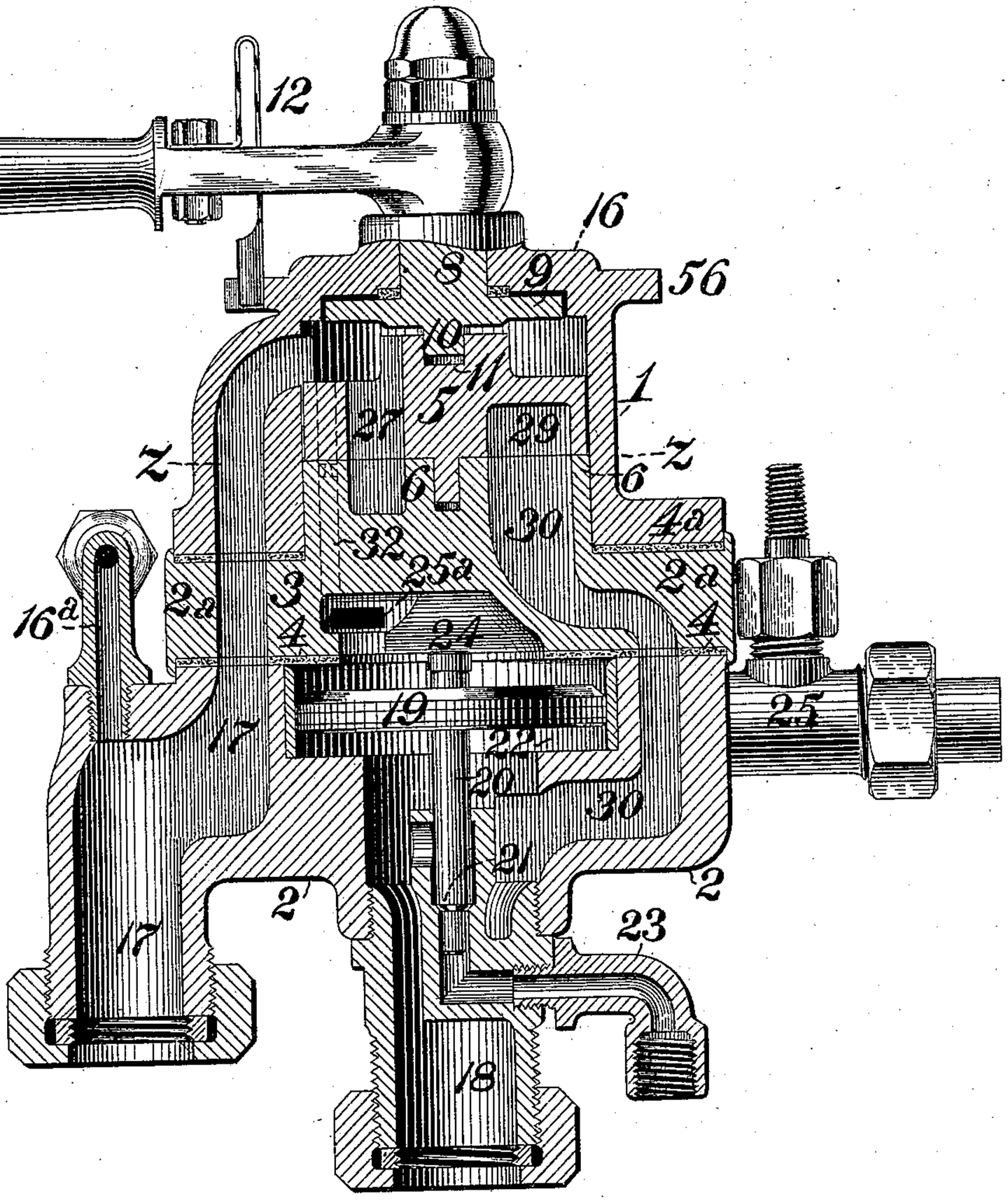
(No Model.) 4 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr.

ENGINEER'S BRAKE VALVE.

No. 557,463. Patented Mar. 31, 1896.

FIG. 1.



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(No Model.) 4 Sheets—Sheet 2.

