No. 757,486. PATENTED APR. 19, 1904.

R. A. McKEE.

THROTTLE VALVE.

APPLICATION FILED MAY 24, 1902.

NO MODEL.

Fig. 1.

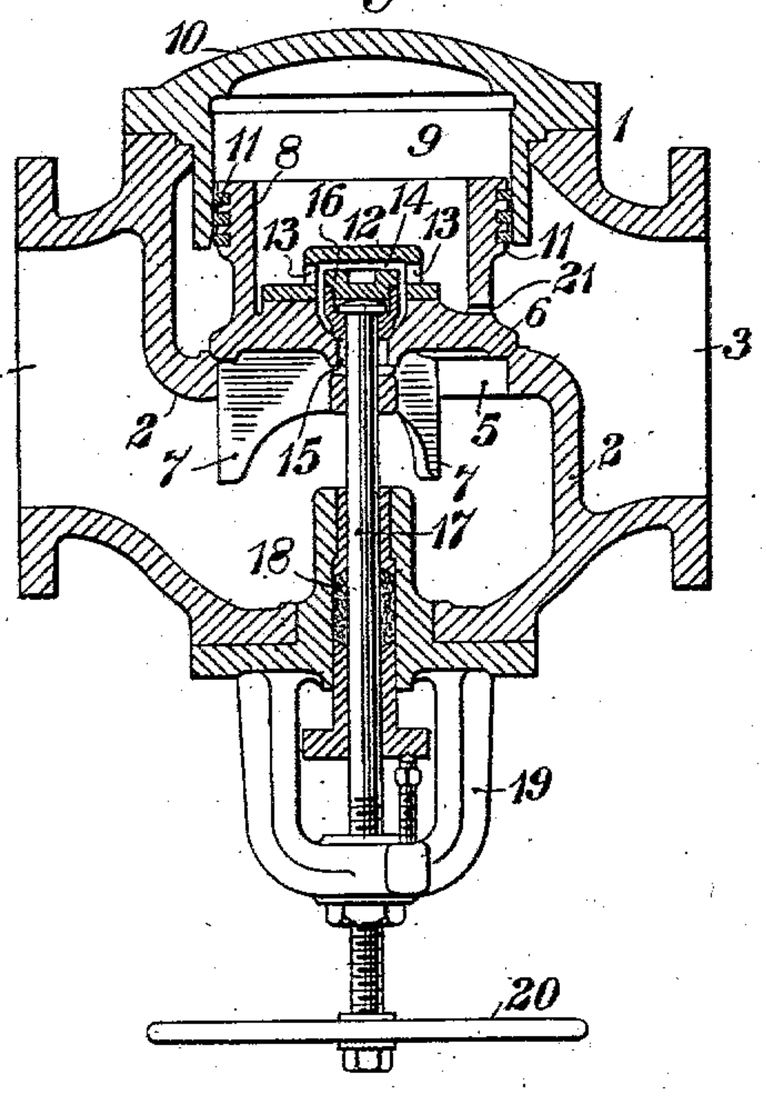


Fig. 2.

