

F. L. CLARK.  
ENGINEER'S BRAKE VALVE.

Reissued Sept. 26, 1893.

T. J. Hogan.  
J. E. Gaither

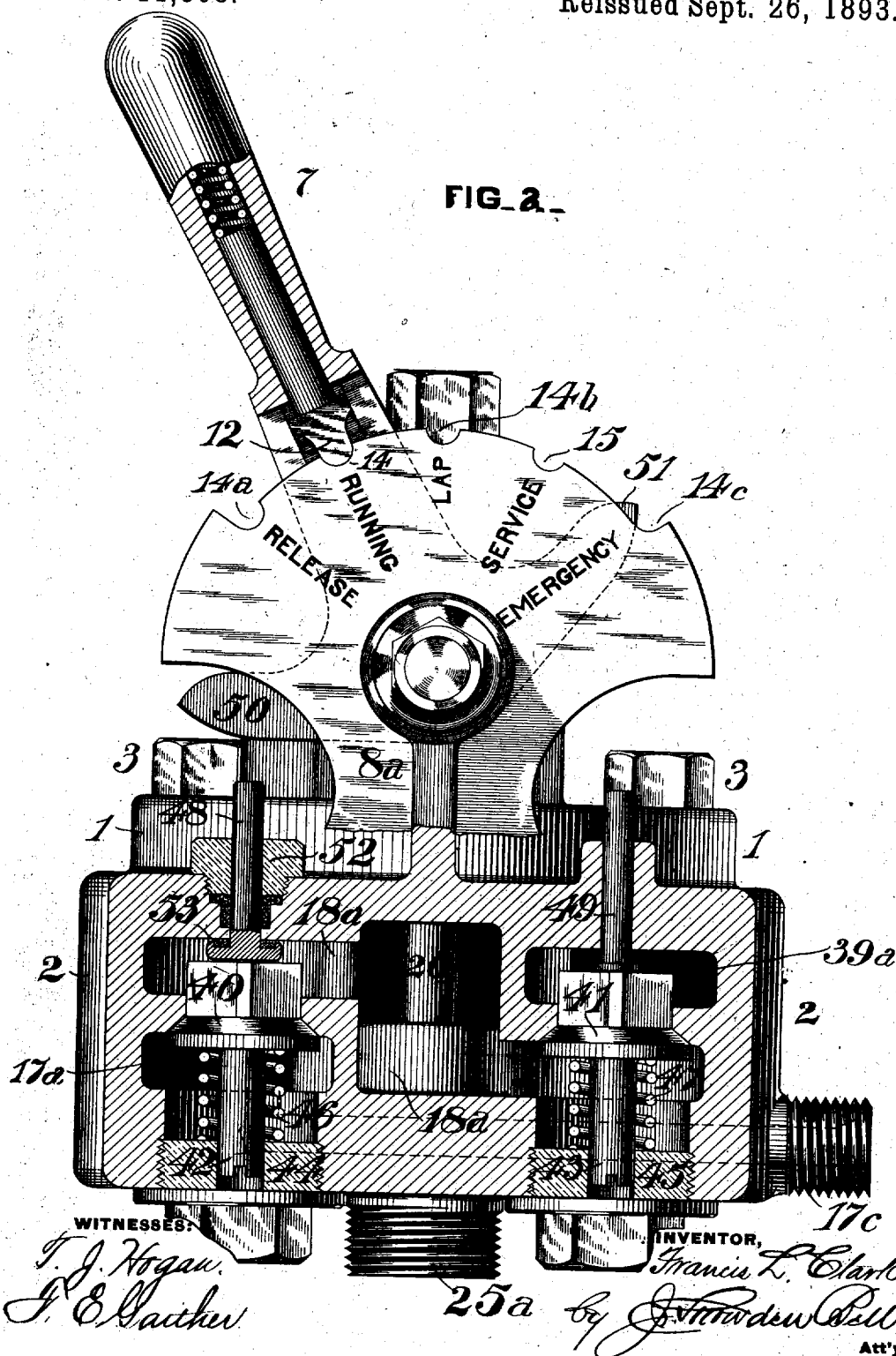
INVENTOR  
Francis L. Clark,  
by J. F. Anderson, Att'y.

F. L. CLARK.  
ENGINEER'S BRAKE VALVE.

6 Sheets—Sheet 2.

No. 11,368.