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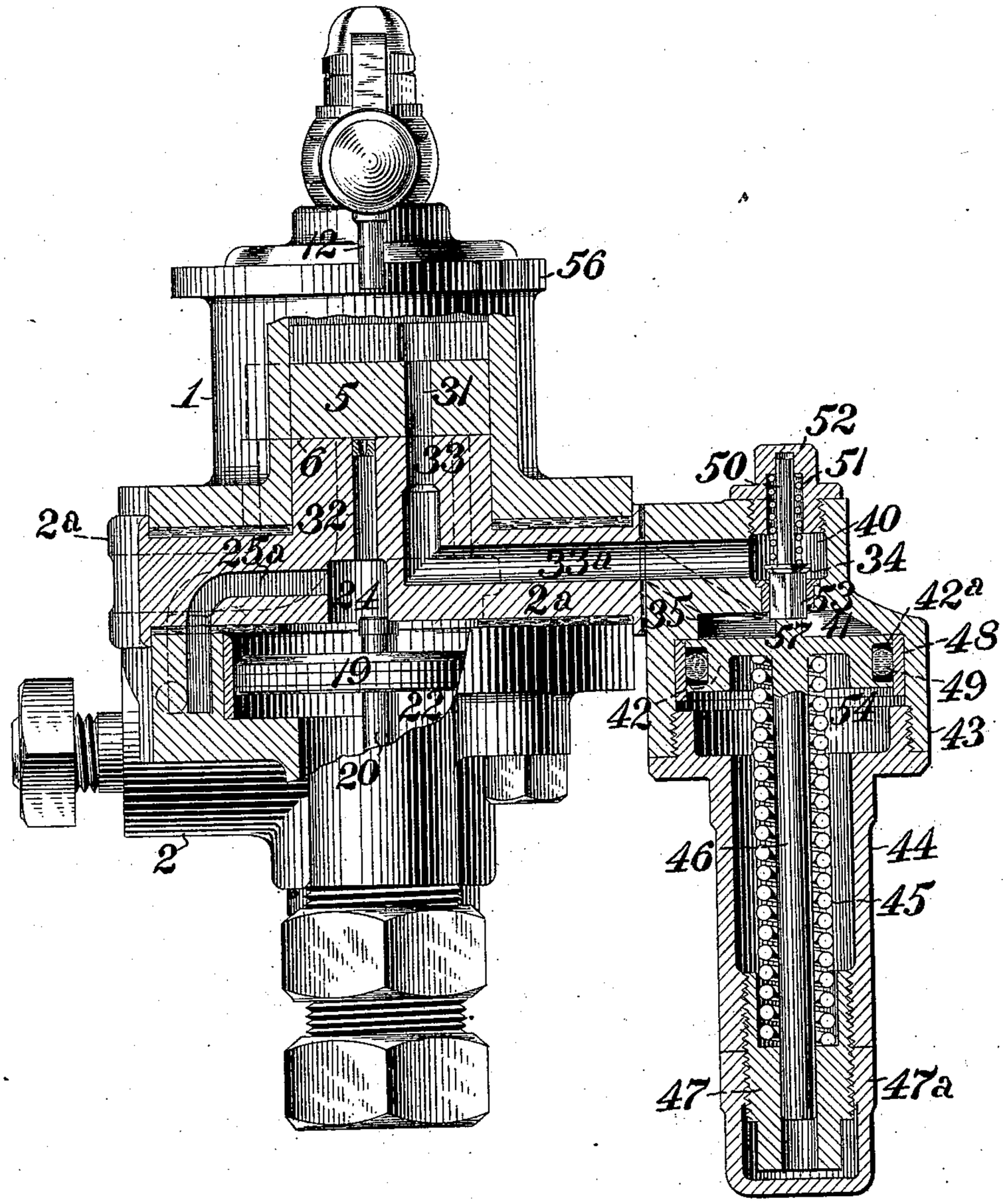
ENGINEER'S BRAKE VALVE.

No. 557,463. Patented Mar. 31, 1896.

FIG. 2.



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G. WESTINGHOUSE, Jr.

ENGINEER'S BRAKE VALVE.

No. 557,463. Patented Mar. 31, 1896.

FIG. 4.

