(No Model.) 4 Sheets—Sheet 1.

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AIR BRAKE.

No. 571,095. Patented Nov. 10, 1896.

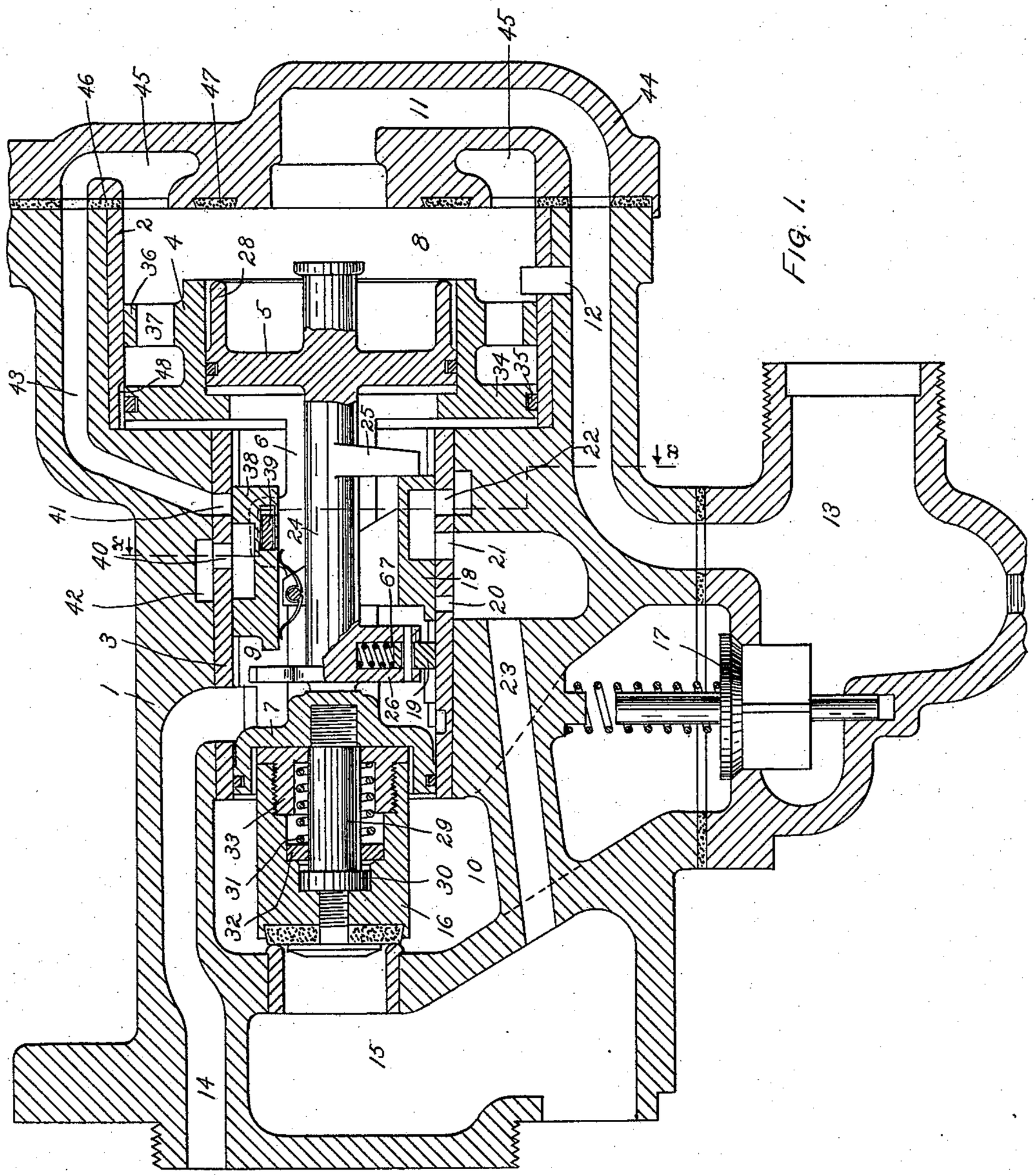

FIG. 1.