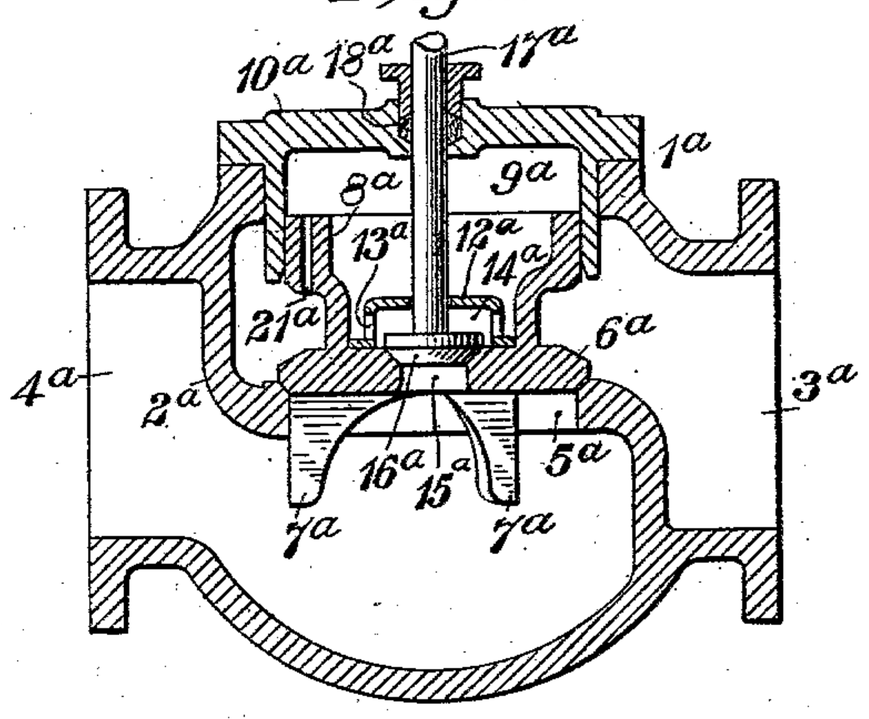


Fig. 3.

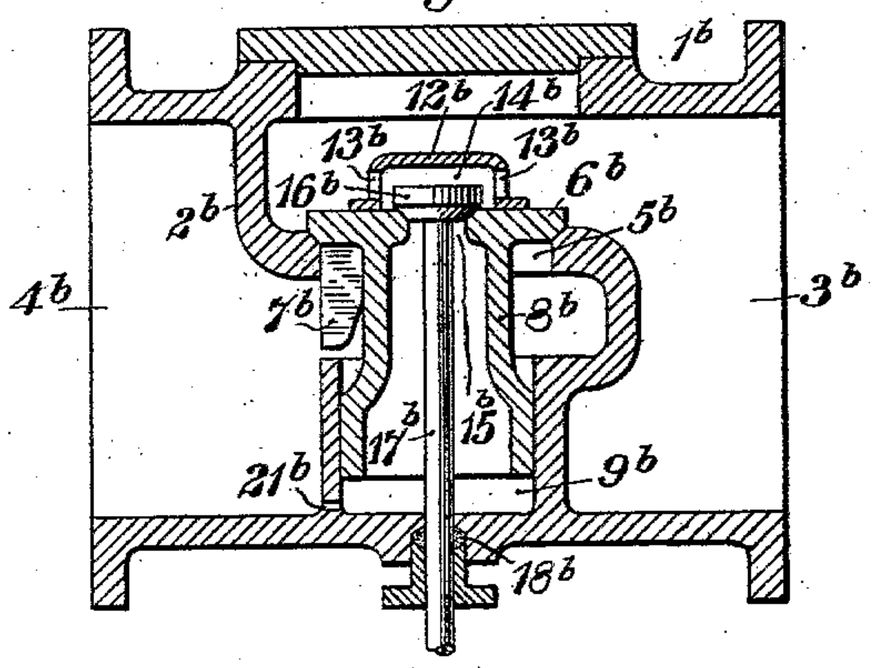


Fig. 4.