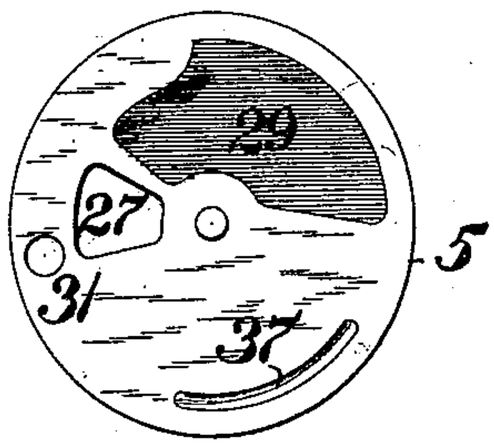
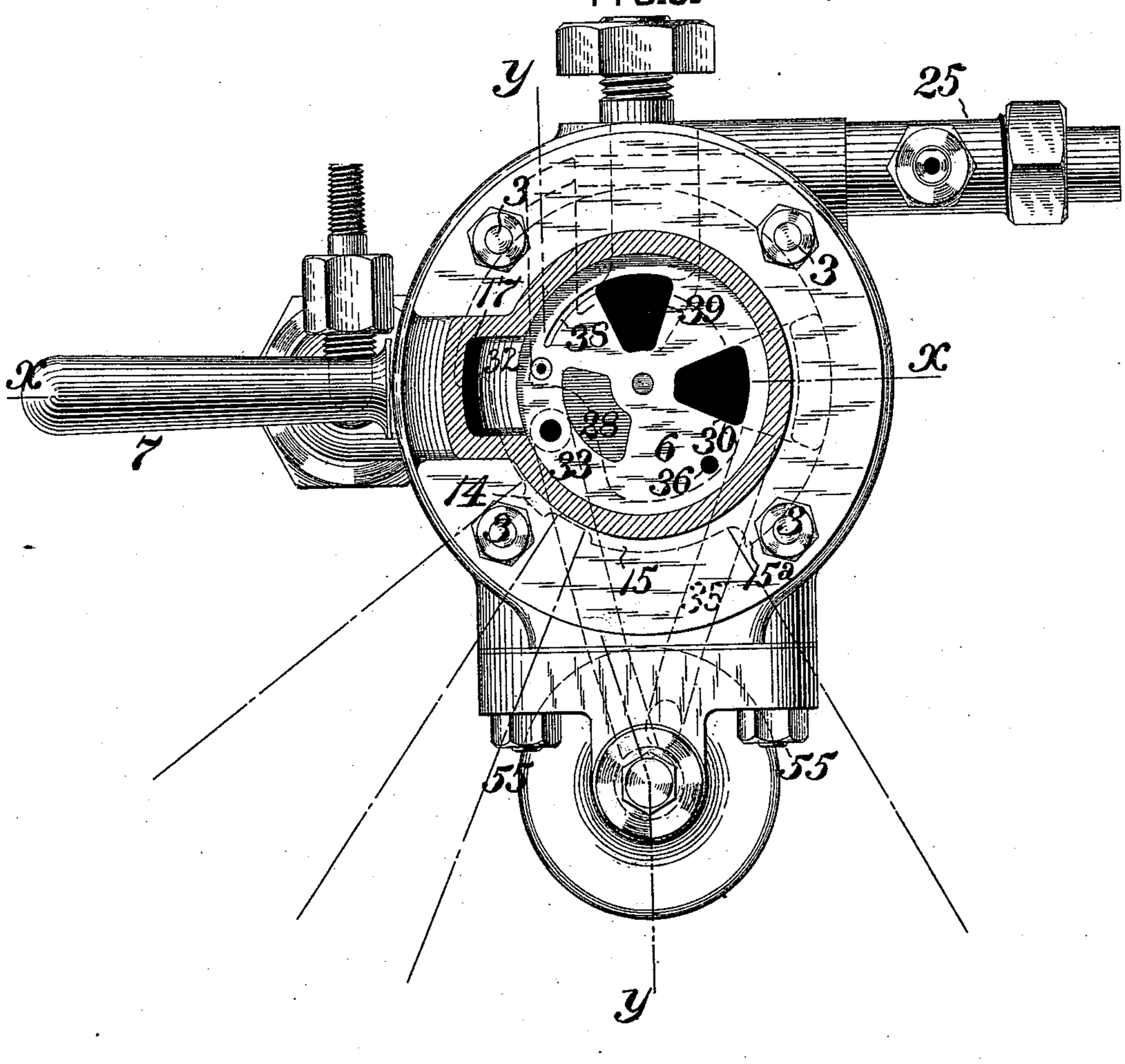


FIG. 3.



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ENGINEER'S BRAKE VALVE.

No. 557,463. Patented Mar. 31, 1896.

