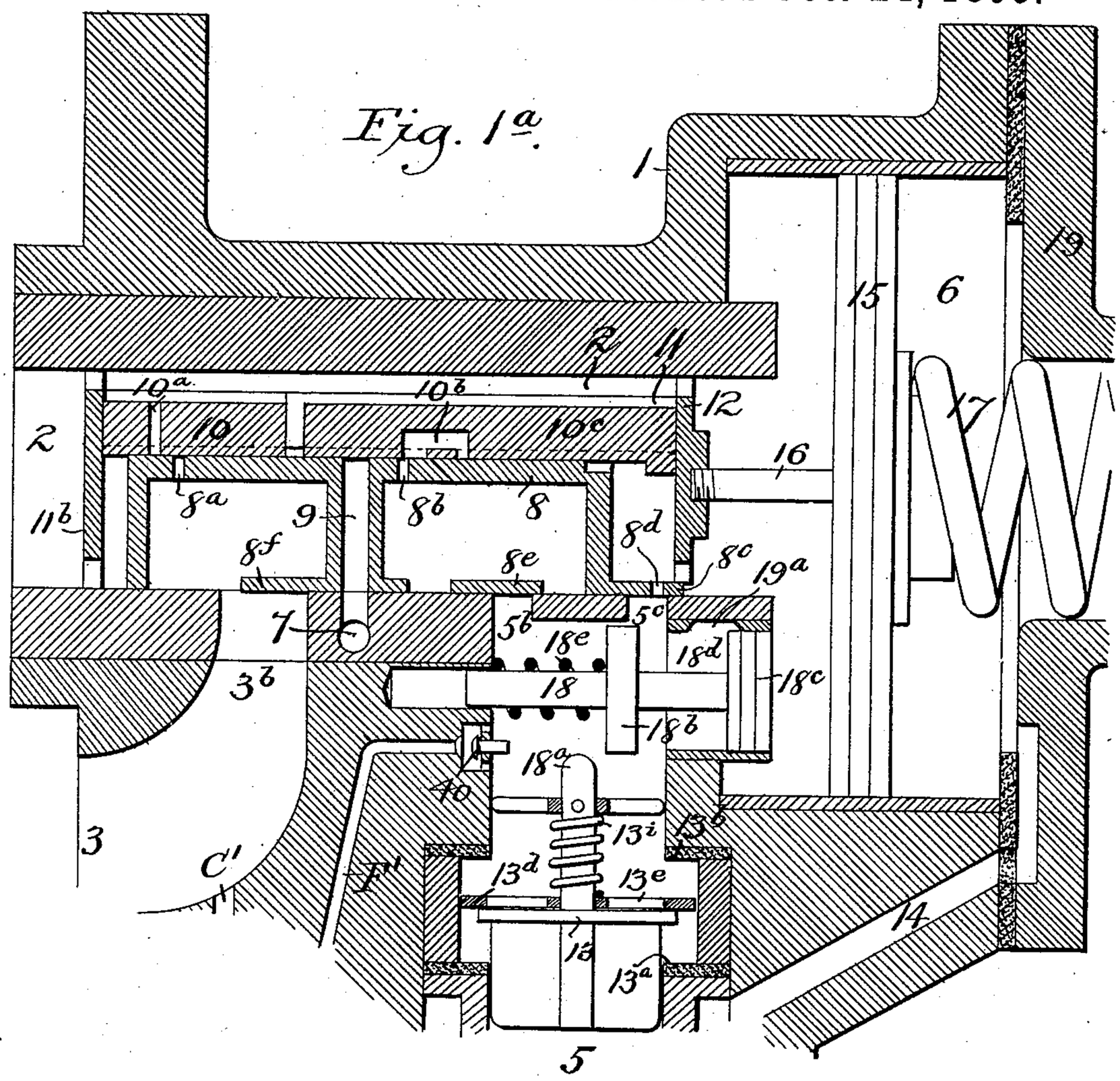


Fig. 4.