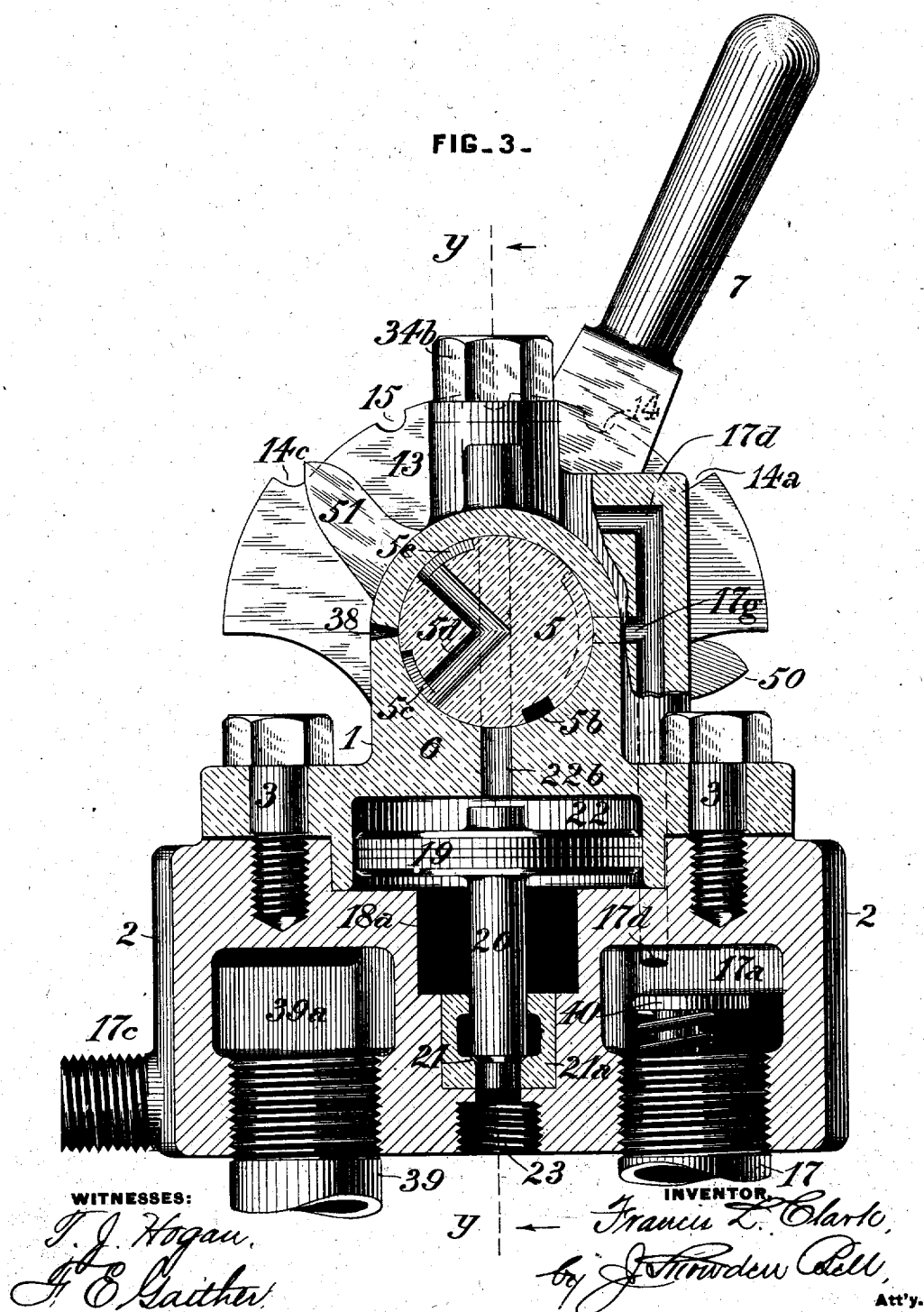
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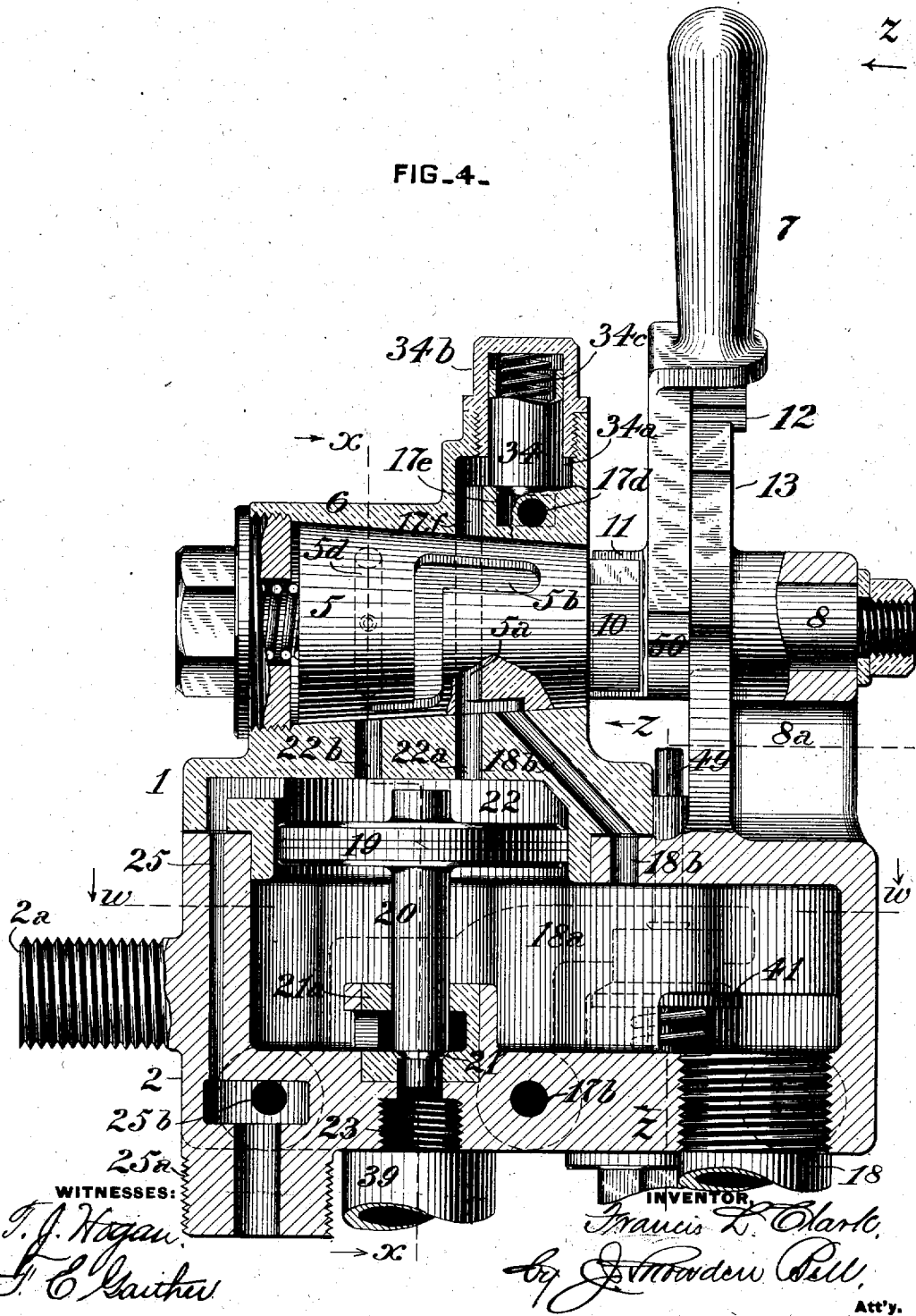