FIG. 5.

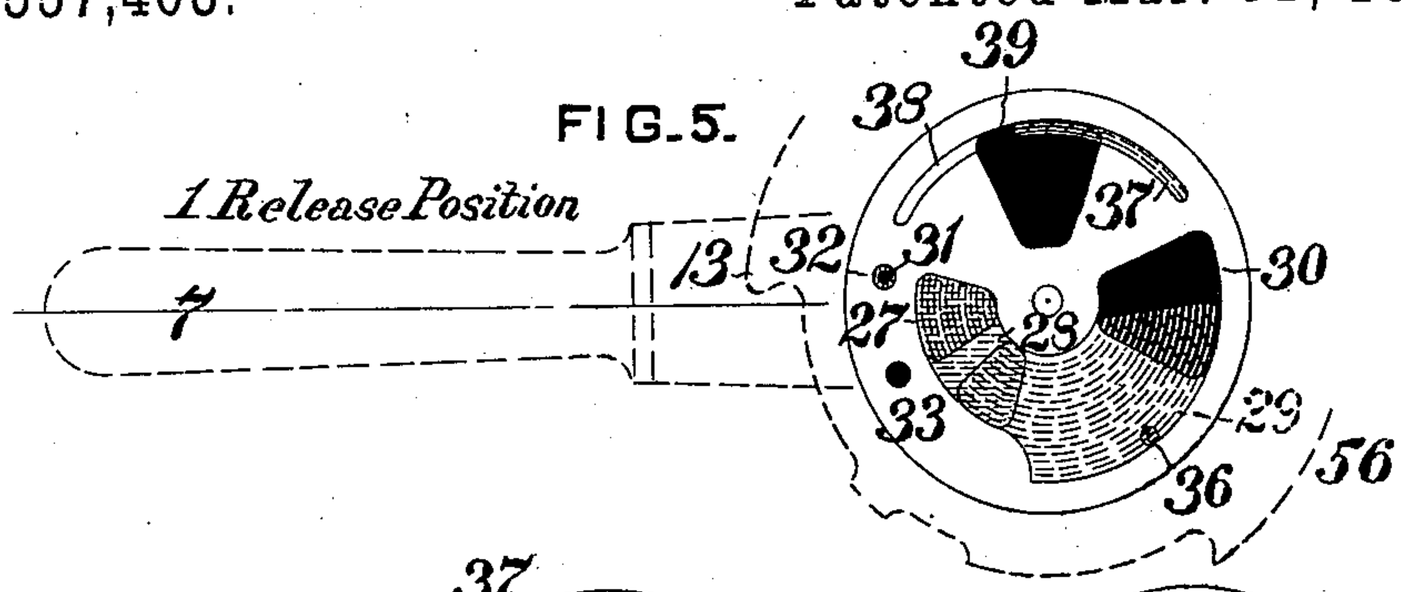

FIG. 6.

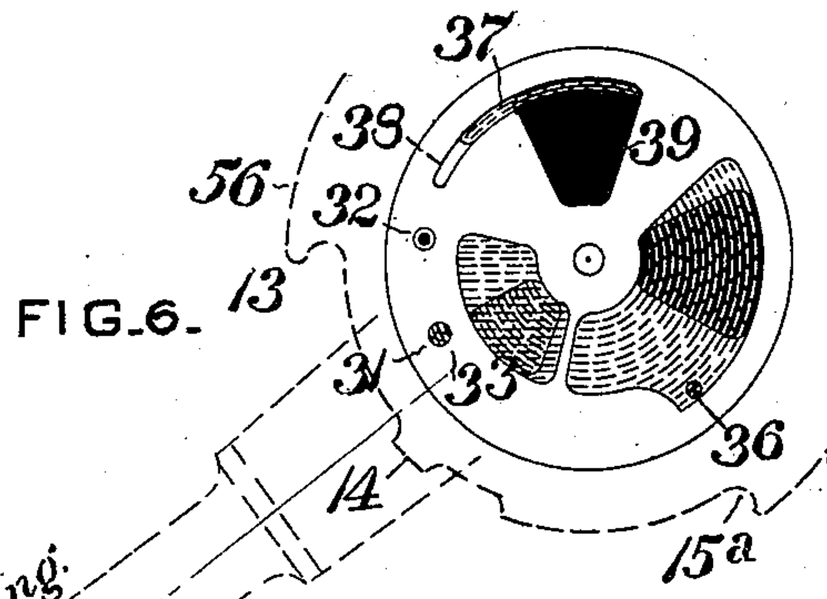

FIG. 7.

