No. 746,640. PATENTED DEC. 8, 1903.

N. C. LOCKE.

AUTOMATIC SHUT-OFF VALVE.

APPLICATION FILED DEC. 22, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

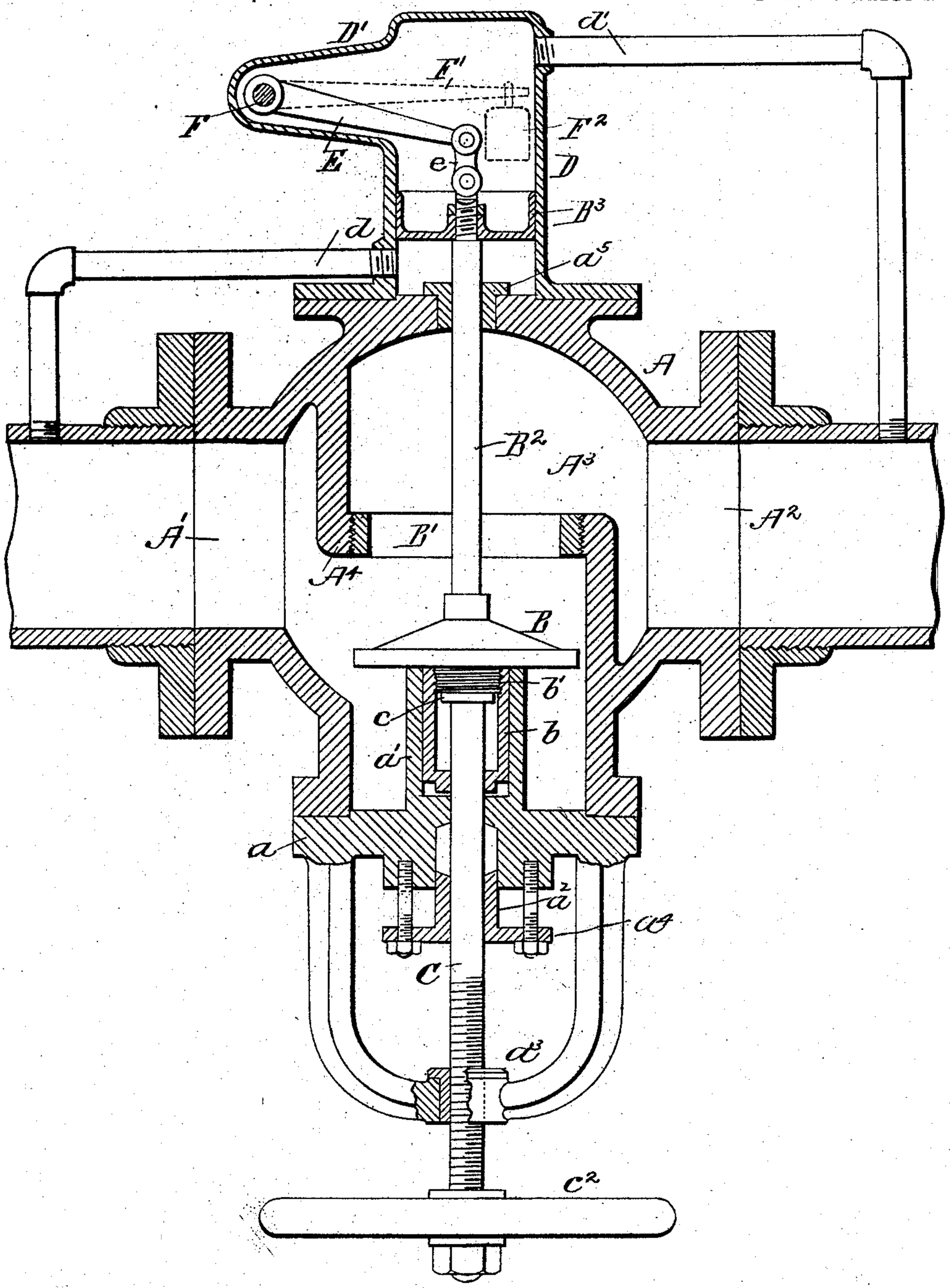

FIG. I.

WITNESSES.