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ENGINEER'S BRAKE VALVE.

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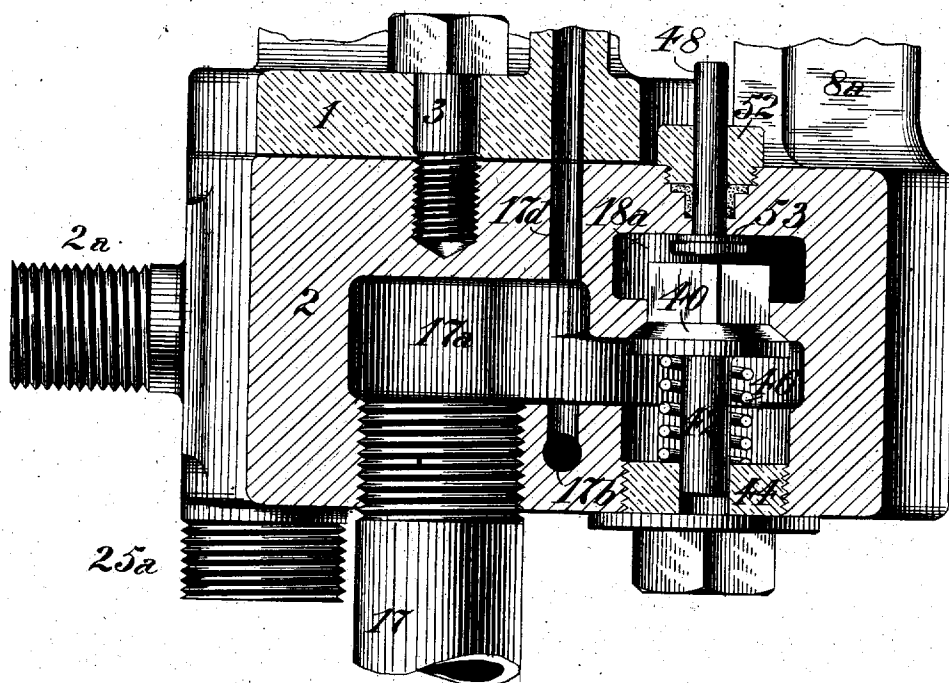
F. L. CLARK.  
ENGINEER'S BRAKE VALVE.

6 Sheets—Sheet 5.

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FIG. 5.



WITNESSES:

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INVENTOR

*Francis L. Clark*  
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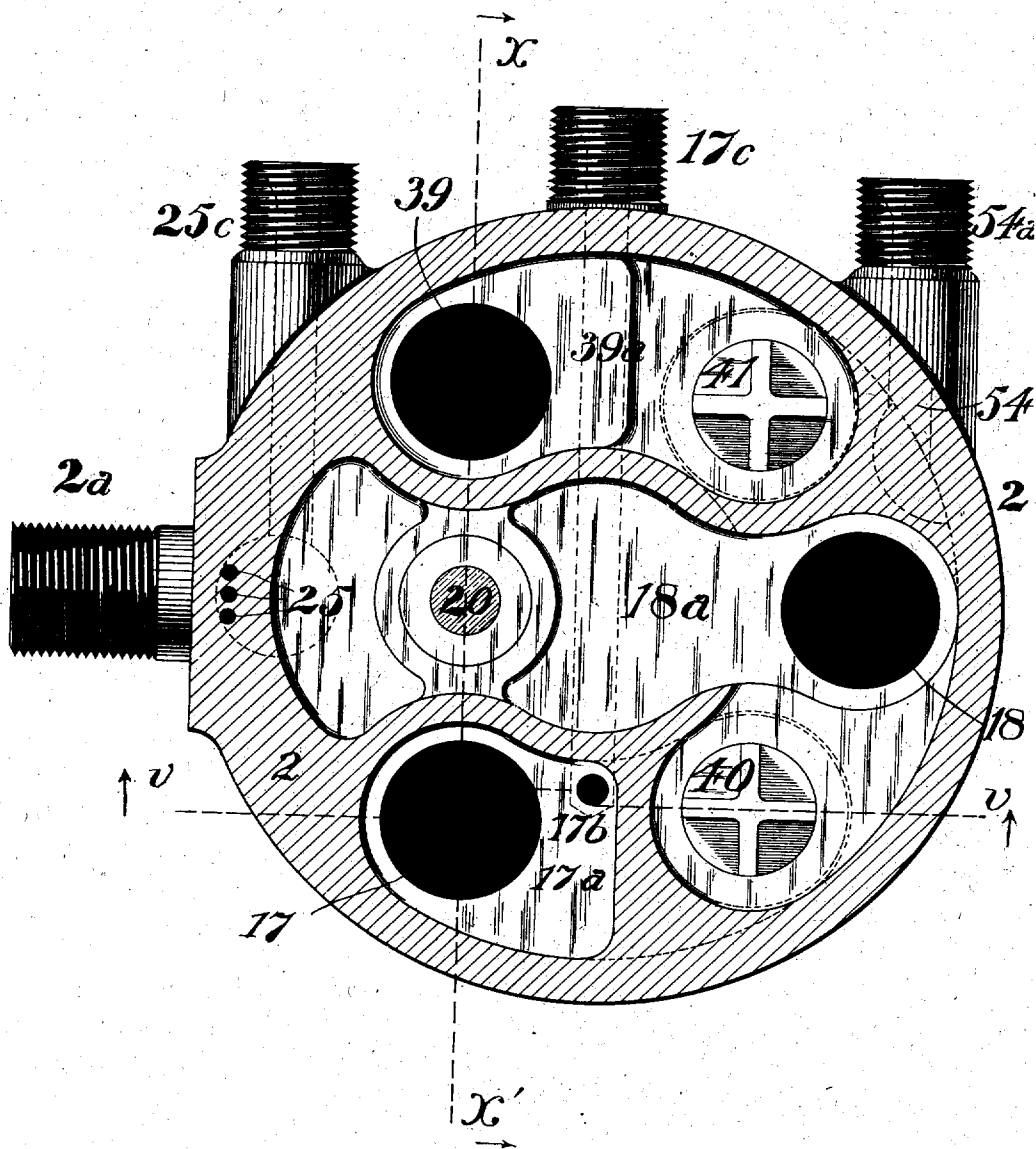
F. L. CLARK.  
ENGINEER'S BRAKE VALVE.