WITNESSES

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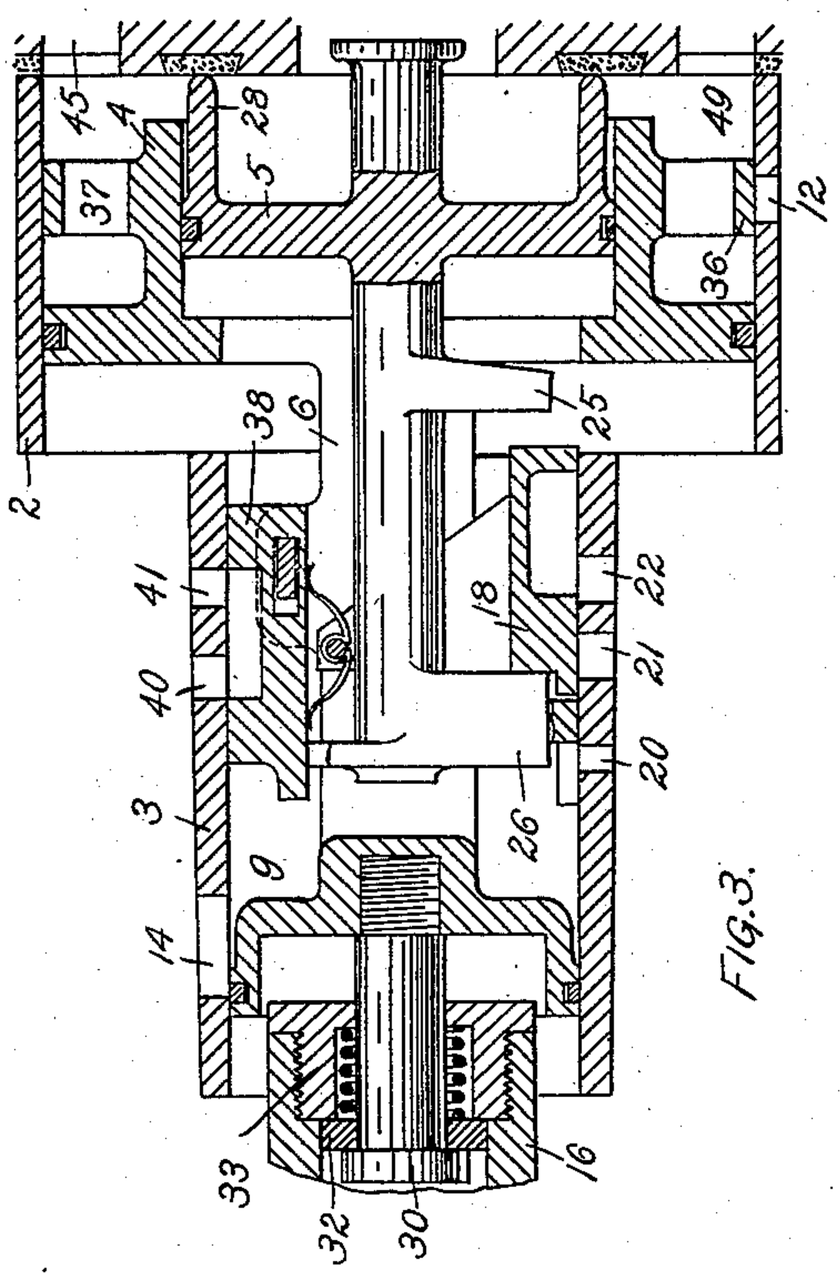

FIG. 3.