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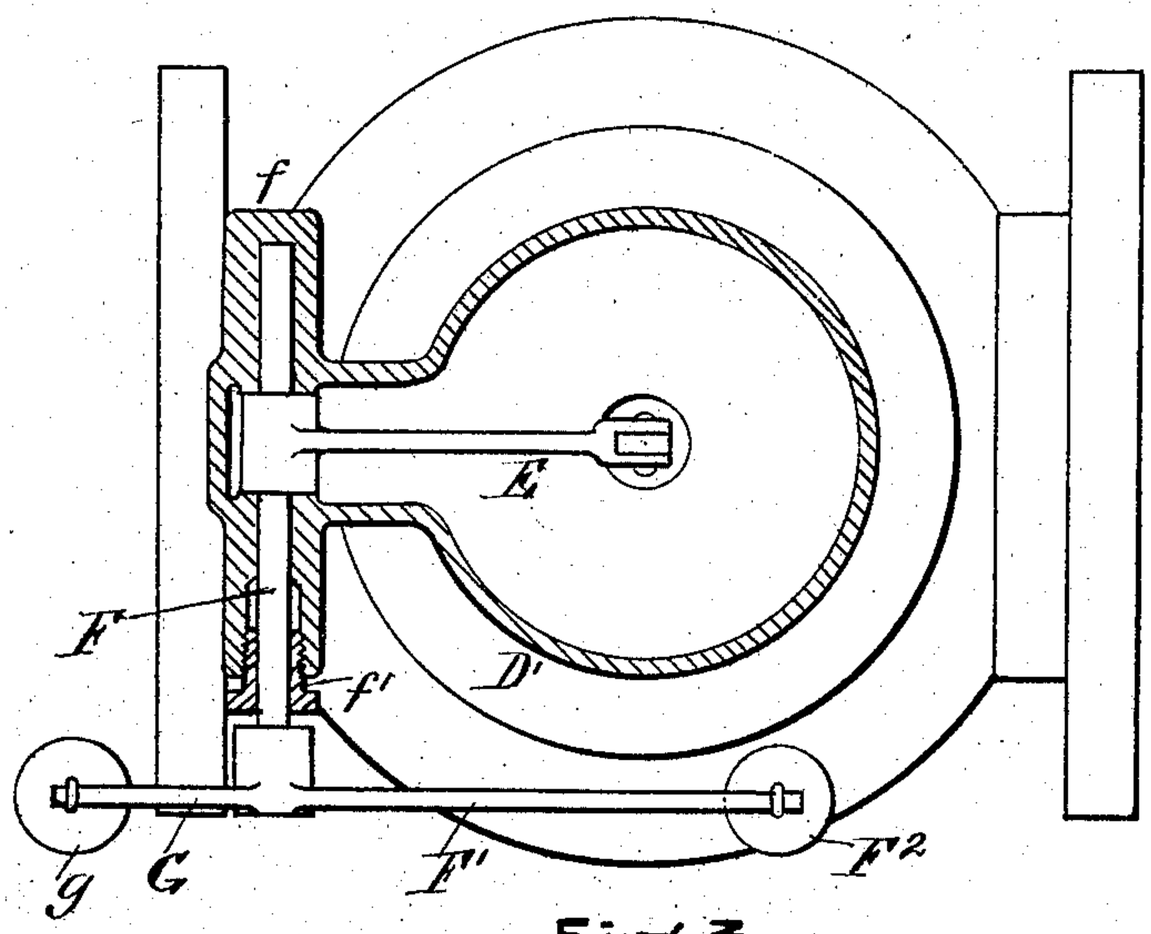

Fig. 3.