6 Sheets—Sheet 6.

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FIG. 6.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

FRANCIS L. CLARK, OF WILKINSBURG, ASSIGNOR TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF PITTSBURG, PENNSYLVANIA.

## ENGINEER'S BRAKE-VALVE.

SPECIFICATION forming part of Reissued Letters Patent No. 11,368, dated September 26, 1893.

Original No. 496,638, dated May 2, 1893. Application for reissue filed August 21, 1893. Serial No. 483,708.

*To all whom it may concern:*

Be it known that I, FRANCIS L. CLARK, a citizen of the United States, residing at Wilkinsburg, 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.

My invention relates to appliances, known as engineers' brake-valves, for effecting and regulating the supply and release of air under pressure, from a main air reservoir, to and from a main air or train pipe, in a fluid pressure automatic brake apparatus, and its object is to provide an appliance of such character embodying the advantages of simplicity, compactness, facility of operation, ready accessibility to all working parts without breaking pipe connections, and freedom from liability to undue or unequal wear of its regulating cock.

To this end my invention consists in certain novel devices and combinations herein-after fully set forth.

In the accompanying drawings: Figure 1 is a plan or top view of an engineer's brake valve illustrating an embodiment of my invention; Fig. 2, a view, partly in front elevation, and partly in longitudinal section, at the line *z, z*, of Fig. 4; Fig. 3, a longitudinal section at the lines *x, x*, of Fig. 4, and *x', x'*, of Fig. 6, respectively; Fig. 4, a view, partly in elevation, and partly in longitudinal section, at the line *y, y*, of Fig. 3; Fig. 5, a longitudinal section at the lines *v', v'*, of Fig. 1, and *v, v*, of Fig. 6 respectively, and Fig. 6, a transverse section at the line *w, w*, of Fig. 4.

In the practice of my invention I provide a valve chamber or casing, composed of an upper section 1 and a lower section 2, which are connected by tap bolts 3, the lower section being provided with a threaded projection 2<sup>a</sup>, for connection to any suitable support. A regulating cock or valve, which, in this instance, is a cock 5, of the ordinary plug type, is fitted in a case 6, on the upper section 1 of the valve casing, and is adapted to be moved about its axial line, in its case 6, by a lever handle 7, formed or fixed upon a short shaft 8, which is journaled, in line axially with the cock 5, in a stand 8<sup>a</sup>, on the

lower section 2 of the valve casing. The cock 5 is provided with a transverse projection or tenon 10, on its end nearest the lever handle shaft 8, said tenon fitting freely in a transverse recess or mortise 11, in the adjacent end of the shaft. The shaft and lever handle are supported entirely by the stand 8<sup>a</sup>, and the cock 5 is relieved of such wear as might be due to the weight of the lever, and the pressure of the operator's hand thereon, if the lever was connected in the usual manner to the cock. This feature of my construction is moreover, important on account of the construction and manner of operating the charging and discharging valves. Both of these valves are held to their seats by a considerable air and spring pressure, and the force exerted on the lever handle, and the arms, 50 and 51, in order to unseat them, imposes a considerable pressure on the fulcrum of the lever. If the lever handle were connected to the cock in the usual manner, so that the cock formed the fulcrum of the lever, the cock would be subjected to considerably greater pressures on some portions of its surface than on others, tending to wear the surface in spots, and to cause the cock to leak. By pivoting and supporting the lever handle in and on the bearing 8<sup>a</sup> and shaft 8, as shown, any unequal wear or strain is taken up by the bearing so formed, instead of by the plug cock, and the self-adjustment of the lever handle and cock is permitted by means of the recess 11 and tenon 10. The cock 5 and its operating lever, are thus coupled by a clutch connection, so that no strain, tending to wear the cock unequally, or out of round, is imposed in effecting movements of the cock. A spring stop or detent 12 is fitted in the handle 7, in order to limit the range of movement of the latter to the length of a circumferential recess in a guide segment 13, formed on the stand 8<sup>a</sup>, said recess having a notch or depression 14<sup>a</sup> at one end, a shoulder 14<sup>b</sup> at the other, and intermediate notches 14, 14<sup>b</sup>, and 15, the several notches and the end shoulder being located in position to be engaged by the outer end of the detent 12 in different adjustments of the cock 5, as hereinafter described.