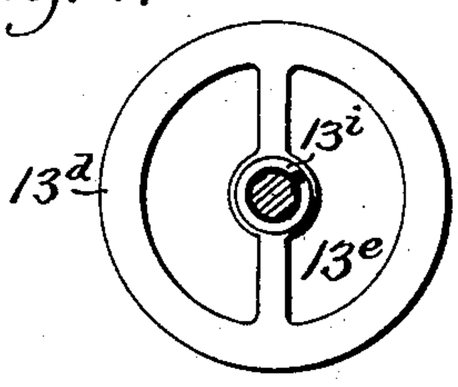
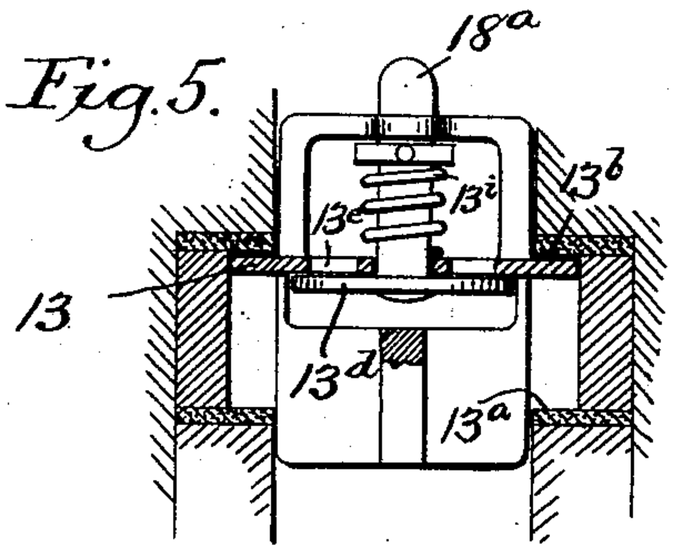


Fig. 5.



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TRIPLE VALVE FOR FLUID PRESSURE BRAKES.

No. 507,134. Patented Oct. 24, 1893.