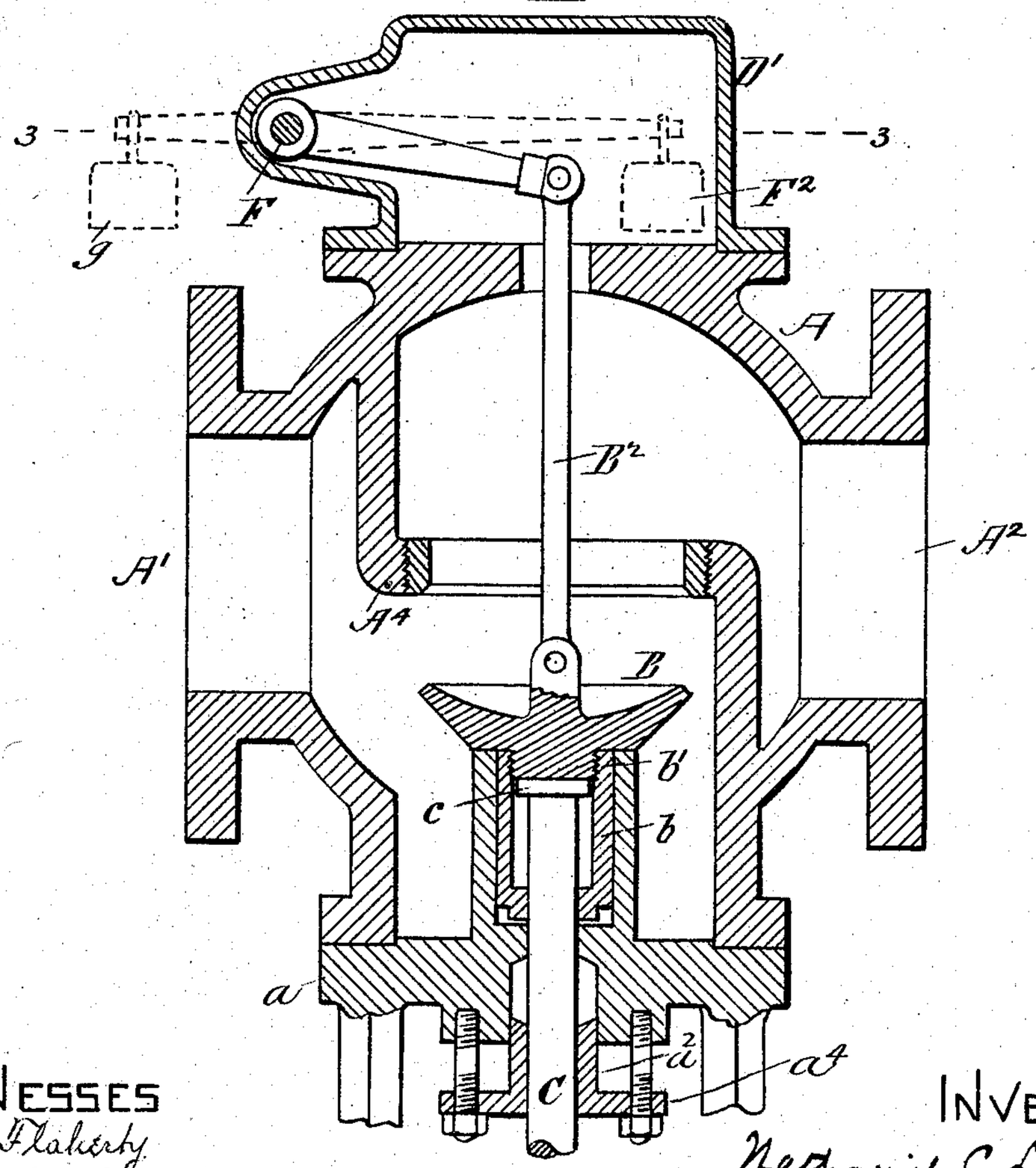

Fig. 2.

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UNITED STATES PATENT OFFICE.

NATHANIEL C. LOCKE, OF SALEM, MASSACHUSETTS, ASSIGNOR TO LOCKE REGULATOR COMPANY, OF SALEM, MASSACHUSETTS.

AUTOMATIC SHUT-OFF VALVE.

SPECIFICATION forming part of Letters Patent No. 746,640, dated December 8, 1903.

Application filed December 22, 1902. Serial No. 136,126. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL C. LOCKE, of Salem, in the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Automatic Shut-Off Valves, of which the following is a specification.

My invention relates to automatic shut-off valves especially adapted to be located in the main supply-pipe of a steam-plant between the boiler and the engine and intended to shut off the steam automatically when there is any break in the pipe on the engine side of the valve.

In this description I shall call the boiler side of the shut-off valve the "inlet" side and the engine side the "outlet" side.