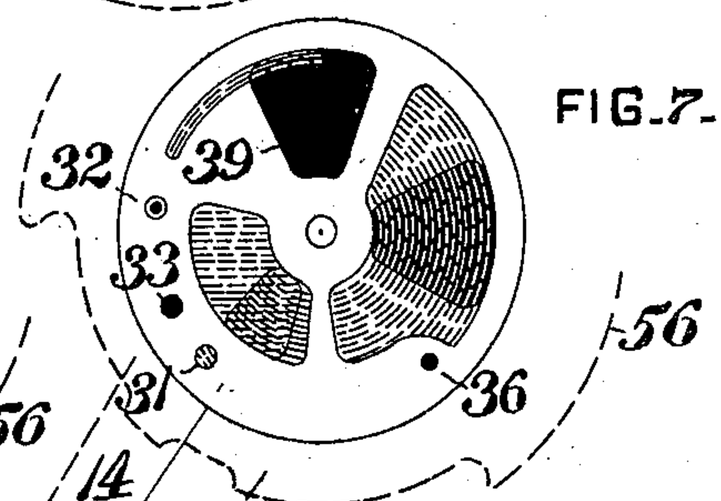

FIG. 8.

FIG. 9.

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UNITED STATES PATENT OFFICE.

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ENGINEER'S BRAKE-VALVE.

SPECIFICATION forming part of Letters Patent No. 557,463, dated March 31, 1896.

Application filed November 1, 1892. Serial No. 450,620. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., 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 Engineers' Brake-Valves, of which improvement the following is a specification.

The object of my invention is to provide a new and improved engineer's brake-valve of the type shown in Letters Patent No. 401,916, to George Westinghouse, Jr., and Frank Moore, dated April 23, 1889; and it consists of an improved construction by which the engineer's valve is made more durable, more easily constructed and repaired, and less liable to get out of repair; and it further consists of improvements in the means for controlling the supply to and exhaust of air from the train-pipe.

The improvements claimed are hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical central section through an engineer's brake-valve embodying my invention on the line *x x* of Fig. 3; Fig. 2, a view, partly in elevation and partly in section, on the line *y y* of Fig. 3; Fig. 3, a horizontal section on the line *z z* of Fig. 1; Fig. 4, a view of the face of the main valve; and Figs. 5, 6, 7, 8, and 9, views showing the relative positions of the ports in the main valve and in its seat when the valve-handle is in the several positions shown.

In the practice of my invention I provide a valve body or casing consisting of three sections. The lower section 2 is connected by means of the pipe 18 with the train-pipe and by means of the nozzle 17 with a pipe leading to the main reservoir. The pipe 25 connects the lower section with a supplemental reservoir, as in Patent No. 401,916, and with the gage for indicating train-pipe pressure. A pipe 16^a connects the nozzle 17 with the gage for indicating pressure in the main reservoir. On the section 2 is placed a section 2^a, which has the valve-seat 6 formed on a projection on its upper side. The main valve 5 rests on this valve-seat and is inclosed by the upper section 1, which has a flange formed on its lower edge for securing it to the sections 2 and 2^a by means of the bolts 3. A packing-gasket 4 is placed between the sections 2 and 2^a, and another, 4^a, between the sections 1 and 2^a, for the purpose of making a tight joint.

It will be seen that with this improved construction the different sections may be easily and quickly taken apart for the purpose of examining or repairing the parts without breaking any of the pipe connections by which the engineer's valve is connected with the main reservoir, the train-pipe, the supplemental reservoir, or the gages for indicating the pressures in the main reservoir or train-pipe. When the upper or cap section 1 is removed, the valve-seat 6, being raised above the other parts of the section 2^a, is more easily examined and repaired, and the joint between the valve and its seat is exposed, so that any defect in the fit of these parts may be readily discovered. In case it becomes necessary to grind or otherwise repair the valve-seat, it will be much more convenient to do so when the valve-seat is formed on a projection, as shown, and the section on which it is formed is free from projecting nozzles or other parts.