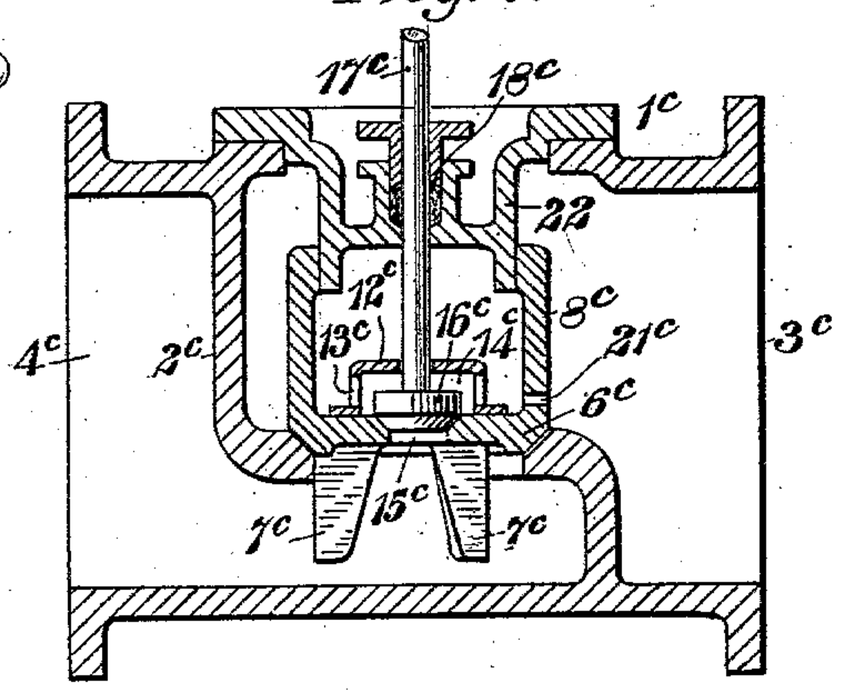
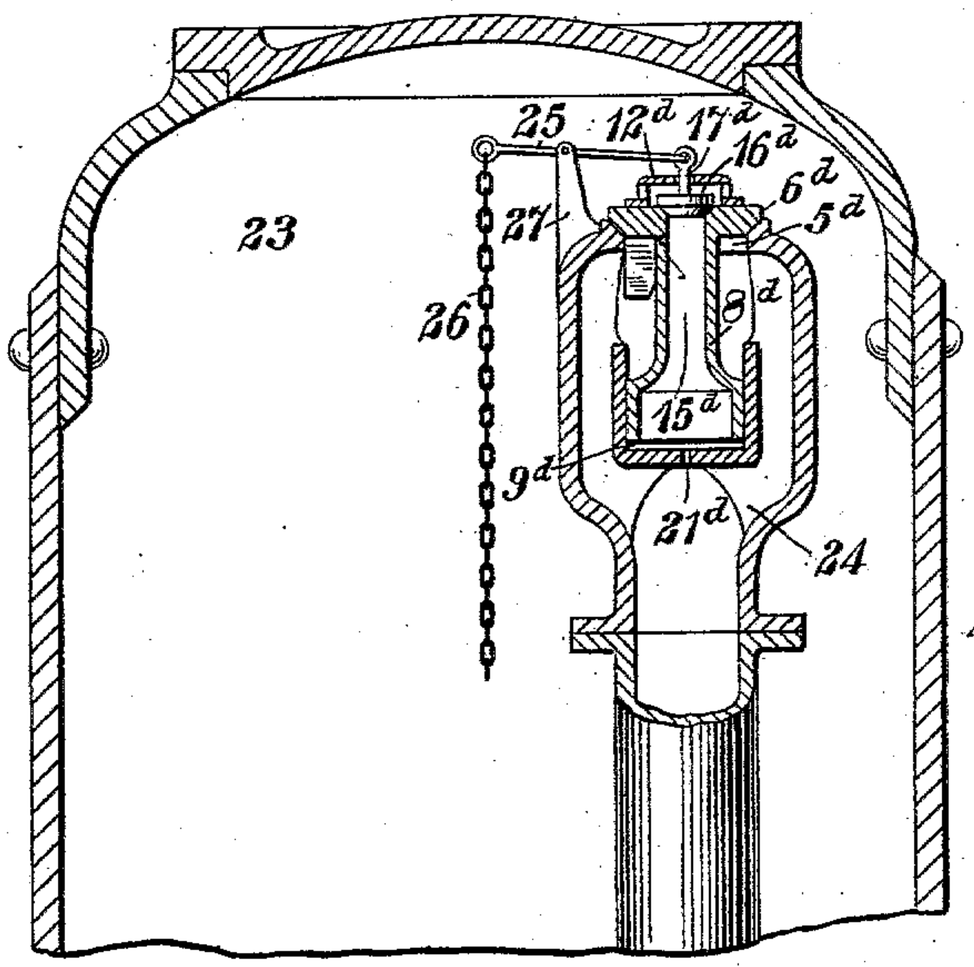


Fig. 5.



WITNESSES:

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No. 757,486. Patented April 19, 1904.

UNITED STATES PATENT OFFICE.

ROBERT A. McKEE, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

THROTTLE-VALVE.