A pipe or passage 17, adapted to be con-

nected with the main air reservoir of the  
 brake mechanism in which the appliance is  
 employed, is connected to a threaded open-  
 ing or nozzle in the lower valve casing sec-  
 tion 2, and establishes continuous communi-  
 cation between the main air reservoir and a  
 main air reservoir pressure chamber 17<sup>a</sup> in  
 the lower section 2. A port or passage 17<sup>b</sup>  
 leads transversely from the chamber 17<sup>a</sup> to a  
 nozzle or threaded connection 17<sup>c</sup>, for the at-  
 tachment of a pipe leading to the main air res-  
 ervoir pressure gage, and a vertical port or  
 passage 17<sup>d</sup>, leads to a transverse passage 17<sup>e</sup>,  
 having an opening in which is seated an ex-  
 tra pressure valve 34, fitted to work in a cham-  
 ber 34<sup>a</sup>, formed in the upper casing section 1  
 and closed by a removable cap 34<sup>b</sup>. The  
 valve 34 is normally held to its seat by a  
 spring 34<sup>c</sup>. A port 17<sup>f</sup> leads from the cham-  
 ber 34<sup>a</sup> through the adjacent portion of the  
 shell 6, of the regulating cock 5, in such loca-  
 tion as to register, in one position of said  
 cock, with a transverse port 5<sup>a</sup> therein and,  
 through said port 5<sup>a</sup> to communicate with a  
 port 18<sup>b</sup>, leading to a chamber 18<sup>a</sup>, communi-  
 cating with the main air or train pipe, and  
 with a port 22<sup>a</sup>, leading to a piston chamber  
 22. A lateral port 17<sup>g</sup>, leads from the port  
 17<sup>d</sup>, through the adjacent portion of the shell  
 6, in such location as to register with a cir-  
 cumferential groove or recess 5<sup>b</sup> in the cock  
 5, said recess having its middle portion in a  
 plane transverse to the cock, and its end por-  
 tions extending in opposite directions from  
 its middle portion, and being in planes longi-  
 tudinal to the cock. A pipe or passage 18,  
 connected to and opening into a main air  
 pipe pressure chamber 18<sup>a</sup>, in the lower sec-  
 tion 2 of the valve casing, leads therefrom to  
 a connection with the main air or train pipe,  
 which is thus maintained in communication  
 with the chamber 18<sup>a</sup>, and, through said cham-  
 ber and the port 18<sup>b</sup> leading therefrom, such  
 communication extends to the surface of the  
 cock 5. A movable abutment 19, which is  
 preferably, as shown, a piston, but which  
 may, if preferred, be a flexible diaphragm, is  
 fitted to work freely in a chamber 22, the  
 lower side of which is open to the chamber 18<sup>a</sup>,  
 so that the piston 19 is subject on its lower  
 side to the pressure in the main air or train  
 pipe. The piston 19 is secured upon a stem  
 20, the lower end of which carries a discharge  
 valve 21, which is adapted to close upon a  
 seat formed in a bushing 21<sup>a</sup>, fitted in the  
 lower wall of the chamber 18<sup>a</sup>, the seat of  
 the valve being formed at the inner end of a  
 discharge passage 23, leading from the cham-  
 ber 18<sup>a</sup> to the atmosphere. Ports 22<sup>a</sup>, 22<sup>b</sup>,  
 lead from the chamber 22 above the piston  
 through the case 6, to the surface of the cock  
 5, the port 22<sup>a</sup> being located in position to  
 communicate with a port 5<sup>a</sup> in said cock, as  
 before explained, and the port 22<sup>b</sup> being lo-  
 cated in position to communicate, in certain  
 positions of the cock, with a circumferential