The air under pressure is supplied from the main reservoir through the nozzle or passage 17 to the space above the main valve 5. In the lower section 2 is formed a chamber 22, in which is fitted a piston or diaphragm 19, to which is connected a stem 20, on the lower end of which is a discharge-valve 21 which controls the outlet-passage 23 opening from the pipe 18 to the atmosphere. The pipe or passage 18 is always in open communication at its lower end with the train-pipe and at its upper end with the chamber 22 below the piston 19, so that the piston 19 is at all times exposed on its lower side to train-pipe pressure. The chamber 24 on the upper side of piston 19 communicates through passage 25^a with the pipe 25, which leads to a small supplemental chamber or reservoir, as in Patent No. 401,916, before referred to. This supplemental chamber or reservoir, which is not shown, merely serves as an enlargement of the chamber 24, with which it is always in open communication. The packing 4 extends partly over the chamber 24, so as to form a seat for the piston 19 when in its upper po-

sition, and thereby prevents any leakage of air that might pass by the packing of the piston.

The valve-seat 6 has two ports or passages 32 and 36, which extend downward and open into the chamber 24, a port 30 which extends downward and opens into the pipe or passage 18, and a port or passage 39 which opens to the atmosphere. The port 33 extends downward and connects with a passage 33^a which leads to a valve-chamber 40, in which is located a regulating-valve 34 for controlling a passage 53 opening into a chamber 41 on the upper side of a spring-pressed piston 42. The chamber 41 is connected by means of the passage 35 with the passage 30, which is always in communication with the train-pipe.

The regulating-valve 34 is for the purpose of automatically regulating the supply of air to the train-pipe when the brakes are off and the main valve 5 is in the second position, as shown in Fig. 6—that is, what is termed the "running" position. When the brakes are released and all the parts in condition to permit the running of the train, it is necessary to maintain in the train-pipe a certain maximum pressure, which is usually referred to as the "normal" train-pipe pressure. After the train-pipe has been charged to release the brakes the main valve 5 is placed in the second position, so that the feed-port 31 through the main valve registers with the port or passage 33 in the valve-seat 6 and permits air from the main reservoir to flow into the passage 33^a, and when the valve 34 is open the air passes from the passage 33^a through the passage 53 into the chamber 41, and from the chamber 41 through the passage 35 into the passage 30, and through the passage 18 to the train-pipe.

My improved regulating-valve permits the flow of air from the main reservoir to the train-pipe so long as the train-pipe pressure is below the desired and determined maximum, but closes and cuts off the flow from the main reservoir as soon as this maximum pressure is obtained in the train-pipe, such closure of the regulating-valve being independent of the pressure in the main reservoir. If the train-pipe pressure becomes reduced from any cause below the proper maximum pressure, the regulating-valve is automatically opened to permit the flow from the main reservoir, and again closed when the train-pipe is properly charged.

The valve 34, as shown in the drawings, has a stem 50 extending upward from it and guided by the cap 52. Surrounding the stem is a spring 51, which abuts at one end against the cap 52 and at the other end against the valve 34 and tends to seat the valve.

In the casing 43, which is secured to the section 2^a by means of bolts 55, is formed a chamber 54, in which the piston 42 is fitted. The piston 42 has a groove 42^a formed in its periphery, in which a continuous rubber packing-ring 49 is fitted, for the purpose of packing the joint around the piston. The thickness of this ring is less than the width of the groove 42^a, but greater than the depth of the groove, so that it fits tightly between the piston and the bushing 48. The stroke of the piston in its movements for opening and closing the regulating-valve is equal to or slightly less than the distance between the ring and the upper or lower side of the groove, so that when the piston moves in either direction it does not slide the ring, but causes it to partly roll or turn. Therefore while the joint is tightly packed to prevent leakage the friction which would be due to a sliding ring, and which would increase with the tightness of the packing, is avoided.

In my improved construction the piston itself need not fit closely in the cylinder or bushing, and said construction is superior to a diaphragm, in that it is not liable to buckle or wrinkle, is more easily fitted centrally in the cylinder or bushing, and is more regular in its movements under varying pressures. It avoids, further, the friction common to other constructions in which a piston is used.