The means for closing such a valve may consist of a piston connected with the valve and working in a cylinder provided with steam-inlets, one above and one below the piston, one of these inlets being connected with the steam supply or boiler and the other with some portion of the main supply-pipe on the outlet side of the valve. So long as these pressures are equal the valve remains in its normal position; but when the pressure on the outlet side is lowered materially, as by a break in the pipe, the pressure on the inlet side or below the piston being unbalanced by pressure above it becomes sufficient to lift the piston and start the valve toward its seat, bringing it into the rush of steam, which closes it. Valves have also been made to close by the rush of steam alone, the valve in this case standing normally somewhat in the passage through which the steam passes and being sufficiently heavy not to be closed by the steam in its ordinary movement, but only when pressure on the outlet side is so reduced that a rush is caused. In either case there is a tendency on the part of the steam in its ordinary flow through the valve-opening to suck the valve onto its seat. This is especially true in the first class of valves, above referred to, where the wire drawing of steam tends to reduce the pressure above the piston. To operate successfully, therefore, the movable parts of these valves must be just heavy enough to withstand this sucking tendency of the steam and not too heavy, or the valve will not shut promptly when a break occurs. Valves of the same size are approximately of the same weight; but variations in weight exist and steam-pressures vary, so that when the weight of a valve is relied upon to hold it open one cannot be positive that it will do so, especially in a case where the rush of steam alone is relied upon to close it. My invention is intended to overcome these difficulties by applying one or more weights, which may be adjusted in amount to assist in holding the valve off its seat, balancing it according to the normal flow of steam, so that it will not close under ordinary conditions, but will close when required, and it will be seen that my invention is equally applicable to the two types of valves to which I have referred, and I have shown it in the drawings applied to valves of both forms. It is also evident that one or more weights may be applied by other means and in other ways than are shown in the drawings. In the drawings, however, I have shown preferred forms of construction.

Figure 1 is a vertical section of a shut-off valve having means for positively closing the valve—namely, a piston and cylinder. Fig. 2 shows a valve structure in which such positive means for operating the valve are omitted, the valve being adapted to be closed by any increased rush of steam above a certain amount. The lower part of the structure, being like that shown in Fig. 1, is omitted. Fig. 3 is a cross-section on line 3 3 of Fig. 2.

A is a casting provided with a steam-inlet A′ and a steam-outlet A^2, the casting being so shaped in its interior as to form a chamber A^3, divided by a diaphragm A^4, having the passage B′ therethrough adapted to be closed by the valve B. This valve B has a chambered cylindrical bearing *b* screwed to its under surface at *b*′. This chambered cylindrical bearing *b* is closed at the bottom, with the exception of an opening through which passes the set-rod C. The bottom of the chamber A^3 is closed by a disk *a*, from which projects upwardly a cylindrical bearing *a*′, in which slides the valve-bearing *b*. The set-rod C has an expanded end *c*, adapted to be moved vertically in the chamber in the bearing *b*, so that there is a certain amount of

lost motion between the valve B and the set-rod C.

The disk *a* has an opening through its middle provided with a stuffing-box a^2, down through which the set-rod C passes, and it also has spider-arms a^4 extending downward and meeting in a hub a^3. The lower portion *c'* of the set-rod C is threaded and passes through a threaded opening in the hub a^3, its lower end being provided with a hand-wheel c^2, this whole structure being such that by means of the set-rod C the exact position of the valve B with relation to the opening B' in the diaphragm may be adjusted to bring it sufficiently into the steam-current to be closed if the force of the current increases materially and yet to remain open under ordinary conditions. If the valve sticks, it may be moved away from its seat by withdrawing the set-rod C until its enlargement *c* engages with the bottom of the chamber in the cylindrical bearing *b*. By screwing the valve onto its seat this valve may be used at any time as a throttle-valve, and yet because of the lost motion between the enlargement of the set-rod and the cylinder the valve will be free to move within certain limits when required to do so in cases of emergency.