groove or recess 5<sup>c</sup>, thereon, said recess com-  
 municating, by a port 5<sup>d</sup>, in the cock, with  
 a similar recess 5<sup>e</sup> located in the same trans-  
 verse plane of the valve. A preliminary ex-  
 haust or discharge port 38 leads through the  
 casing 6, in the same transverse plane as the  
 recesses 5<sup>c</sup> and 5<sup>e</sup>, from the surface of the  
 cock 5 to the atmosphere. The piston cham-  
 ber also communicates, above the piston,  
 through a port or passage 25, with a nozzle or  
 connection 25<sup>a</sup> for the attachment of a pipe  
 leading to a small supplemental reservoir, in  
 order to provide an increased capacity for  
 storage of air under pressure. In this in-  
 stance, three passages 25, each of compara-  
 tively small diameter are shown, these being  
 employed to avoid weakening the shell of the  
 lower casing section 2 by a single large pas-  
 sage. A port or passage 25<sup>b</sup> leads from the  
 passages 25 to a nozzle or threaded connec-  
 tion 25<sup>c</sup>, for the attachment of a pipe leading  
 to the main air or train pipe pressure gage.  
 A pipe or passage 39, of materially larger di-  
 ameter than the discharge opening which is  
 controlled by the valve 21, leads from a dis-  
 charge chamber 39<sup>a</sup> in the lower casing sec-  
 tion 2 to the atmosphere. Communication  
 between the main air reservoir pressure cham-  
 ber 17<sup>a</sup> and the main air pipe pressure cham-  
 ber 18<sup>a</sup>, is controlled by a downwardly open-  
 ing charging valve 40, of the puppet type,  
 having its seat in a partition between the  
 chambers 17<sup>a</sup> and 18<sup>a</sup>, and communication be-  
 tween the main air pipe pressure chamber 18<sup>a</sup>  
 and the discharge chamber 39<sup>a</sup>, is controlled  
 by a downwardly opening discharge or ex-  
 haust valve 41, also of the puppet type, hav-  
 ing its seat in a partition between the cham-  
 bers 18<sup>a</sup> and 39<sup>a</sup>. The valves 40 and 41 are  
 provided with wings fitting the openings in  
 the partitions which are controlled by the  
 valves, and are, respectively, fixed upon stems  
 42 and 43, guided in removable caps 44 and  
 45, closing openings in the casing section  
 2 through which the valves are introduced  
 and removed as required. The valves 40 and  
 41 are held normally seated by springs 46 and  
 47, bearing on their lower sides, and acting  
 in conjunction with the normal excess of  
 pressure thereon.

By the employment of the separate valves  
 40 and 41 for controlling the large charging  
 and discharging ports, I am enabled to em-  
 ploy a much smaller plug cock than would be  
 required if both of these large ports were  
 formed in the plug cock, with the result that  
 the resistance and wear, as well as the weight  
 of the cock, are diminished. The valves 40  
 and 41 being disconnected from the handle  
 of the regulating cock, all resistance and wear  
 which might be due to a connection therewith  
 are avoided, and the movements of the handle,  
 from the running to the service position and  
 back, are performed with the least possible  
 friction, while the resistance required to be  
 overcome in making an emergency applica-



tion, due to the resistance of the valve 41, is such that there can be no doubt as to when an emergency application is being made.

Opening movement is imparted to the valves 40 and 41, as respectively required in operation, by arms 50 and 51, formed or fixed on the lever handle 7, and projecting in opposite directions therefrom adjacent to the axial line of its shaft 8. The arms 50 and 51, bear respectively, (when the lever handle 7 is moved into the positions in which the detent 12 engages the recess 14<sup>a</sup>, or abuts against the shoulder 14<sup>c</sup>, as the case may be) on and depress stems 48 and 49, passing through the shell of the casing section 2, above and in line with the valves 40 and 41 respectively, and resting at their lower ends on said valves. Either of said valves will consequently be unseated by the movement of the lever handle into the appropriate position, during which movement the cock 5 will, of course, be coincidentally moved, so as to open or close the proper communicating ports.

It frequently happens that when the engineer moves the handle to emergency position, he has other manipulations to make, and he merely pushes the handle over and then withdraws his hand, leaving the handle in the emergency position, and the emergency exhaust port remains open longer than is necessary. The consequence is an unnecessary loss and waste of air, and an undesirable reduction of train pipe pressure. With my construction, as soon as the engineer's hand is removed from the handle, the air and spring pressures acting on the under side of the valve 41, return it to its seat, thereby closing the discharge port. By this movement of the valve, the stem 49, which moves freely is pushed back, and, through it, the arm 51, and handle 7, are moved just enough to permit the valve 41 to seat; the friction of the spring stop 12, preventing further backward movement of the handle.

The stem 48 is provided with suitable packing, which is compressed by a gland 52, and as an additional preventive against leakage of train pipe air, a packing ring 53 is slipped around the stem, and is held between its head and the adjacent inner surface of the wall of the chamber 18<sup>a</sup>. As the valve 41 is subject only to atmospheric pressure on its upper side, packing is not required for the stem 49.

In order to supply air under main air or train pipe pressure to the air pump governor, a port or passage 54, indicated in dotted lines in Fig. 6, is led from the main air pipe pressure chamber 18<sup>a</sup> to a nozzle or threaded connection 54<sup>a</sup>, for the attachment of a pipe leading to the air pump governor.

The lever handle 7, and regulating cock 5, control in the several positions into which they may be moved, as presently to be described, the series of ports and passages in the valve casing, by which communication

is established as follows: first, between the main air reservoir and the main air or train pipe, for the purpose of releasing the brakes, and between the main air reservoir and the chamber above the piston 19, in order to charge said chamber, and its connected supplemental reservoir, with air at a pressure equal to that in the main air or train pipe, and thereby to institute an equilibrium of pressure on both sides of the piston 19, and hold the discharge valve 21 to its seat; second, between the main air reservoir and a port leading to the extra pressure valve 34, which governs a passage leading to the main air or train pipe, in order to effect the accumulation of a determined excess of pressure in the main air reservoir to insure the release of the brakes, and also between the main air or train pipe and the chamber above the piston 19, to maintain an equilibrium of pressure in said chamber and the main air or train pipe; third, between the chamber above the piston 19 and the atmosphere, in order to destroy the equilibrium of pressure existing on both sides of the piston, and thereby, through the higher pressure which then acts on the lower side of the piston, to effect its upward movement, and the consequent unseating of the discharge valve 21, for the discharge of air in the application of the brakes in ordinary or service stops, and, fourth, between the main air or train pipe and the atmosphere, through a passage of comparatively large area, in order to effect the application of the brakes with maximum rapidity and force, as in emergency stops.