The piston, as shown, may be made in a single piece, with a groove formed in its periphery, into which the continuous ring is sprung without being cut. The stem 46 of the piston 42 is surrounded by a tubular casing 44, which at one end is screwed into the casing 43 and is closed at the other end by an adjusting-plug 47. The plug 47 serves as a guide for the stem 46 and as an abutment for the spring 45, which, at its other end, bears against the piston 42. The adjusting-plug 47 is protected by the screw-cap 47^a. The spring 45 tends to hold the piston at the upper end of its movement, in which position the projection 57 abuts against the winged stem of the valve 34 and holds it away from its seat. The tension of the spring 45 is such that when the proper maximum pressure is reached in the train-pipe, which is always in open communication with the chamber 41, the train-pipe pressure, acting on the upper side of piston 42, is sufficient to compress the spring 45 and move the piston 42 away from the valve 34, thereby permitting the valve 34 to be seated by its spring and the pressure above it, and to cut off the flow from the main reservoir. If the pressure in the train-pipe becomes reduced below the proper maximum, the reduction of pressure in the chamber 41 permits the spring 45 to move the piston 42 back again to open the valve 34.

The main valve 5 has formed in it the through ports or passages 27 and 31 and the recesses or cavities 29 and 37, which coöperate with the ports in the valve-face 6 in the different positions of the valve. The valve-handle 7 is secured to the stem 8, on the end of which is formed the disk 9, between which and the cap is placed a suitable packing to prevent leakage around the stem. A key 10, projecting from the disk, engages with a slot 11 in the back of the valve, by which the

movement of the handle is communicated to the valve. The lower end of a spring-stop 12, secured to the handle 7, bears against the recessed edge of a flange 56, formed on the cap or upper section 1 of the valve-casing, and in the different positions of the valve-handle engages the projections 13, 14, 15, and 15ª, formed on the flange 56, for the purpose of checking the handle in the proper positions and indicating the position of the valve.

The valve is placed in the first or release position (shown in Fig. 5) when it is desired to release the brakes by closing the exhaust-ports and opening the large charging-ports between the main reservoir and the train-pipe for quickly charging the train-pipe to its full normal pressure. The spring-stop 12 then bears against the projection 13 on the flange 56, the port 31 in the valve registers with the port 32 in the seat, and as the valve is exposed on top to air from the main reservoir the air passes down through passage 32 into the chamber 24, and, acting on piston 19, forces it down and closes discharge-valve 21. At the same time air from the main reservoir passes down through the supply-port 27 in the valve into the cavity 28 in the valve-seat, and as the cavity 29 in the valve overlaps the cavity 28 in the seat the air then passes through cavity 29 to the passage 30 and down through the passages 30 and 18 to the train-pipe. At the same time the passage 36, which extends from the valve-seat 6 down to the chamber 24, is connected by means of the cavity 29 with the passage 30 leading to the train-pipe and serves to equalize the pressures in the train-pipe and chamber 24.

When the brakes are released and the train-pipe charged to its normal pressure, the valve is moved to its second position—that is, the position which it usually occupies when the train is running, with the brakes off. The spring-stop 12 then bears against the left side of the projection 14. The valve is then in position to close the port 32 in the valve-seat. The port 31 in the valve registers with the port 33 in the seat and permits air to flow from the main reservoir through passage 33ª to the regulating-valve 34. The cavity 29 in the valve no longer overlaps the cavity 28 in the valve-seat, and there is therefore no passage from the main reservoir to the train-pipe except through the regulating-valve, which, as described above, is closed if the train-pipe pressure is sufficiently high, but which opens if the train-pipe pressure falls below the proper amount. The cavity 29 in the valve still connects the passage 30, leading to the train-pipe, with the passage 36, leading to the chamber 24, and permits the equalization of pressure in the train-pipe and chamber 24.

When in the position shown in Fig. 7, the spring-stop bears against the right side of the projection 14, and all of the ports by which air is admitted to or released from the train-pipe or chamber 24 are closed, and the valve is then said to be in the "lap" position.

When it is desired to apply the brakes for a service stop, the handle is moved so that the spring-stop 12 bears against the projection 15 on the flange 56, as shown in Fig. 8. The valve is then in position to connect the port 32, leading to the chamber 24, with the exhaust-passage 39 by means of the groove or cavity 37 in the valve. Air then flows from the chamber 24 through the passages 32, 37, and 39 to the atmosphere, which causes a reduction of pressure on the upper side of the piston 19 and permits the train-pipe pressure to move the piston upward, thereby opening the discharge-valve 21 and permitting air to flow from the train-pipe to the atmosphere through the pipe 23. The reduction of train-pipe pressure thus produced causes a service application of the brakes. When a sufficient quantity of air has been discharged from the chamber 24, the valve may be moved back to the lap position, in which the main valve closes all the ports in the seat 6 and cuts off the exhaust from the chamber 24. The discharge-valve 21 will then remain open until the train-pipe pressure is sufficiently reduced to permit the pressure in chamber 24 to move the piston downward and close the valve 21. If it is required to apply the brakes with greater force, the valve 5 is again moved to the service position and the pressure in chamber 24 further reduced, causing the discharge-valve 21 to be again opened and a further reduction of train-pipe pressure to be made.