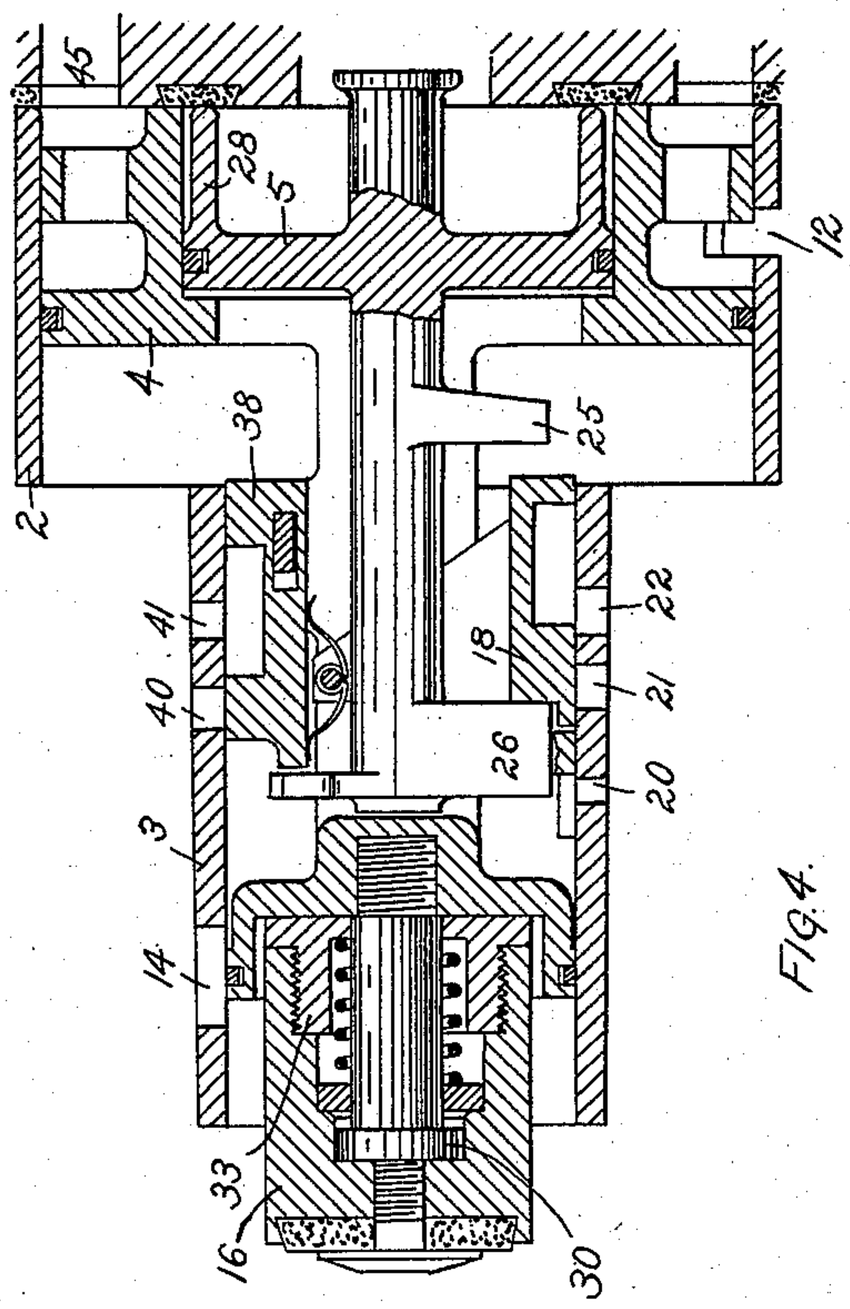

FIG. 4.

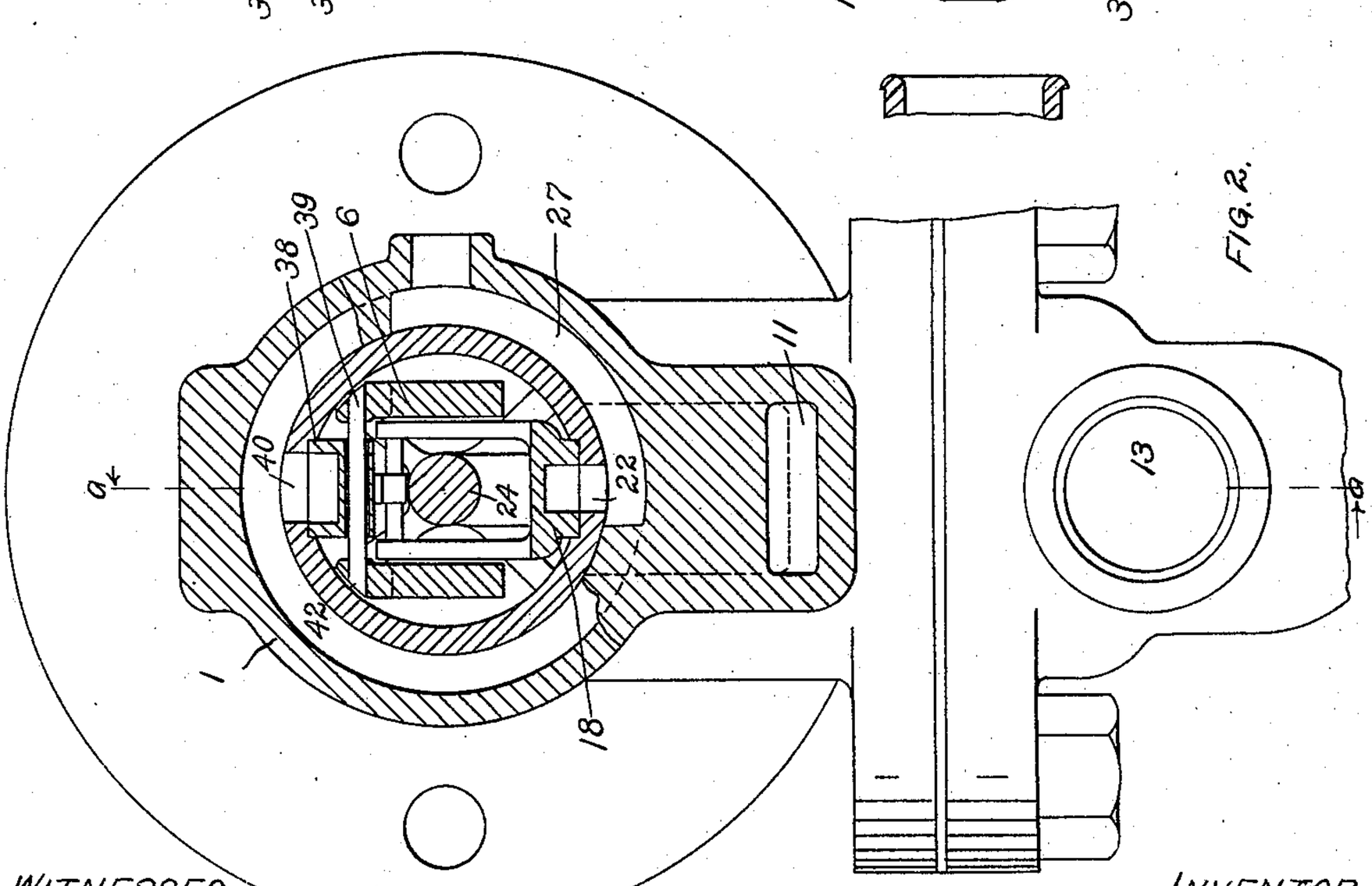

FIG. 2.