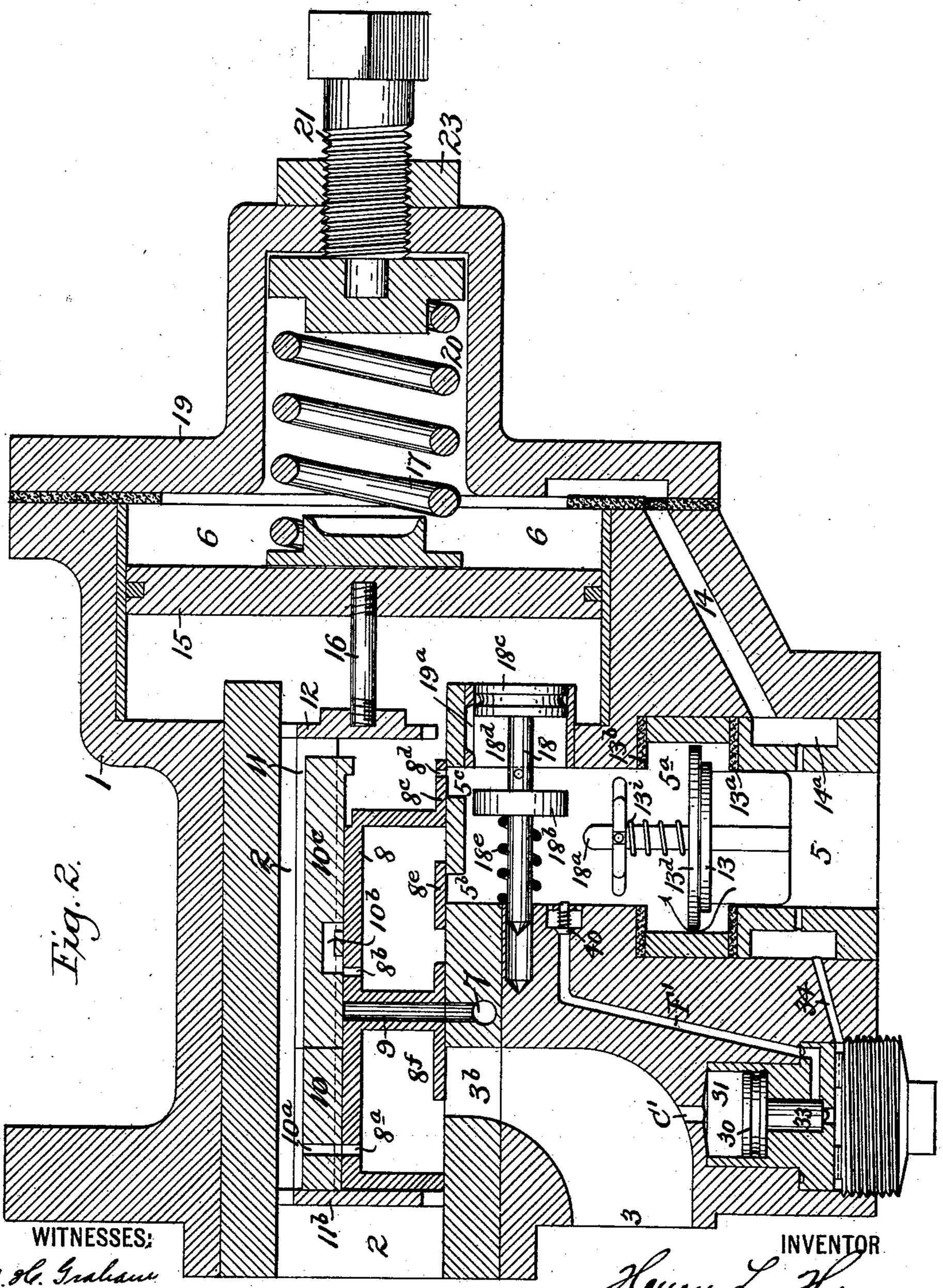

Fig. 2.

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TRIPLE VALVE FOR FLUID PRESSURE BRAKES.

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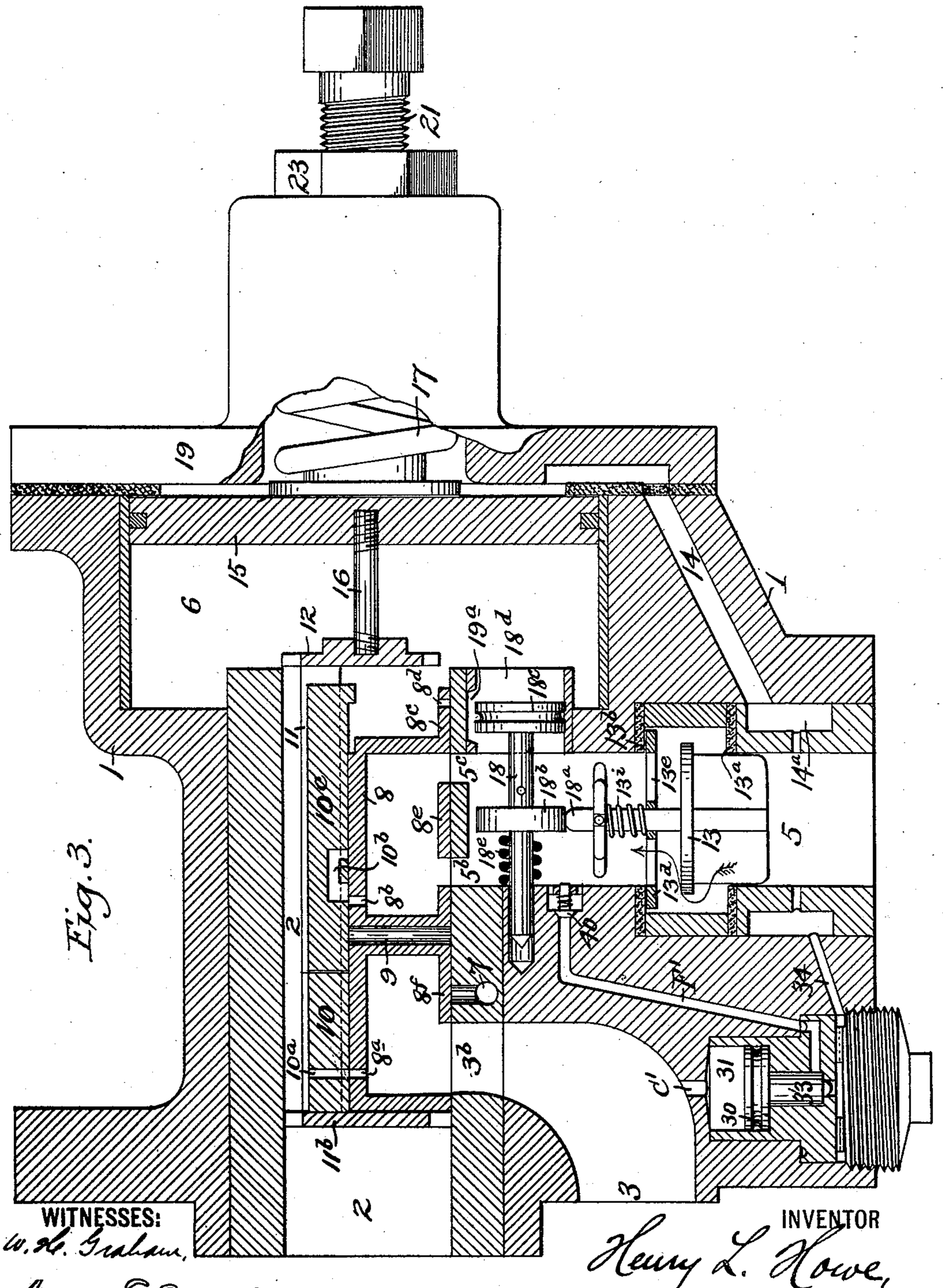