SPECIFICATION forming part of Letters Patent No. 757,486, dated April 19, 1904.

Application filed May 24, 1902. Serial No. 108,811. (No model.)

To all whom it may concern:

Be it known that I, ROBERT A. McKEE, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Throttle-Valves, of which the following is a specification.

My invention relates to valves, and particularly to such valves as are employed for controlling or cutting off the expansive fluids employed for operating engines.

The object of my invention is to provide a valve which shall be normally subjected to fluid-pressure in such direction as to tend to hold it to its seat and shall be provided or combined with a supplemental valve in such manner as to substantially equalize the opposing pressures upon the main valve, and thus balance the said valve prior to moving it from its seat.

My invention is primarily intended for use in connection with steam-engines of large size and for controlling steam under high pressure, it being specially useful in such connections. It is to be understood, however, that it is capable of use in connection with fluids other than steam and in connection with any size of valve and any degree of fluid-pressure.

When a large valve is utilized for controlling fluid under high pressure, an expenditure of a great amount of power is necessary to raise the valve from its seat, provided the entire pressure of the fluid is exerted in such a direction as to tend to hold the valve to its seat. I am enabled by my invention to so divide the pressure that it shall be exerted with substantially the same force in a direction tending to unseat the valve as in a direction tending to seat it, and consequently the power exerted to lift the valve from its seat is only that necessary to move the weight of the valve itself against the action of gravity. In case the valve operates horizontally the necessity of overcoming the action of gravity is not involved, and if the valve be arranged to move away from its seat downwardly instead of upwardly obviously the action of gravity actually assists in moving the valve from its seat instead of opposing it, as in the case first mentioned.

In the accompanying drawings, Figure 1 is a sectional view of a portion of a fluid-conduit and the controlling-valves therefor constructed in accordance with my invention; and Figs. 2, 3, 4, and 5 are views corresponding to Fig. 1, but showing different modifications of my invention.

Referring first to Fig. 1, the valve-casing 1 is provided with the usual diaphragm 2 between the inlet passage or port 3 and the outlet passage or port 4, this diaphragm having a main valve-port 5, the wall or rim of which at one side constitutes the seat for the valve 6, the latter being provided with guide-wings 7, the outer edges of which engage with the walls of the opening or port 5. The valve 6 is provided with an extension 8, having the form of a hollow piston, located and movable in a cylinder 9, formed in a cap-piece 10, constituting part of the valve-casing 1. The piston 8 is also shown as provided with packing-rings 11, which engage with the cylindrical surface of the cylinder 9. The outer face of the valve 6 within the piston extension 8 is provided with a cap 12, provided with side ports 13, leading to a chamber 14, formed partially by the cap 12 and partially in the valve-body 6. The chamber 14 communicates with the outlet-space in the valve-casing 1 through a port 15, which is normally closed by means of a valve 16, having a stem 17, that also serves as the stem for the valve 6 and projects outward through a suitable stuffing-box 18, with which the valve-casing 1 is provided, and has a screw-thread engagement with a supporting-bracket 19. The stem is shown as provided with a hand-wheel 20; but any other suitable means for operating the stem and valves might be employed, if desired. The cylindrical portion of the piston 8 is provided with a small port or passage 21, which provides communication between the inlet port or opening 3 and the cylinder or space 9 beyond the valve 6 and its piston.

The operation of the mechanism thus far described is as follows: Assuming that the

parts are in the position indicated in the drawings, the steam or other fluid under pressure will leak through the port or passage 21 until the space above the piston and valve is filled, when the entire pressure of the fluid on the inlet side is exerted in such direction as to tend to hold the valve to its seat. As has already been indicated, if this pressure were not relieved by some means a very large expenditure of force would be necessary in order to open the main valve, provided it were of considerable size. In order to relieve this pressure, the stem 17 is turned by means of the handle 20, and by reason of the screw-thread connection between the stem and the bracket 19 the valve 16 will be raised from its seat, thus opening the port 15, and as this port is materially larger than the port 21 the pressure above the valve 6 and piston 8 will be quickly reduced, and, assuming that the pressure within the cylinder 9 and that below the valve 6 is thus made substantially equal, it follows that the pressure exerted upwardly within the inlet-space of the valve-casing upon the projecting portion of the piston will be approximately equal to that exerted in the opposite direction upon the valve 6, and consequently the valve is substantially balanced and may then be readily unseated by the application of a comparatively small amount of power to the hand-wheel 20, the further upward movement of the stem and valve 16 being imparted to the valve 6 by reason of the engagement of the outer end of the valve 16 with the cap 12.