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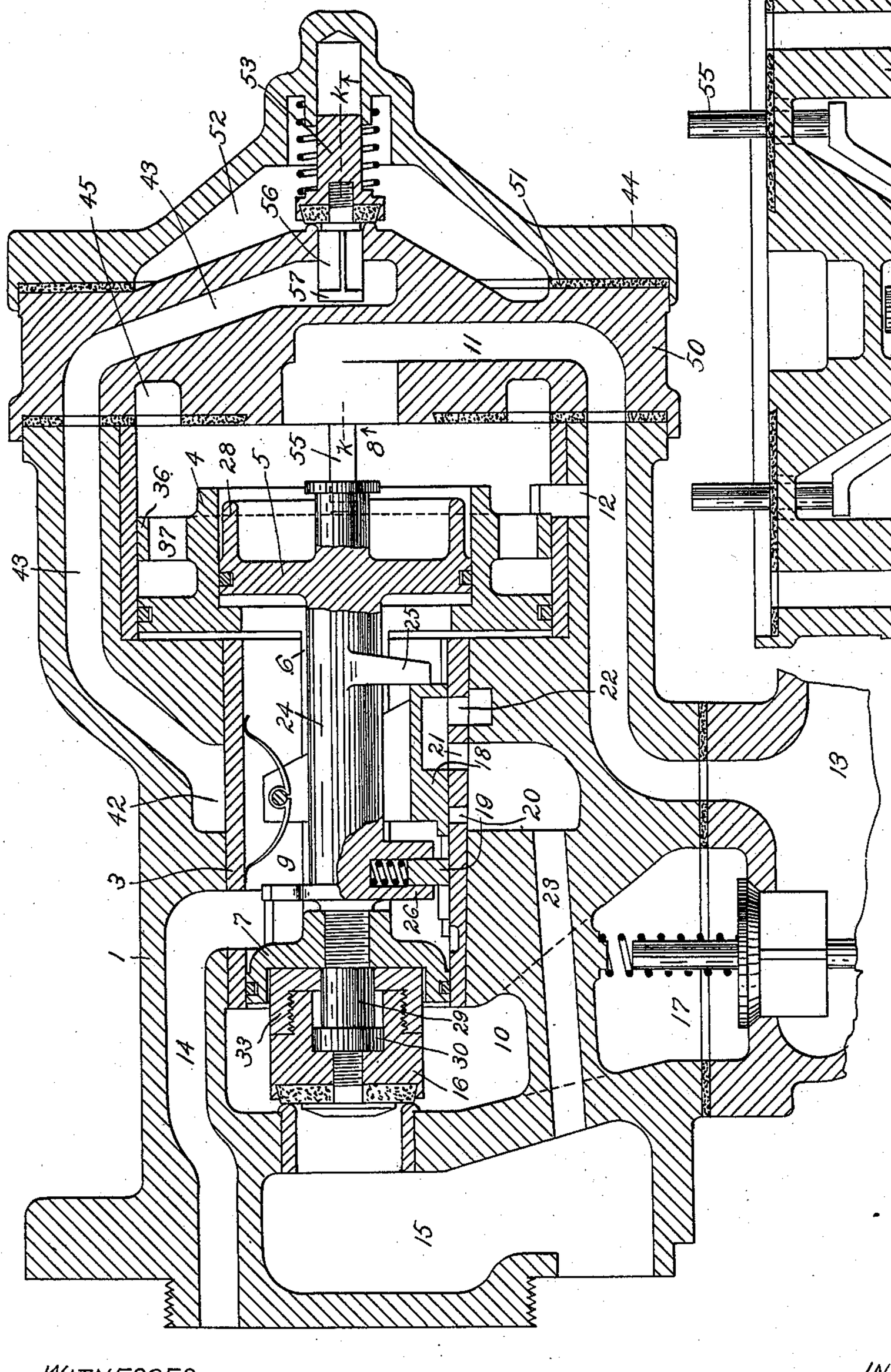

FIG. 5.

FIG. 6.