The valve B has a valve-rod B^2 extending up through a bushing in the top of the casting A, and, as shown in Fig. 1, it has attached near its upper end a piston B^3, which slides in a cylinder D, forming part of a casing D'. This cylinder has two small pipes leading into it. The pipe *d*, extending from the bottom of the cylinder, leads to a coupling, (not shown,) with the main steam-pipe on the inlet side of the shut-off valve, while the pipe *d'* extends from the upper part of the cylinder, connecting the chamber above the piston with the main steam-pipe on the outlet side of the shut-off valve. Under ordinary circumstances, the pressure on both sides of the shut-off valve being equal, the piston B^3, and consequently the valve B, when once properly set will retain its position such that the passage B' will be open, whereas any weakening of the pressure above the piston, such as might be caused by a breakage in the steam-pipe with which it connects, will allow the pressure on the side of the shut-off valve acting through the pipe *d* to lift the piston, and consequently start the valve B toward its closing position, carrying it into the body of steam which fills the chamber A^3 in the casting A and is rushing toward the break. The valve will thus be closed and held closed by the pressure behind it, so that all further escape of steam will be prevented.

The valve B tends to remain open owing to its own weight and the friction between the piston and cylinder; but as it is desirable to adjust a valve according to the peculiar conditions under which it is to be used I have provided means for the purpose, comprising a rocker-arm E, which is connected by a link *e* with the top of the valve-rod B^2. This rocker-arm E is mounted on a rock-shaft F, one end of which lies in a bearing *f*, cast with the casing D', its other end passing through a stuffing-box *f'* and carrying a second rocker-arm F' outside the casing D'. A weight F^2 of sufficient size may be hung on the arm F' to coöperate with the weight of the valve B and its parts and just counterbalance the closing effect of the steam. This construction will be understood by reference to Fig. 3, which shows the means for mounting the rock-shaft and the relation of the rocker-arms. By adjusting the location of the valve B with relation to the opening B' and also by adjusting the weight F^2 the valve may be rendered very delicate in its balance, so that it will close with great promptness in case of accident. Moreover, if the weight be removed when the valve is in use, whether by hand or automatically, the valve will immediately close. It may thus be used as an emergency shut-off even when there is no break in the pipe.

I have shown in Fig. 2 my weight attachment applied to the other form of valve above referred to, that in which the cylinder and piston are omitted, and the valve depends for its closing upon the suction and impetus caused by a sudden increase in the rush of steam through the opening B' if at any time there is a breakage in the main pipe on the engine side of the valve. In this case the valve-stem B^2 is extended up, as before, through a suitable opening in the top of the casing A and is there pivotally connected directly with the rocker-arm E, projecting from the rock-shaft F, carrying the second rocker-arm F', with a weight F^2. In this case it is evident that the position of the valve must be more delicately adjusted, for the piston and cylinder being absent the element of friction is lacking, as well as the means for positively starting the valve. The valve must therefore be located nearer its seat. In this case the stem of the valve serves somewhat as a guide; but it is not necessary for that purpose, provided the portion *b*, extending below the valve B and forming part of it, is sufficiently long and has a sufficient bearing in the part *a'* to keep the valve in proper horizontal position.

In the construction shown in Fig. 2 it is sometimes desirable to use a closing-weight, so that when the weight F^2 is removed the valve will start to its seat immediately. For this purpose I have shown in dotted lines a rocker-arm G, mounted on the rock-shaft F and carrying at its outer end a weight *g*, which will be sufficient when the weight F^2 has been removed to start the valve to its seat. This is shown in full lines in Fig. 3.

When suction is not depended upon to start the valve, I prefer to make its upper surface conical, as shown in Fig. 1, as the ordinary flow of steam will not tend to suck up a valve of this shape.

The value of this invention will be fully

appreciated by all those skilled in the art when it is considered that it is necessary in an automatic valve of this character that it shall close almost instantly when necessity requires and yet shall always remain open except in an emergency. By means of weights applied to the valve its delicacy may be adjusted to suit any given case, and less care may be taken in the weight of the metal of which the valve is made.

I have described my invention in connection with a steam system, as that is the most frequent use to which it is likely to be put; but it is evident that valves of this construction may be used elsewhere for the purpose of an automatic shut-off.

While I have described the valve B as moving vertically, it is evident to one skilled in the art that by changing the arrangement of weight-carrying levers they may be applied to a horizontally-moving valve without departing from the spirit of my invention, which relates not to the exact means whereby the weighting is accomplished, but to the weighting of a valve of this character, however it may be accomplished.