In Fig. 2 the valve-casing 1^a is provided with a diaphragm or partition 2^a, which separates the inlet port or opening 3^a from the outlet port or opening 4^a, substantially as indicated in the preceding figure. In this case, however, the main valve 6^a, which controls the main port 5^a in the diaphragm 2^a, is operated from the opposite side of the casing to that from which the valve shown in Fig. 1 is operated, only a portion of the stem 17^a being shown. Any suitable means for moving the stem and valve may obviously be employed. The piston 8^a, which constitutes an extension of the main valve, operates in a cylinder 9^a, substantially as in the form shown in Fig. 1; but in the present case the leakage port or passage 21^a is differently located. The relief port or passage 15^a, supplemental valve 16^a, and cap 12^a, and, in fact, all of the parts are substantially like the corresponding parts shown in Fig. 1 as regards both structure and mode of operation, except that the valves are adapted for operation from above instead of from below.

In Fig. 3 the valve-casing 1^b is provided with a diaphragm or partition 2^b, which with the main valve 6^b separates the inlet port or opening 3^b from the outlet port or opening 4^b, the same as in the construction shown in the preceding figures; but in this case the cylinder 9^b, which is joined to and constitutes a part of the diaphragm, is provided with a leakage-port 21^b, that opens into the space at the outlet side of the valve-casing. The piston 8^b is hollow and projects into the cylinder 9^b in the opposite direction from what is shown in Figs. 1 and 2 and is provided with guide-wings 7^b, similar to those shown in the preceding figures. The valve 6^b is provided with a cap 12^b, having lateral ports 13^b, which open into the chamber 14^b, as in the construction shown in Fig. 1. The port 15^b, which opens into the hollow piston and from that into the cylinder, is normally closed by means of a valve 16^b, which has a stem 17^b, that extends out through the stuffing-box 18^b and may be operated by any suitable means. It will be seen that with this construction the full pressure of fluid in the inlet-space of the valve-casing is exerted in a direction tending to hold the main valve to its seat and that when the valve 16^b is lifted from its seat the steam or other fluid will flow into the hollow piston and the cylinder 9^b, and since the leakage through the port 21^b is slow the pressure exerted outwardly upon the valve-piston will be substantially equal to that exerted in the other direction, and the piston will therefore be balanced, and its further movement by engagement of the valve 16^b with the cap 12^b may be effected by the exercise of only such power as is necessary to overcome the action of gravity. After the valves are again seated the steam within the cylinder 9^b and the hollow piston 8^b will gradually leak out through the port 21^b, so that the valve will again become subject to the maximum resulting pressure, tending to hold it to its seat.

In Fig. 4 the valve-casing 1^c is provided with a diaphragm 2^c, that separates the inlet port or opening 3^c from the outlet port or opening 4^c, substantially as in the preceding figures, and in this case, as in Fig. 1, the hollow piston 8^c, with which the main valve 6^c is provided, has a small leakage-port 21^c opening into the inlet-space in the valve-casing. In this modification, however, the piston is really a movable cylinder, the outer end of which surrounds the stationary piston 22, which is provided with a stuffing-box 18^c, through which the stem 17^c of the supplemental valve 16^c projects. A cap 12^c, having ports 13^c, is mounted upon the valve 6^c within the hollow piston and is engaged by the supplemental valve 16^c to raise the main valve 6^a in the same manner as has already been described. The operation of this modification will be readily understood from the description heretofore given with reference to what is shown in the other figures of the drawings, the resultant pressure in such direction as to seat the main valve being attained after sufficient time has elapsed for the leakage through the port 21^c of sufficient fluid to fill the space within the piston 8^c and the balancing pres-

sures being secured by raising the valve 16^c, and thus permitting the accumulated pressure in the hollow piston or cylinder 8^c to pass out through the port 15^c.