In what may be termed the "first position," or "release position," of the regulating cock 5, into which it is brought by the movement of the lever handle 7 into such position that the spring stop or detent 12 engages the recess 14<sup>a</sup> of the segment 13, being the position for charging or recharging the main air or train pipe and for thereby releasing the brakes, the arm 50 of the lever handle 7, bears upon and depresses the stem 48, and, through said stem, unseats the valve 40, thereby opening a passage for air from the main air reservoir to the main air pipe through the pipe 17, chamber 17<sup>a</sup>, opening controlled by the valve 40, chamber 18<sup>a</sup>, and pipe 18. At the same time communication is established between the main air pipe pressure chamber 17<sup>a</sup>, and the chamber 22 above the piston 19 (as well as with the small supplemental reservoir, which is always in communication with the chamber 22, by the passages 25) through the ports 17<sup>d</sup>, 17<sup>e</sup>, the recess 5<sup>b</sup> of the regulating cock 5, and the port 22<sup>b</sup>. Equilibrium of main air or train pipe pressure above and below the piston 19 is thereby established, and the discharge valve 21 is held to its seat by the pressure on the upper side of the piston equivalent to the area of the valve.

In the second or "running" position of the regulating cock 5, in which, as shown in the drawings, the spring stop 12 engages the re-

cess 14, being the position while running, the arms 50 and 51 are clear of the stems 48 and 49, and the valves 40 and 41 are held seated by their springs 46 and 47 and by the excess pressure on their lower sides. Communication from the main air reservoir to the lower side of the extra pressure valve 34, is established through the pipe 17, chamber 17<sup>a</sup>, port 17<sup>d</sup>, and passage 17<sup>e</sup>, and communication is established from the upper side of said valve to the main air or train pipe, through the port 17<sup>f</sup>, port 5<sup>a</sup> of the cock 5, port 18<sup>b</sup>, chamber 18<sup>a</sup>, and pipe 18. The extra pressure valve 34 is loaded by a spring 34<sup>e</sup> to maintain a determined excess of the pressure in the main air reservoir over that in the main air or train pipe, in order that there may always be a reserve pressure in the main air reservoir to insure the release of the brakes. The main air or train pipe is at the same time in communication with the piston chamber 22, on the lower side of the piston 19, through the pipe 18, and chamber 18<sup>a</sup>, and with said chamber 22, on the upper side of the piston, through the pipe 18, chamber 18<sup>a</sup>, port 18<sup>b</sup>, port 5<sup>a</sup> of the cock 5, and port 22<sup>a</sup>. There is therefore an equalization of main air or train pipe pressure on the opposite sides of the piston 19.

In the third or "service" position of the regulating cock 5, in which the spring stop 12 engages the recess 15, being the position for the application of the brakes in making ordinary or service stops, communication is established between the chamber 22, on the upper side of the piston 19, and the atmosphere, through the port 22<sup>b</sup>, recess 5<sup>c</sup>, port 5<sup>d</sup>, and recess 5<sup>e</sup>, of the cock 5, and preliminary exhaust port 38. The equilibrium of pressure on opposite sides of the piston 19 being consequently destroyed, the piston and connected discharge valve 21 are moved upwardly by the then excess of pressure on the lower side of the piston, and air is discharged from the main air or train pipe, through the pipe 18, chamber 18<sup>a</sup>, opening controlled by the valve 21, and discharge connection 23, for the application of the brakes. After such an amount of air has been discharged as is requisite to apply the brakes with desired force, the regulating cock 5 is moved backward, into what is termed "lap" position, which is about midway between its second and third positions above specified, the spring stop 12 then engaging the recess 14<sup>b</sup>. When in said lap position, all ports are closed, and the discharge of air through the connection 23 continues until the pressure below the piston 19 is reduced slightly below the pressure acting on the upper side of the piston, when the excess of pressure above the piston will gradually move it downwardly, closing the discharge valve 21 and cutting off the discharge of air from the main air or brake pipe. The slow and gradual downward movement of the

piston, in closing the discharge valve, admits of sufficient time for the equalization of pressure throughout the entire length of the main air or train pipe and thereby insures a substantially uniform application of the brakes on all the cars of a long train. The discharge of air may be repeated one or more times by returning the regulating cock 5 to its service position, after having been brought to lap, and the application of the brakes with any desired degree of force may be effected by repeated discharges of air from the chamber above the piston.

In the "emergency" position of the lever handle and regulating cock, in which the spring stop 12 abuts against the end shoulder 14<sup>c</sup> of the segment 13, being the position for the application of the brakes in making emergency stops, the arm 51, of the lever handle 7, bears upon and depresses the stem 49, and, through said stem, unseats the valve 41, thereby opening a passage of comparatively large area from the main air or train pipe to the atmosphere, through the pipe 18, chamber 18<sup>a</sup>, opening controlled by the valve 41, chamber 39<sup>a</sup>, and discharge pipe 39. In this, as in the service position, pressure is relieved from the upper side of the piston 19, through the port 22<sup>b</sup>, recess 5<sup>c</sup>, port 5<sup>d</sup>, and recess 5<sup>e</sup> of the cock 5, and preliminary exhaust port 38. The free and rapid discharge of air from the main air or train pipe which is effected as above described, provides for the application of the brakes with maximum rapidity and force, as required in making emergency stops.