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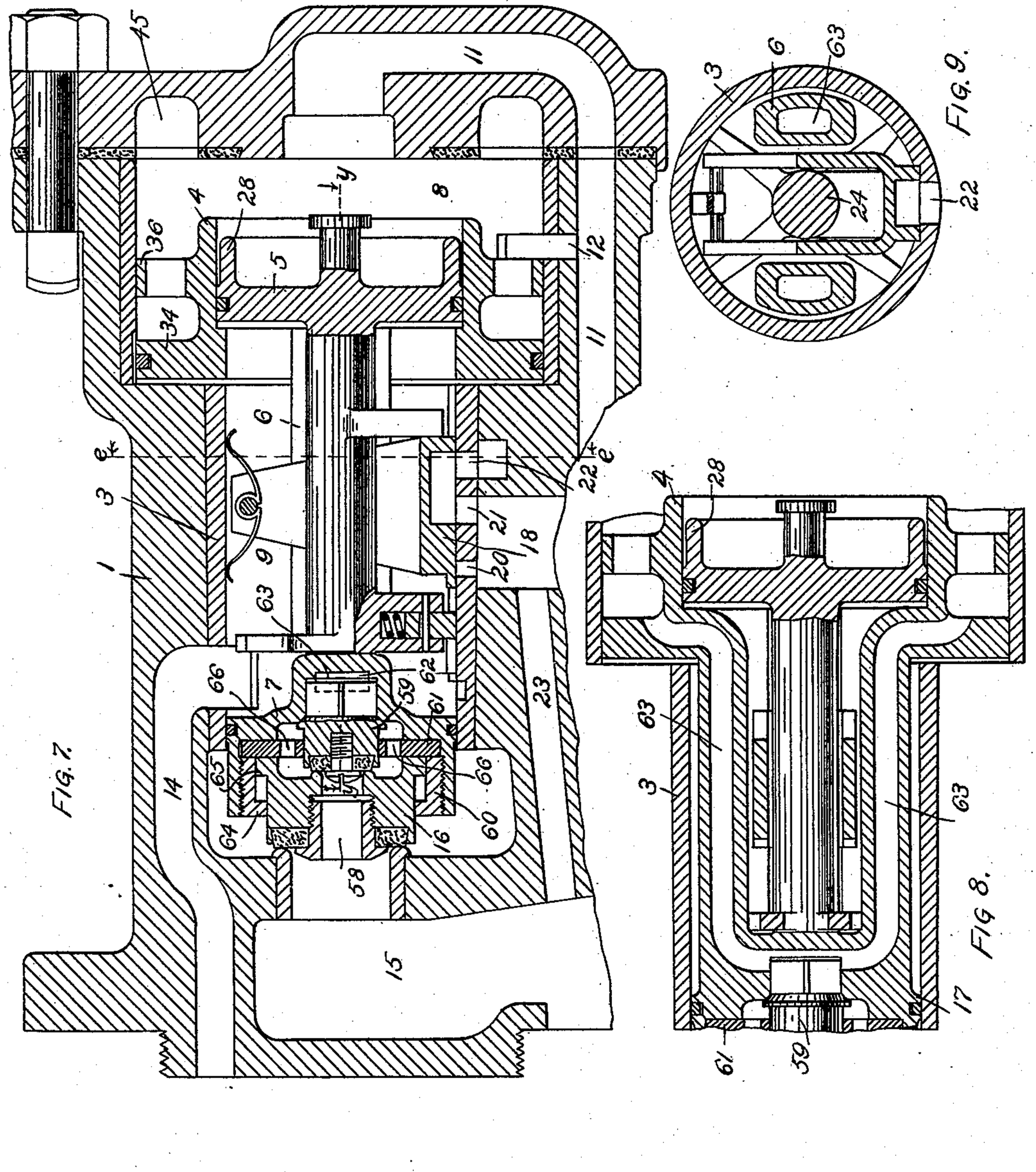

FIG. 7.

FIG. 9.

FIG 8.

WITNESSES

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UNITED STATES PATENT OFFICE.

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AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 571,095, dated November 10, 1896.

Application filed November 29, 1895. Serial No. 570,530. (No model.)

To all whom it may concern:

Be it known that I, HENRY F. NOYES, of Elgin, Kane county, Illinois, have invented certain new and useful Improvements in Air-Brakes, of which the following is a full and complete specification.

This invention relates to "quick-action triple valves," as they are commonly called, and in particular has reference to a previous application by me filed May 13, 1895, Serial No. 549,167, and has for its object to produce a valve having the advantages of the above-mentioned invention combined with a mechanism for effecting a quicker action of the brakes.

The structure of my improvement is fully illustrated in the following drawings, in which the same reference-figures refer to the same parts in different views, and in which—

Figure 1 is a vertical sectional elevation taken on line *a a* of Fig. 2. Fig. 2 is a vertical sectional elevation taken on line, *x*, *x*, of Fig. 1. Fig. 3 is a skeleton section showing the relative position of the valves and pistons at the beginning of an emergency application. Fig. 4 is a similar section showing the pistons and valves at the completion of an emergency application. Fig. 5 is a vertical sectional elevation of a slightly-different embodiment of my invention, in which the spring controlling the emergency operation is replaced by more reliable mechanism. Fig. 6 is a detail section of the casting 50 taken on line *k k*. Fig. 7 is a vertical sectional elevation of a still different embodiment of my invention, in which the exhaust-valve operates within the emergency-valve. Fig. 8 is a partial section of the same taken on line *y y* of Fig. 7. Fig. 9 is a partial section taken on line *e e* of Fig. 7.

Referring to Figs. 1, 2, 3, and 4, I provide a main shell or casing 1. Within this shell are bushings 2 and 3. Working in the bushing 2 are the pistons 4 and 5. Piston 4 forms a bushing in which piston 5 works and is connected by the bars 6 to the partition 7. These pistons 4 and 5 and the partition 7 thus divide the interior of the casing into three chambers 8, 9, and 10. Chamber 8, by the passages 11 and 12, connects with the train-pipe at 13; chamber 9, by the passage 14, with the auxiliary reservoir. Chamber 10 is separated from the opening 15, which leads to the brake-cylinder, by the emergency-valve 16 and from the train-pipe by the check-valve 17. Operating in the chamber 9 are the slide-valves 18 and 19, controlling the ports 20, 21, and 22. Ports 20 and 21 connect with the brake-cylinder by the passage 23 and port 22 with the atmosphere by the passage 27. To operate these valves, piston 5 has a stem 24, provided with flanges 25 and 26, the latter also having a transverse slot 67, in which to receive the graduating-valve 19, which is securely pinned to this flange. Piston 5 is provided with an annular rim 28, to which reference will be made later. Piston 5 and valves 18 and 19 form the operating mechanism for service applications.