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UNITED STATES PATENT OFFICE.

HENRY L. HOWE, OF CANANDAIGUA, NEW YORK.

TRIPLE VALVE FOR FLUID-PRESSURE BRAKES.

SPECIFICATION forming part of Letters Patent No. 507,134, dated October 24, 1893.

Application filed May 1, 1893. Serial No. 472,547. (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, State of New York, have invented certain new and useful Improvements in Triple Valves for Fluid-Pressure Brakes, of which the following is a specification.

This invention relates generally to fluid pressure brakes for railway trains, and more particularly to the triple valve for such brakes by which, and the variation of pressure in the train pipe, the putting on and letting off of the brakes are accomplished.

One of the tests to which triple valves are subjected to determine their delicacy in moving from service stop position to exhaust position is to permit the pressure from the main reservoir to leak into the train pipe very slowly and gently by allowing the pressure entering the train pipe to pass through a restricted opening, say three thirty-seconds of an inch in diameter, and then by such slow accumulation in the train pipe to determine how nearly simultaneous the triple valves in a train of fifty cars will move to exhaust position. In order to effect this simultaneous or nearly simultaneous operation of the triple valves, it is necessary to confine as much of the slowly accumulating train pipe pressure as possible on the back of the operating piston so that the proper movement of such piston will be insured; and to aid in accomplishing this as little of the pressure as possible must be kept from escaping or passing into the auxiliary reservoir.

The present invention provides means by which in addition to the absolute closing of the communication between the train pipe and the auxiliary reservoir when the train pipe pressure is raised or lowered, a minimum sized opening may be obtained by a slight excess of train pipe pressure and a maximum sized opening by a large excess of train pipe pressure. By this means when the pressure in the train pipe is raised slightly or to a small degree it is permitted to pass by a minimum sized opening from the train pipe into the auxiliary reservoir without affecting the position of the triple valve; but should such pressure be so raised in the train pipe as to gain on the small quantity passing through said minimum sized opening such pressure will therefore cause such opening to be closed so that the pressure may accumulate in the train pipe to act only on the operating piston to move the triple valve to exhaust position. By this means also when the train pipe pressure is suddenly reduced, as for instance to bring the triple valve to emergency stop position, the maximum sized opening is formed, so that the train pipe pressure immediately following such reduction, shall have a free and unrestricted passage to pass onward, say, for instance, to the brake cylinder.

The invention is directed more particularly to the check valve which in some classes of triple valves is interposed in the train pipe passage to the auxiliary reservoir or brake cylinder, and which is adapted to be seated to close such passage by reason of a change in pressure in the train pipe, and which is furthermore arranged to permit at certain desired times a supply of the pressure past its seat without necessarily seating it so tightly as to prevent such supply.