An engineer's brake valve as herein described and shown is of small compass and can be readily applied on a locomotive engine. The movement of the operating handle in a vertical plane can be conveniently made by the engineer, and the regulating cock not being exposed to unbalanced pressure upon a large area, such movement does not require any material exertion of power by the operator.

Access may be had to all working parts, and the same may be removed and replaced, whenever required, without breaking any pipe connections, the regulating cock 5 being removable by unscrewing and removing its cap, the valves 40 and 41 by removing their caps 44 and 45, and the piston 19, and discharge valve 21, by unscrewing the tap bolts 3 and removing the upper casing section 1. The excess pressure valve can be removed by removing its screw cap 34<sup>b</sup>. It will also be seen that by reason of the clutch engagement of the regulating cock and its operating lever handle, and the support of the lever handle in a bearing independent of the cock, the latter is relieved from any strain in operation tending to impose undue or unequal wear upon it.

A further advantage is found in the fact that the detent of the lever handle not being engaged with a recess when in the emergency

position, the valve 41 controlling the emergency discharge passage is not held open by a positively engaged lever, and is permitted to close automatically on the withdrawal of pressure by the operator on the lever handle, thereby obviating waste of air and delay which would otherwise result from an unnecessary escape of air from the main air or train pipe, after an emergency application has been made.

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

1. In an engineer's brake valve, the combination of a lower valve casing section provided with connections for pipes to a main air reservoir, and to a main air or train pipe, a movable abutment, a discharge valve actuated by said abutment and controlling the exhaust of air from the main air or train pipe, an upper casing section connected to the lower section and removable therefrom independently of the pipe connections, and a regulating cock or valve working in the upper section, and controlling ports through which an equilibrium or an inequality of pressure, as the case may be, is established on opposite sides of the movable abutment, substantially as set forth.

2. In an engineer's brake valve, the combination of a valve casing provided with connections for pipes to a main air reservoir and to a main air or train pipe, a movable abutment working in said casing, a discharge valve actuated by said abutment and controlling the exhaust of air from the main air or train pipe, a charging valve controlling communication between the main air reservoir connection and the main air or train pipe connection, a regulating cock or valve controlling ports through which an equilibrium or an inequality of pressure, as the case may be, is established on opposite sides of the movable abutment, and an operating lever handle imparting movement to the regulating cock or valve and to the charging valve, substantially as set forth.

3. In an engineer's brake valve, the combination of a valve casing provided with connections to a main air reservoir and to a main air or train pipe, a movable abutment working in said casing, a discharge valve actuated by said abutment and controlling the exhaust of air from the main air or train pipe, an exhaust or discharge valve controlling communication between the main air or train pipe and the atmosphere, a regulating cock or valve controlling ports through which an equilibrium or an inequality of pressure, as the case may be, is established on opposite sides of the movable abutment, and an operating lever handle imparting movement to the regulating cock or valve and to the exhaust or discharge valve, substantially as set forth.

4. In an engineer's brake valve, the combination of a valve casing provided with con-

nections to a main air reservoir and to a main air or train pipe, a movable abutment working in said casing, a discharge valve actuated by said abutment and controlling the exhaust of air from the main air or train pipe, an emergency exhaust or discharge valve controlling communication between the main air or train pipe and the atmosphere, a regulating cock or valve controlling the movements of the abutment, an operating lever handle, and an arm connected to said lever handle and imparting movement to the emergency exhaust or discharge valve, substantially as set forth.

5. In an engineer's brake valve, the combination of a valve casing provided with connections to a main air reservoir and to a main air or train pipe, a regulating cock or valve controlling communication between said connections, an exhaust or discharge valve controlling communication between the main air or train pipe and the atmosphere, and an operating lever imparting movement to the regulating cock or valve and to the exhaust or discharge valve, substantially as set forth.

6. The combination in an engineer's brake valve, of a valve casing provided with connections for pipes to a main air reservoir and to a main air or train pipe, a movable abutment working in said casing, a discharge valve actuated by said abutment and controlling the exhaust of air from the main air or train pipe, a charging valve controlling communication between the main reservoir connection and the main air or train pipe connection, an exhaust or discharge valve controlling communication between the main air or train pipe connection and the atmosphere, a regulating cock or valve controlling ports through which an equilibrium or an inequality of pressure, as the case may be, is established on opposite sides of the movable abutment, and an operating lever handle imparting movement to the regulating cock or valve, to the charging valve, and to the exhaust or discharge valve, substantially as set forth.

7. The combination, in an engineer's brake valve, of a valve casing provided with connections for pipes to a main air reservoir and to a main air or train pipe, a movable abutment working in said casing, a discharge valve, actuated by said abutment and controlling the exhaust of air from the main air or train pipe, a charging valve controlling communication between the main air reservoir connection and the main air or train pipe connection, a regulating cock or valve controlling ports through which an equilibrium or an inequality of pressure, as the case may be, is established on opposite sides of the movable abutment, an operating lever handle coupled to the regulating cock or valve, and an arm fixed to the operating lever handle and adapted to impart opening movement to the charging valve, at a desired point in the

traverse of the arm, without positive connection to said valve, substantially as set forth.

8. In an engineer's brake valve, the combination of a regulating cock or valve, a lever  
5 handle journaled in a bearing independent of said regulating cock or valve and coupled thereto, an emergency exhaust or discharge valve, and an arm fixed to said lever handle and imparting movement to said emergency

exhaust or discharge valve, substantially as is set forth.

In testimony whereof I have hereunto set my hand.

FRANCIS L. CLARK.

Witnesses:

J. SNOWDEN BELL,  
F. E. GAITHER.