The partition 7 has a pin 29 firmly fastened to it. This pin has a head 30 and works within the body of the emergency-valve 16, having enough lost motion to allow flange 34 of piston 4 to close feed-groove 48 before this lost motion is taken up. Within the valve-body is confined the spring 31 between the washer 32 and the head 33, which head is firmly screwed into the valve-body. It is evident that this spring and washer form a check to the operation of the emergency-piston. The emergency-piston 4 is provided with two flanges, one, 34, having a packing-ring 35, and the other, 36, having a number of holes 37, to which reference will be made later. Working in the top of chamber 9 is the slide-valve 38, connected with a little lost motion to the bars 6 by the key 39. This valve governs the ports 40 and 41. Port 40 connects by means of the annular passage 42 and passage 23 with the brake-cylinder. Port 41 connects by means of the passage 43 with the chamber 8. The cap 44 is provided with an annular channel 45 and with the packing 46 and 47.

The operation of this invention is as follows: The pistons and valves, as shown in Fig. 1, are in their normal or "running" position. Train-pipe pressure passes through feed-groove 48 to chamber 9 and then to the auxiliary reservoir, keeping the pressure on both sides of the pistons 4 and 5 nearly balanced. For a service application a slight or slow re-

duction of pressure of about five or six pounds in the train-pipe actuates piston 5 to move to the right until its rim 28 is stopped by packing 47. The piston-stem carries valves 18 and 19 with it, closing connection between ports 21 and 22 and opening port 20, when pressure from the auxiliary reservoir passes to the brake-cylinder until the pressure in the chamber 9 has been reduced slightly below that in the train-pipe, when the slight excess of pressure on the right-hand side of piston 5 causes it to return until the lost motion between its flanges 25 and 26 and the valve 18 is taken up. This return is sufficient to cause graduating-valve 19 to close port 20. If the brakes have not been applied with sufficient force, another slight reduction of pressure in the train-pipe is made, again opening port 20 and admitting further pressure from the auxiliary reservoir, and these operations are repeated until the brakes have been applied as hard as is desired, or until the pressures in the brake-cylinder and auxiliary reservoir have equalized. It is to be noted that during these operations the train-pipe pressure has not been lowered sharply enough to allow the greater pressure behind piston 4 to overbalance the pressure of spring 31. Hence the emergency-piston and its connected valves remain inoperative. It must also be noted in this connection that it requires a much greater reduction of pressure to lift emergency-valve 16 from its seat than is required to compress spring 31.

To release the brakes, the train-pipe pressure is increased, which drives piston 5 and its valves back to the position shown in Fig. 1, when pressure from the brake-cylinder quickly passes to the atmosphere through passage 23 and ports 21 and 22.

For an emergency application of the brakes a quicker or greater reduction of train-pipe pressure of eight or ten pounds is made. Piston 5 now moves to the right until its rim 28 strikes packing 47, as before. At the same time piston 4 moves up, causing pin-head 30 to compress spring 31 until the washer 32 strikes a cap 33, when the pistons and valves are in the positions shown in Fig. 3. It is now evident that by the rim 28 of the piston 5 shutting off connection with the train-pipe through the passage 11, and flange 36 covering port 12, an annular chamber 49 is formed. At the same time valve 38 has moved up so as to connect ports 40 and 41. Hence the pressure in this chamber 49 passes through passage 43, ports 40 and 41, passages 42 and 23 to the brake-cylinder, thus instantaneously relieving the piston 4 from all pressure on its outer side, causing the pressure on its inner side to quickly overbalance the pressure with which valve 16 is held to its seat, and to open this valve when train-pipe pressure lifting check-valve 17 passes quickly and in large volume to the brake-cylinder and applies the brakes with great rapidity. The pistons and valves are then in the positions shown in Fig. 4. It is evident that now the valve 38 has closed port 40. Hence it provides against any escape of pressure from the brake-cylinder in case the train should break in two.

To release the brakes, the train-pipe pressure is raised as before. The object of the holes 37 is now apparent. The pressure feeding through port 12, and also through passage 11, both pistons are simultaneously exposed to a greater pressure on their outer sides, and the holes 37 prevent the pressure from being equal upon each of the flanges 34 and 36 and from delaying the return of piston 4, and hence the release.

It is evident that when the train-pipe pressure is lowered to effect an emergency application of the brakes check-valve 17 prevents the rapid lowering of the pressure in chamber 10, and hence the pressures on each side of partition 7 remain about the same, and the full area of piston 4 is utilized. It is evident that this escape of pressure through the passage 43 to the brake-cylinder might with equal facility be directed to the atmosphere, and that for the operation of piston 4 it is immaterial which way this escape was effected.