The present improvements are illustrated in connection with that class of triple valve shown and described in my application filed in the United States Patent Office February 6, 1892, Serial No. 420,496, as improved by the structure shown in that filed June 6, 1892, Serial No. 435,735, and as further improved by the structure shown in that filed November 11, 1892, Serial No. 451,649. In said structures, the triple-valve consists essentially of an operating piston moved to a greater or less extent by the variation in pressure in the train pipe to move a slide valve that controls the communication between the brake cylinder and the exhaust as when the brakes are off in running position, and controls the communication between the auxiliary reservoir and the brake cylinder, as when the brakes are on in a service stop, and also to move another slide valve that controls direct communication between the train pipe and the brake cylinder as when the brakes are on in an emergency stop. In addition to these slide valves such structure also includes a double seated check valve arranged in the train pipe passage, which, on a change in pressure in

the train pipe immediately seats against one or the other of its seats according as the pressure is raised or lowered and usually prevents any leakage of pressure past the seat.

One important and distinctive feature of the arrangement of the triple valve set forth in said applications and illustrated herein consists in being able to recharge the auxiliary reservoir while the brakes are on in a service stop without danger of inadvertently releasing them in so doing. To permit this recharging operation the pressure in the train pipe is very slightly raised so that the double seated check valve is just raised above its lower seat but not sufficient to be seated against its upper seat, so that in a measure it floats in the fluid pressure between its two seats and thus permits the slight increased pressure to pass onward through the slide valve chamber into the auxiliary reservoir. In this case the slight rise in pressure in the train pipe only partially overcomes the gravity of the double check valve. If now this rise in pressure is exceeded a little so as to wholly overcome the tendency of the double check valve to seat upon its lower seat, or if the pressure accumulates a little faster than it can find ready passage past said double check valve, such double check valve will be seated against its upper seat and thus close the train pipe and confine the pressure thereto against leakage to the auxiliary reservoir or any other part of the triple valve, and in this manner this pressure is made to act solely upon the operating piston and consequently effects the timely movement thereof moving the triple valve to exhaust position.

At another time the double seated check valve is positively held from seating against its upper seat as in emergency stop position where it is necessary to allow the train pipe pressure to pass direct to the brake cylinder. In this latter case it is needful to rapid operation to obtain the full train pipe opening past said double check valve, and in the former case where the auxiliary reservoir is simply being recharged a very small passage past said double check valve is all that is needed or desired in practice. The present improvements are directed to effect this three-fold result, namely, provide a minimum sized opening in the train pipe passage, close such passage, and form a maximum sized opening in such passage, and they consist in the novel structures hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a vertical sectional elevation of a triple valve provided with the improvements and Fig. 1^a is a similar view with the parts in a changed position. Figs. 2 and 3 are similar sectional elevations showing particularly the compound check valve in different positions. Fig. 4 is a plan view of said check valve. Fig. 5 illustrates a diagram of a slight modification of the improvement.

The triple valve with which the present invention is combined in said drawings may be briefly stated to consist of a shell or casing 1, containing a valve chamber 2 having connection with an auxiliary reservoir, a brake cylinder by passage 3^b and a train pipe by passage 5. In this valve chamber 2, is mounted an underlying hollow valve 8, that normally closes the direct communication between the train pipe and brake cylinder passages 5 and 3^b, and a pair of overlying slide valves 10, 10^c that control the admission of pressure from the auxiliary reservoir to the brake cylinder and also the exhaust from the brake cylinder to the atmosphere; the valve 10 having a port or ports 10^a adapted to coincide with a port or ports 8^a in the underlying valve 8, and the valve 10^c having a recess 10^b adapted to connect the opening 8^b in the valve 8 with the exhaust duct 9 carried by said valve 8 which is arranged to register with the exhaust port 7 in the shell or casing 1.

The valves 10 and 10^c are arranged to slide over the surface of the valve 8; the valve 10 being directly carried and moved by a yoke 11, and the valve 10^c is seated loosely within the yoke with sufficient lost motion longitudinally to permit the valve 10 to move in advance of the valve 10^c so that the duty to be performed in the first movement of the yoke will not be so great in moving one valve of comparatively small area as it would were the two valves 10 and 10^c made in one piece or arranged to move together as one piece. The opposite ends 11^b and 12 of the yoke 11 are arranged to meet the ends of the underlying valve 8 and at the proper time move it.