In Fig. 5 a valve mechanism is shown which is adapted for use in connection with steam-locomotives, the steam-dome 23 constituting the inlet passage or space and the outlet passage or space being the pipe 24. The upper end of this pipe 24 is provided with a main port 5^d, which is normally closed by the main valve 6^d. This valve is provided with a hollow piston 8^d, having a leakage-port 21^d. The supplemental valve 16^d is provided with a short stem 17^d, to which is attached one end of a lever 25, to the other end of which is connected one end of an operating chain or cord 26, the lever being pivoted at an intermediate point to a bracket 27. The opening of the main valve is effected by engagement of the supplemental valve 16^d with the cap 12^d, the structure and mode of operation of this valve mechanism being substantially the same as the structure and mode of operation of the mechanism shown in Fig. 3.

It will be understood that while I have shown and described several different embodiments of my invention other forms, combinations, and arrangements of elements may be employed without departing from the spirit and scope of the invention. I desire it to be understood, therefore, that my invention is not limited, except in so far as limitations may be imposed, by the prior art and specified in the claims.

I claim as my invention—

1. The combination with the main valve embodying a piston, and a cylinder therefor, one of said parts having a small port or passage for transferring fluid-pressure to or from the cylinder and having a larger port for transferring fluid-pressure from or to the cylinder, of a supplemental valve for said larger port, the opening of which serves to substantially balance opposing pressures exerted against the main valve and a single means for opening both valves.

2. The combination with a main valve embodying a piston, and a cylinder therefor, one of which has a port or passage for admitting fluid-pressure from the inlet side of the main valve to the cylinder and the other of which has a port or passage for exhausting the pressure from the cylinder to the outlet side of the main valve, said ports being of unequal size, of a supplemental valve for the larger of said ports, the opening of which serves to substantially balance the opposing pressures exerted against the main valve and a single means for opening both valves.

3. The combination with a main valve embodying a piston, and a cylinder therefor, one of said parts having a port or passage between the cylinder and the space at the inlet side of the main valve and one of said ports having a port or passage between the cylinder and the space at the outlet side of the main valve, said ports or passages being of unequal size, of a supplemental valve for the larger of said ports or passages the opening of which serves to provide a balance of opposing pressures exerted against the main valve and a single means for opening both of said valves.

4. The combination with a main valve having a piston, of a cylinder for said piston between which and the main fluid-pressure conduit, at one side of the main valve, is a leakage port or passage and at the other side of the main valve is a larger port or passage, a supplemental valve for said larger port or passage and a single means for operating both valves.

5. The combination with a fluid-pressure conduit and a main valve therefor having a piston, of a cylinder for said piston between which and the conduit, at the inlet and outlet sides of the valve, are ports or passages of unequal size, a supplemental valve for the larger port and a single means for successively actuating the supplemental valve and the main valve.

6. The combination with a fluid-conduit and a main valve therefor having a piston provided with two ports opening respectively from the cylinder in which it operates to the inlet and outlet portions of the conduit, of a supplemental valve serving to normally close one of said ports and a single means for successively actuating the supplemental valve and the main valve.

7. The combination with a fluid-conduit and a valve therefor having a piston provided with a small, valveless inlet-port and a relatively large exhaust-port, of a cylinder into and from which said ports respectively admit and exhaust the fluid, and a supplemental valve for the exhaust-port having a lost-motion connection with the main valve and initially movable to effect equalization of opposing pressures upon the main valve.

8. The combination with a fluid-conduit, and a main valve therefor provided with a piston, of a cylinder for said piston between which and the conduit, at the respective sides of the valve, are ports of different size, a supplemental valve for the larger of said ports connected to the main valve and having lost motion with reference thereto whereby initial movement of the supplemental valve equalizes opposing pressures upon the main valve and subsequent movement unseats said main valve.

In testimony whereof I have hereunto subscribed my name this 20th day of May, 1902.

ROBERT A. McKEE.

Witnesses:

ROBT. M. ALLEN,

J. L. MOORE.