In Figs. 5 and 6 I have shown a modification of my invention, in which I replace spring 31 by a more reliable controlling device. The main features of this structure are the same and marked the same as in the figures previously referred to. The pin 29 is firmly fastened to the partition 7 as before, its head 30 having a certain amount of lost motion before it strikes the cap 33. Between the cap 44 and the main casing I place a piece 50, suitable packing 51 being provided between the two. The circular channel 45 now connects with the chamber 52. In this chamber is the valve 53. This valve has two projecting arms 54, provided with pins 55, and controls the opening from chamber 52 to passage 43. It also has a guiding-stem 56, provided with a head 57, to which reference will be made later. The service operation of this structure is the same as that of the structure of Fig. 1.

In emergency operations a quick reduction of pressure in the train-pipe causes both pistons to move to the right, forming the annular chamber 49 as before. Piston 4 at the same time strikes the pins 55, and lifting-valve 53 continues its travel until it reaches the position, when the head 30 strikes the cap 33. As the pressure in the chamber 52, which is connected with the annular chamber 49, escapes to the brake-cylinder through passage 43, the piston 4 continues its travel, lifting valve 16 from its seat and allowing train-pipe pressure to pass directly to the brake-cylinder. This travel of the piston is sufficient to bring head 57 fully into the opening between chamber 52 and passage 43, and as it fits this opening closely it prevents the rapid escape of pressure from the brake-cylinder in the event of the train breaking in two.

The third embodiment of my invention is

illustrated in Figs. 7, 8, and 9, in which the mechanism for service operations is the same and numbered the same as in the previous constructions. The emergency-valve 16 is provided with a port or opening 58 through it and controlled by the valve 59. The partition 7 is fitted with a cap 60, which is firmly screwed into the partition and holds the plate 61 in place. The cap 60 operates the valve 16 by means of a shoulder 64, which is fitted to bear against a shoulder 65 on the valve, allowing the valve a good deal of play, and the plate 61 actuates the valve 59 with less lost motion. The valve 59 also acts as a check-valve in the port 62, which opens into the passage 63, leading through the connecting-bars 6 to the outer side of piston 4.

The operation of the device is as follows: A quick reduction of pressure causes pistons 4 and 5 to move over, and as piston 5 forms the chamber 49 piston 4, through its connection to partition 7 and plate 61, actuates the plate to take up the lost motion with which it is fitted to valve 59, and raising this valve from its seat allows the pressure confined in chamber 49 to pass through the passages 63, through the openings 66 in the plate, and through the passage 58 to the brake-cylinder, thus causing an instantaneous release of the pressure in chamber 49, which actuates piston 4 to quickly open the emergency-valve 15 and admit pressure directly from the train-pipe to the brake-cylinder. The pistons 4 and 5 take the same relative positions during an emergency application as in the previous cases, and the illustrations in Figs. 4 and 5 will show these positions. It is evident that the point at which an emergency application begins is governed by the reduction of train-pipe pressure necessary to open valve 59 and always takes place with the same degree of reduction. The main feature of this invention, which is shown in combination with different details in each of the three structures, consists in the formation of a chamber by the main piston, which chamber is cut off from the train-pipe, and hence is readily exhausted of whatever pressure is within it, and the exhaustion of this pressure is accomplished by the emergency-piston. Thus it will be evident the advantages of this invention are: very quick action for emergency applications, since the emergency-piston does not have to wait for the main piston in all cases, but sometimes, as in case of a large and quick reduction of pressure, both pistons will move up simultaneously, since the emergency-piston will be able to overcome the pressure with which valve 16 is held to its seat without waiting for the chamber 49 to be completely exhausted of pressure; convenience for inspection and repairs, since only one part has to be taken off in order to get at the operating mechanism, and this without disturbing the connection with the train-pipe.

While I have described my invention with more or less completeness as regards the details thereof, and as being embodied in more or less precise form, I do not desire to be limited thereto unduly, as I contemplate all proper changes of form, omission of parts, and the substitution of equivalents as circumstances may suggest or necessity render expedient.

I claim—

1. In a triple-valve device, the combination of a casing provided with the usual connections with a train-pipe, an auxiliary reservoir and a brake-cylinder, a piston working within such casing, a chamber which is completed by such piston when at the limit of its stroke in the direction necessary to apply the brakes, an auxiliary valve adapted to effect the release of pressure from such chamber, and an emergency-valve adapted to effect the direct admission of pressure from the train-pipe to the brake-cylinder, substantially as described.

2. In a triple-valve device, the combination of a casing provided with the usual connections with a train-pipe, an auxiliary reservoir, and a brake-cylinder, a main and an emergency piston directly connected with each other and operating within such casing, and an auxiliary valve, directly controlled by said emergency-piston and adapted to effect the release of pressure from the chamber in which said piston operates, and an emergency-valve actuated by said piston to effect the admission of pressure from the train-pipe to the brake-cylinder, substantially as described.