In the preferred construction the train pipe passage leading into the valve chamber 2 is divided into two openings 5^b and 5^c; and the underlying slide valve 8, is provided with a flange 8^c which overlies the opening 5^c, but is provided with an opening or series of openings 8^d through which the pressure may pass from the train pipe passage into the valve chamber 2 and thence to the auxiliary reservoir. This valve 8, also is provided with a cross-bar 8^e which covers the opening 5^b; and said valve 8 is provided with another cross-bar 8^f which when the valve 8 is moved closes the exhaust port 7 and prevents the pressure passing from the train pipe to the brake cylinder from leaking to the atmosphere. When this valve 8 is moved to emergency position the cross-bar 8^e moves over and registers with the wall between the two openings 5^b and 5^c so that both of said openings are utilized by the pressure passing to the brake cylinder in an emergency stop. All three valves 10, 10^c and 8 are moved by an operating piston 15 mounted within a cylinder 6, formed in the shell 1 in communication at one side of the piston with the valve chamber 2, and on the opposite side by a duct 14, and annular passage 14^a with the train pipe passage. This piston is connected by a rod 16 with the yoke 11.

The outward movement of the piston is controlled and limited by a rearwardly projecting spring 17, carried in a recess 20 in the

head 19 of the cylinder 6; the extent of projection of the spring being adjusted and fixed by a screw bolt 21 and jam nut 23.

The train pipe passage is provided with two separated seats 13^a and 13^b coacting with which in a recess 5^a is a double seated and duplex or two part check valve 13 arranged to seat against one or the other of said seats and close the train pipe passage, according as the pressure in said passage is raised or lowered.

On the emergency stop in order to hold the check valve 13 from seating against its upper seat so that the train pipe pressure may be free to pass directly into the brake cylinder, there is provided a movable stop 18^b arranged to meet the end or projection 18^a on the said check valve 13 and hold it from closing the train pipe passage. This movable stop 18^b in the present instance is formed by a disk on a rod 18 carrying an independent piston 18^c that moves in a cylindrical opening 18^d in the shell 1 between and opening into the cylinder 6 and train pipe passage 5; the disk being held in its normal idle position by a spring 18^e surrounding the rod 18.

In order to provide a direct or even an additional opening from the auxiliary reservoir to the brake cylinder (in addition to that formed by the ports 10^a and 8^a) on an emergency stop, there is provided a passage 19^a in the cylindrical opening 18^d so arranged that when the independent piston 18^c is moved in an emergency stop such piston will uncover said passage 19^a and permit the auxiliary reservoir pressure to pass from the valve chamber 2, and cylinder 6, into the train pipe passage and by the recess of the valve 8 into the brake cylinder. 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, below the upper seat of said double check valve. The opening and closing of this passage F′ are 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.

The double seated check valve 13 in the present construction is of compound form made in two parts or in addition to the usual valve or valve-plate 13, is provided with a superimposed disk 13^d, so that the upper surface of said disk may seat against the upper seat 13^b, and the under surface of the valve plate will seat against the lower seat 13^a. The valve or valve plate 13 proper is much smaller in diameter than the diameter of the recess 5^a in which it projects between the seats 13^a and 13^b so that the annular space between the valve and the wall of the recess will be substantially equal to the area of the train pipe passage 5. The superimposed disk 13^d on the other hand is larger in diameter than the valve or valve plate 13, and fits the valve recess sufficiently close to provide a minimum sized opening sufficient to permit the pressure to leak past the disk as indicated by the arrow, Fig. 2. The disk 13^d also, is provided with an opening or openings 13^e in line with the valve 13 equal in area to that of the train pipe passage so that when the disk has been separated from valve or valve plate 13 a free and unrestricted passage is formed of the maximum size for the pressure as indicated in Fig. 3.

The disk 13^d is mounted loosely on the stem of the valve and a spring 13^i surrounding the stem holds it down in contact with the upper surface of the valve 13; the spring being of sufficient strength to counterbalance the weight of the valve or valve plate 13 which would tend to separate said valve from the disk should the disk be held rigid by some outside influence.

During ordinary operations of the triple valve the valve 13 and the superimposed disk 13^d will act as a single piece as the said valve 13 would if the disk 13^d were absent. In service stop position when the brakes are on, and it is desired to re-charge the auxiliary reservoir without danger of releasing the brakes, the pressure in the train pipe is slightly raised so that the double and compound check valve instead of being moved up against its upper seat 13^b will be simply raised from its lower seat 13^a and held suspended or floating between its lower and upper seats, as in Fig. 2, so that the pressure may leak around the valve by the minimum sized opening between the edge of the disk 13^d and the wall of the valve recess 5^a and pass onward to the auxiliary reservoir.