What I claim as my invention is—

1. In an automatic shut-off valve, a casing having a steam-chamber provided with an inlet and an outlet, a perforated diaphragm dividing said steam-chamber horizontally, a valve located below the perforation in said diaphragm, and adapted to close said peforation, said valve having an upwardly-projecting stem, in combination with a rock-shaft carrying a rocker-arm connected with said valve-stem, and a second rocker-arm provided with weighting means adapted to act with the weight of said valve to hold said valve normally from closing said perforation, as described.

2. In an automatic shut-off valve, in combination a casing containing a steam-chamber having an inlet and an outlet, a perforated diaphragm, a valve adapted to close the perforation in said diaphragm and held off its seat by gravity, said valve being provided with an upwardly-projecting stem carrying a piston at its upper end, a cylinder mounted above said casing, said piston being located within said cylinder, two steam-inlets entering said cylinder, one above and the other below said piston, a rock-shaft carrying two rocker-arms, one connected with said valve-stem and the other adapted to be adjustably weighted, as and for the purposes set forth.

3. In an automatic shut-off valve, a casing containing a steam-chamber and having an inlet and outlet, a perforated diaphragm dividing said chamber into two parts, a valve free to move toward and from said diaphragm and adapted when in its upward position to close the perforation in said diaphragm, means slidably connected with said valve such as a weight connected with said valve and adapted to move it toward its seat, and means such as a weight also connected with said valve and adapted to hold said valve off its seat, as and for the purposes set forth.

4. In an automatic shut-off valve, a casing having a steam-chamber provided with an inlet and an outlet, a perforated diaphragm dividing said steam-chamber, a valve located below the perforation in said diaphragm and adapted to close said perforation, said valve having an upwardly-projecting stem and a piston mounted thereon, in combination with a cylinder mounted above said casing, said piston being located in said cylinder, said cylinder also being provided with two steam-inlets, one entering it above and the other below said piston, said inlets being adapted to be connected with the steam system, one on the inlet side of the diaphragm, the other on the outlet side thereof, and a rock-shaft carrying a weighted rocker-arm connected with said valve-stem, as and for the purposes set forth.

5. In an automatic shut-off valve, a casing having a steam-chamber provided with an inlet and an outlet, a perforated diaphragm dividing said steam-chamber, a valve located below the perforation in said diaphragm and adapted to close said perforation, said valve having an upwardly-projecting stem and a piston mounted thereon, in combination with a cylinder mounted above said casing, said piston being located in said cylinder, said cylinder also being provided with two steam-inlets, one entering it above and the other below said piston, said inlets being adapted to be connected with the steam system, one on the inlet side of the diaphragm, the other on the outlet side thereof, and a rock-shaft carrying a rocker-arm connected with said valve-stem, said rocker-arm being provided with a detachable weight adapted when in place to assist in holding the valve off its seat and when removed from said rocker-arm to allow said valve to close automatically, as described.

6. In an automatic shut-off valve, a casing having a steam-chamber provided with an inlet and an outlet, a perforated diaphragm dividing said steam-chamber horizontally, a valve located below the perforation in said diaphragm and adapted to close said perforation, said valve having an upwardly-projecting stem and a downwardly-projecting hollow bearing, said casing also being provided with an upwardly-projecting hollow bearing adapted to receive the bearing projecting from said valve, and to form a guide therefor, said valve also being provided with a set-rod adapted to adjust the lower position of said valve, said valve-bearing being capable of a sliding upward movement with relation to the end of said adjusting-rod, as and for the purposes described.

7. In an automatic shut-off valve, a casing having a steam-chamber provided with an inlet and an outlet, a perforated diaphragm dividing said steam-chamber horizontally, a valve located below the perforation in said

diaphragm and adapted to close said perforation, said valve having a downwardly-projecting bearing, said casing also being provided with an upwardly-projecting hollow bearing adapted to receive the bearing projecting from said valve and to form a guide therefor, in combination with a rock-shaft suitably connected to said valve and carrying a weighted rocker-arm whereby the normal position of the valve may be adjusted with relation to its seat, as described.

In testimony whereof I hereunto set my name this 11th day of December, 1902.

NATHANIEL C. LOCKE.

Witnesses:
GEORGE O. G. COALE,
M. E. FLAHERTY.