3. In a triple-valve device, the combination of a casing provided with the usual connections with a train-pipe, an auxiliary reservoir and a brake-cylinder, two pistons working within such casing, one of such pistons operating in a chamber which is completed by the other piston when the latter is at the limit of its stroke in the direction necessary to apply the brakes, an auxiliary valve adapted to effect the release of pressure from such chamber, and an emergency-valve adapted to effect the direct admission of pressure from the train-pipe to the brake-cylinder, substantially as described.

4. In a triple-valve device, the combination of a casing provided with the usual connections with a train-pipe, an auxiliary reservoir and a brake-cylinder, a main and an emergency piston working within such casing, the emergency-piston operating in a chamber which is completed by the main piston when the latter is at the limit of its stroke in the direction necessary to apply the brakes, an auxiliary valve actuated by the emergency-piston to effect the release of pressure from such chamber, and an emergency-valve actuated by the emergency-piston to effect the direct admission of pressure from the train-pipe to the brake-cylinder, substantially as described.

5. In a triple-valve device, the combination of a casing provided with the usual connections with a train-pipe, an auxiliary reservoir and a brake-cylinder, two pistons working

within such casing, one of such pistons operating in a chamber which is completed by the other piston when the latter is at the limit of its stroke in the direction necessary to apply the brakes, an auxiliary valve which controls a port leading from such chamber to the brake-cylinder, and an emergency-valve which controls a port leading from the train-pipe to the brake-cylinder, substantially as described.

6. In a triple-valve device, the combination of a casing, provided with the usual connections with a train-pipe, an auxiliary reservoir and a brake-cylinder, a main and emergency piston directly connected with each other and working in such casing, an emergency-valve actuated by the emergency-piston to control a port leading from the train-pipe to the brake-cylinder, an auxiliary valve actuated by the emergency-piston to control a second port leading from the train-pipe to the brake-cylinder, the opening of said auxiliary valve adapted to take place prior to and to effect the opening of such emergency-valve, substantially as described.

7. In a triple-valve device, the combination of a casing provided with the usual connections with a train-pipe, an auxiliary reservoir and a brake-cylinder, a chamber in such casing, which chamber is completed by the walls of a main piston when the latter is at the limit of its stroke in the direction necessary to apply the brakes, an emergency-piston operating in such chamber, an auxiliary valve actuated by such emergency-piston to control a port leading from such chamber to the brake-cylinder, and an emergency-valve actuated by such emergency-piston to control a port leading from the train-pipe to the brake-cylinder, substantially as described.

8. In a triple-valve device, the combination of a casing, having the usual connections with a train-pipe, an auxiliary reservoir and a brake-cylinder, a main and an emergency piston working within such casing, a chamber which is completed by the wall of said main piston when the latter is at the limit of its stroke in the direction necessary to apply the brakes, a port connecting such chamber with the train-pipe, said emergency-piston adapted to effect the opening and closing of such port, an auxiliary valve actuated by said emergency-piston to control a port leading from said chamber to the brake-cylinder and an emergency-valve controlling a port leading from the train-pipe to the brake-cylinder, substantially as described.

9. In a triple-valve device, the combination of a casing having the usual connections to a train-pipe, an auxiliary reservoir and a brake-cylinder, a main piston, working within such casing and adapted, when at the limit of its stroke in the direction necessary to apply the brakes, to complete a chamber confining a certain volume of pressure, and a means of effecting the release of pressure from such chamber, and a means whereby the release of pressure from such chamber effects an independent release of pressure from the train-pipe, substantially as described.

10. In a triple-valve device, the combination of a casing having the usual connections to a train-pipe, an auxiliary reservoir and a brake-cylinder, a main piston working within such casing and adapted, when at the limit of its stroke in the direction necessary to apply the brakes, to form a chamber confining a certain volume of pressure, and a means of effecting a release of pressure from such chamber, and means whereby the release of pressure from such chamber, effects an independent release of pressure from the train-pipe to the brake-cylinder, substantially as described.

11. In a triple-valve device, the combination of a casing, a main and an emergency piston working within such casing, said main piston provided with a cylindrical flange, a chamber which is formed when the main piston is at the limit of its stroke in the direction necessary to apply the brakes, by the contact of said cylindrical flange with an inner face of the casing, an auxiliary valve actuated by the emergency-piston to control a port leading from such chamber to the train-pipe, and an emergency-valve actuated by the emergency-piston to control a port leading from the train-pipe to the brake-cylinder, substantially as described.

12. In a triple-valve device, the combination of a casing provided with the usual connections to a train-pipe, an auxiliary reservoir and a brake-cylinder, a main piston, an emergency-piston operating an emergency-valve, and an auxiliary valve, independent of and unconnected with the emergency-valve and actuated by the emergency-piston to effect the release of pressure from the chamber in which said emergency-piston works, substantially as described.

13. In a triple-valve device, the combination of a casing provided with the usual connections with an auxiliary reservoir, a train-pipe and a brake-cylinder, a main and emergency piston directly connected with each other and working in a chamber of such casing, and an auxiliary valve actuated by such emergency-piston to control a port leading from the chamber in which said emergency-piston operates, and an emergency-valve actuated by such emergency-piston to control a port leading from the train-pipe to the brake-cylinder, substantially as described.

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