If now, while the brakes are on in service stop position, the train pipe pressure be so raised as to gain on the small quantity that can pass by the minimum sized opening between the edge of the disk 13^d and the wall of the recess 5^a, such pressure will thereupon move the double and compound check-valve against the upper seat 13^b as in Fig. 1, so that the train pipe passage 5 will be closed. When this occurs the train pipe pressure, no longer able to pass to the auxiliary reservoir, will continue to accumulate in the train pipe and passing by the piston duct 14 enter the cylinder 6 and acting upon the operating piston 15 will force it toward the position shown in Fig. 1, and move the triple valve to exhaust position. In this way the train pipe pressure has been confined so as to act only on the operating piston to cause its movement and that of the valve or valves with which it is connected.

If, when the triple valve is in exhaust position, as in Fig. 1, or in service stop position,

as in Fig. 2, it be desired to effect an emergency stop, a heavy reduction in train pipe pressure will cause the double and compound check valve to seat against its lower seat 13^a preventing any leakage of air from the auxiliary reservoir into the train pipe, and causing the operating piston 15 to move to the limit of forward stroke as in Fig. 3, compressing the spring 17 to its fullest extent and moving the slide valves 8, 10 and 10^c so that the recess of the valve 8 is brought into coincidence with the openings 5^b and 5^c and the brake cylinder passage 3^b, thereby opening the direct communication between the train pipe passage 5 and the brake cylinder. Upon the heavy 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 stem of the valve or valve plate 13, so that as soon as the double and compound check valve rises, which it almost immediately does by reason of the expansion of the air above it into the brake cylinder, the end of the stem of the valve or valve plate 13 will strike the finger 18^b so that said valve or valve plate will be held suspended between the upper and lower seats 13^b and 13^a and the disk 13^d will be moved by the train pipe pressure seeking to pass it up against the upper seat 13^b against the slight force of the spring 13^i, thereby separating the disk from the valve plate and exposing the maximum sized opening through said double and compound check valve formed by the openings 18^c. The maximum sized opening thus formed permits the train pipe pressure to have a free and unobstructed passage by the recess in the valve 8 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^a, 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, ports 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 and compound check valve will fall to the lower seat 13^a the spring 13^i returning the disk 13^d to its normal position seated upon the upper surface of the valve plate 13; and when the pressures of brake-cylinder and auxiliary reservoir are equalized, the spring 18^e will return the piston 18^c to its normal position, thus allowing double and compound check valve to seat on the upper seat 13^b without obstruction, whenever the train-pipe pressure is sufficiently increased for the purpose. While the valve plate 13 is held from its upper seat in the emergency stop and the maximum sized opening is formed, 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.

From the foregoing it will be readily understood that the double seated and compound check valve serves a three-fold function in the operation of the triple valve, that is to say, it may seat against either of the seats 13^b and 13^a to close the train pipe passage stopping communication from or to the auxiliary reservoir or to the brake cylinder; it provides a minimum sized opening past it when the train pipe pressure is slightly raised to charge the auxiliary reservoir in service stop position without danger of inadvertently letting the brakes off; and it provides a maximum sized opening on an emergency stop which gives substantially the full train pipe opening for the pressure to pass through said check valve into the brake cylinder.

The extreme sensibility of the double and compound check valve to seat against the upper seat 13^b should the train pipe pressure gain on that which will ordinarily pass around the check valve by the restricted or minimum sized opening as in Fig. 2, causes it to seat against said upper seat the moment such pressure commences to gain and hence closes the train pipe passage and permits the pressure to accumulate therein and in rear of the operating piston 15 by the duct 14, until the pressure is sufficient to move said piston and the connected slide valves to exhaust position. Hence in a train of many cars with the triple valves all in service stop position, as soon as the train pipe pressure gains on that which can simply lift the compound check valves and hold them suspended between their two seats and pass by the minimum sized opening thereby provided, such gain will immediately lift all the compound check valves to the upper seat 13^b and the pressure will be confined to the train pipe and may only act upon the operating pistons of the triple valves. The construction of this compound check valve provides in its two parts, *i. e.*, the valve plate 13 and the disk 13^d, a valve and a seat

within itself independent of the seats 13^a and 13^b, and thus each part has one face of the other for its seat and for the other seats the respective ends of the recess 5^a in which the compound check valve operates.