When it is desired to make an emergency application of the brakes, it is necessary to make a quicker and greater reduction of train-pipe pressure than is necessary in making a service application, and for this purpose the valve is moved to the position shown in Fig. 9. The spring-stop 12 of the handle then bears against the projection 15ª, the cavity 29 in the valve connects the port 30 with the exhaust-port 39 to permit a free exhaust from the train-pipe to the atmosphere, and the groove or cavity 37 in the valve connects the small port 32 with the groove 38 in the valve-seat, thereby permitting the air to escape from above the piston 19 into the exhaust-passage 39 and to the atmosphere.

The exhaust of air from the train-pipe to the atmosphere not only takes place through the large openings or passages 30, 29, and 39, but also through the passage 23, the valve 21 being opened by the upward movement of the piston 19, caused by exhausting the air from the chamber 24. The opening of the valve 21, when the valve 5 is in the emergency position, has the same effect as enlarging the main or large exhaust-passages, and this effect is obtained without any enlargement of those passages or any increase in the number of openings.

Another advantage of this improvement is that the gage which indicates the pressure in the chamber 24 shows the reduction of pressure made by placing the valve 5 in the emergency position.

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

1. In an engineer's brake-valve, the combination of a main valve, a discharge-valve and connections by which the discharge-valve may be opened by train-pipe pressure in making emergency applications of the brakes, substantially as set forth.

2. In an engineer's brake-valve, the combination of a main valve which releases air from the train-pipe when in position to make an emergency application of the brakes, a discharge-valve and connections by which the discharge-valve is opened by train-pipe pressure and releases air from the train-pipe when the main valve is in position to make an emergency application of the brakes, substantially as set forth.

3. In an engineer's brake-valve, the combination of a discharge-valve, a piston or diaphragm connected thereto and operated by variations of fluid-pressure on its opposite sides and a main valve controlling said variations of pressure and having ports and passages for releasing the fluid under pressure from the train-pipe and from one side of the piston or diaphragm directly to the atmosphere in emergency applications of the brake, substantially as set forth.

4. In an engineer's brake-valve, the combination of a main valve, a discharge-valve for releasing air from the train-pipe, a piston or diaphragm connected to the discharge-valve and exposed to fluid-pressure on its opposite sides, an exhaust-port in the seat of the main valve through which fluid under pressure is released in making emergency applications of the brakes and a passage in the main valve through which the fluid under pressure is released from one side of the piston to said exhaust-port when the main valve is in the service position, substantially as set forth.

5. In a fluid-pressure brake system, the combination of an engineer's brake-valve, a train-pipe, a passage from the engineer's valve to the train-pipe, a regulating-valve in the passage, and a piston or diaphragm which is independent of the regulating-valve and is moved by the pressure of a spring to effect the opening of the valve when the train-pipe pressure is below a determined maximum, and is moved by fluid-pressure to permit the closure of the valve when the train-pipe pressure is above the determined maximum, substantially as set forth.

6. In a casing for an engineer's brake-valve, the combination of a cap-section which covers and incloses the main valve, a section on which a raised seat is formed for the main valve, and a lower section containing the piston-chamber of the discharge-valve and having nozzles or passages for connecting the pipes leading to the engineer's valve, substantially as set forth.

7. In an engineer's brake-valve, a casing consisting of an upper section which covers the main valve and forms a bearing for its stem, a middle section having a raised seat for the main valve, and which covers the piston-chamber of the discharge-valve, and a third section which contains the piston-chamber of the discharge-valve and is connected to all the pipes communicating with the engineer's valve, whereby the upper and middle sections may be removed, to examine the main valve and its seat and the discharge-valve and its piston, without breaking the pipe connections to the casing, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEO. WESTINGHOUSE, JR.

Witnesses:
L. C. CARUANA,
J. SNOWDEN BELL.