A slightly modified form of the compound check valve is shown in Fig. 5, wherein the valve plate 13 by nearly filling the recess 5^a forms between its edge and the wall of the recess the minimum sized opening. This valve plate is also provided with the central opening 13^e closed by the disk 13^d from the underside of the valve plate, and when opened or separated from the valve plate exposes the maximum sized opening through the valve plate. The stem of the disk 13^d extends upward with its end forming the projection 18^a and a coiled spring 13^i surrounding the stem holds the disk 13^d seated against the valve plate closing the opening 13^e. In this same Fig. 5, the finger 18^d is carried by the operating piston 15, and moves with it, instead of being connected to the independent piston 18^c before described. When the operating piston 15, of Fig. 5 moves to emergency stop position, the end of the finger 18^d stops just above the projection 18^a ready to stop and hold the disk 13^d against further upward movement, while the train pipe pressure is moving the valve plate 13 upward toward and finally holds said plate against the upper seat 13^b to provide the maximum sized passage through the opening 13^e.

So far as the differential piston is concerned controlling the by-pass F′ its function and operation need not and do not modify the operation of the compound check valve and hence may be entirely absent. Its use, however, is preferred. When the parts of the triple valve are in exhaust position, and it is desired to charge the auxiliary reservoir by raising the train pipe pressure sufficiently to cause the compound check valve to seat against the upper seat 13^b closing the train pipe passage 5 to the auxiliary reservoir, the pressure in the train pipe will act upon the small area 33 of the differential piston (the larger area 30, being exposed to the brake cylinder pressure which at this time is open to the atmosphere by exhaust port 7) such differential piston will be moved to open the by-pass F′ as in Fig. 1, and permit the train pipe pressure to pass by the by-pass around the seated compound check valve and thence into the auxiliary reservoir.

When the triple valve is moved to service stop position as in Fig. 2, or to emergency stop position as in Fig. 3, and the pressure in the brake cylinder acting upon the large area 30 of the differential position is sufficient to overcome the train pipe pressure acting on the smaller area 33 said differential piston will move to close the by-pass F′ shutting off the train pipe pressure passing to the auxiliary reservoir. In this position and while the triple valve is in service stop position, the auxiliary reservoir may be charged without releasing the brakes by permitting the slight rise in train pipe pressure to pass by the minimum sized opening formed by just lifting the compound check valve from its lower seat as before described.

What is claimed is—

1. In a triple valve for fluid pressure brakes, the combination of a valve seat in the train pipe passage, a two part valve adapted to said seat, and normally providing a minimum sized opening past such seat, and said two parts of the valve being separable to expose a maximum sized opening, substantially as described.

2. In a triple valve for fluid pressure brakes, the combination of a valve seat in the train pipe passage, a two part valve adapted to said seat, and normally providing a minimum sized opening past such seat, and a movable finger for meeting one part of the valve and arresting its movement, while the other part of the valve moves onward, substantially as described.

3. In a triple valve for fluid pressure brakes, the combination of a valve seat in the train pipe passage, a two part check valve adapted to said seat, and normally providing a minimum sized opening past such seat, a piston and its finger mounted independent of the triple valve and moved to obstruct one part of the check valve while the other part moves onward, substantially as described.

4. In a triple valve for fluid pressure brakes, the combination of a valve seat in the train pipe passage, a two part valve, each of the two parts of which has one face of the other for its seat, and one of the parts being adapted to said valve seat, and the other part adapted to another valve seat, and means for arresting one part to permit separation of the other substantially as described.

5. In a triple valve for fluid pressure brakes, the combination of a recess in the train pipe passage, having at each of its ends a valve seat, a two part valve arranged within said recess, one part of which valve nearly fills the recess, and is provided with an opening through it, and the other part of which two part valve normally closes such opening and means for arresting one part to permit separation of the other to expose such opening, substantially as described.

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

HENRY L. HOWE.

Witnesses:
GEO. H. GRAHAM,
E. L. TODD.