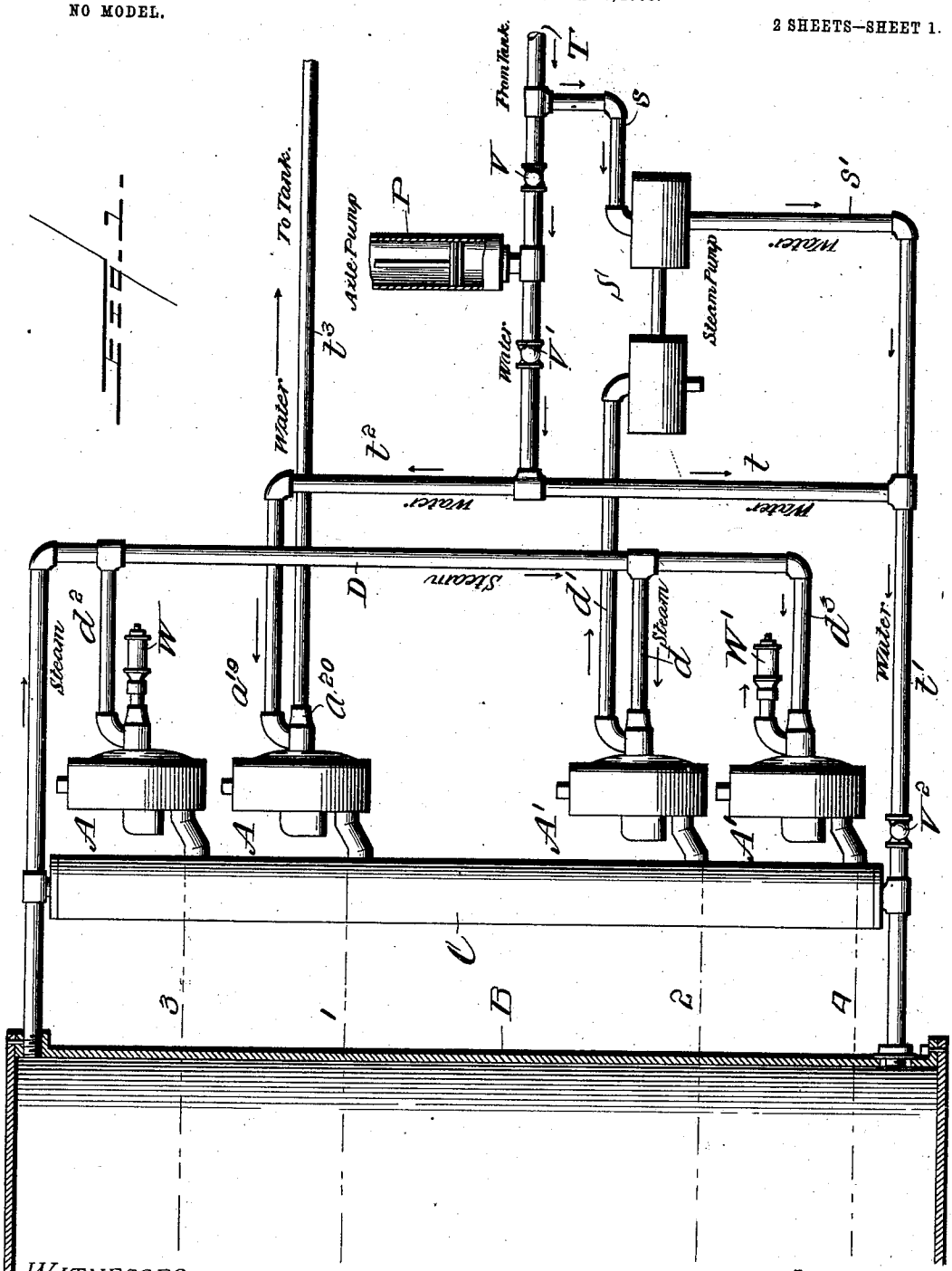
No. 747,843. PATENTED DEC. 22, 1903.

J. E. BALDWIN.

VALVE OPERATING DEVICE FOR STEAM GENERATORS.

APPLICATION FILED JUNE 27, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



WITNESSES:

Wm. F. Doyle

J. K. Moore

INVENTOR

James Edward Baldwin

BY Whittaker & Prescott

Attorneys

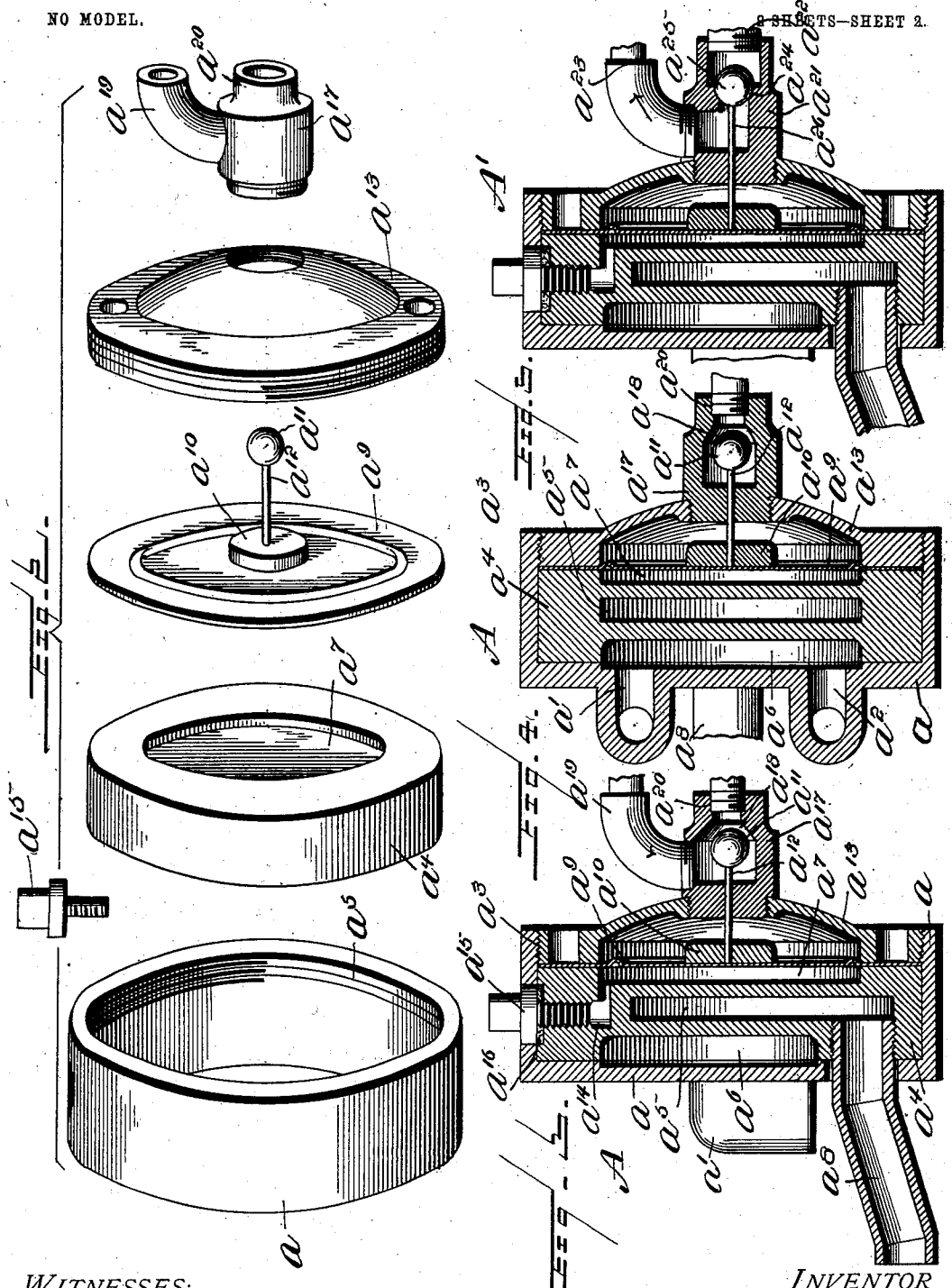
No. 747,843. PATENTED DEC. 22, 1903.

J. E. BALDWIN.

VALVE OPERATING DEVICE FOR STEAM GENERATORS.

APPLICATION FILED JUNE 27, 1903.

NO MODEL. 2 SHEETS—SHEET 2.



WITNESSES:

W. F. Doyle.

J. K. Moore

INVENTOR

James Edward Baldwin

BY Whittaker & Prevost

Attorneys

No. 747,843. Patented December 22, 1903.

UNITED STATES PATENT OFFICE.

JAMES EDWARD BALDWIN, OF EAST WILLISTON, NEW YORK, ASSIGNOR TO ABBOT AUGUSTUS LOW AND ALBERT AUGUSTUS DAY, OF BROOKLYN, NEW YORK.

VALVE-OPERATING DEVICE FOR STEAM-GENERATORS.

SPECIFICATION forming part of Letters Patent No. 747,843, dated December 22, 1903.

Application filed June 27, 1903. Serial No. 163,343. (No model.)

To all whom it may concern:

Be it known that I, JAMES EDWARD BALDWIN, a citizen of the United States, residing at East Williston, in the county of Nassau and State of New York, have invented certain new and useful Improvements in Valve-Operating Devices for Steam-Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawings, which illustrate one form in which I have contemplated embodying my invention, said invention being fully disclosed in the following description and claims.

Referring to the drawings, Figure 1 represents a steam-boiler with feed-water-supply system, showing my invention applied thereto. Fig. 2 represents the various parts of my valve-operating device detached. Fig. 3 is a vertical sectional view of said device, showing the parts assembled. Fig. 4 is a horizontal sectional view of the device. Fig. 5 is a view similar to Fig. 3 of a slightly-modified form of the device.

My invention consists, essentially, of a valve-operating device adapted to be connected with a steam-boiler or the water-column connected therewith and, further contemplated, the combination of a plurality of such devices in a feed-water system for a steam-boiler for maintaining the water-level therein, preventing the burning out of the boiler, and indicating the presence of high and low water, all as hereinafter fully set forth.

My improved valve-operating device A is illustrated in Figs. 2, 3, and 4 and is constructed, preferably, as follows:

a represents the exterior shell or casing of the device, which is ordinarily of cylindrical form, closed at the rear end and provided with inlet and outlet apertures a' a^2 and is open at the front end and provided interiorly adjacent to the front end with threads, as shown at a^3.

a^4 represents a hollow cylindrical block adapted to fit within the casing a and provided with an interior steam-space a^5 and exteriorly with a circular recess a^6 on its rear face and with a similar recess a^7 on its front face. On its rear face this block is provided with a threaded aperture communicating with the steam-space to receive a pipe a^8, which also extends through a registering aperture in the rear wall of casing a.

a^9 represents a metal diaphragm which is placed over the recess a^7 in the block a^4 and is preferably provided with a central reinforcing-washer a^{10}. In this instance I have shown connected with said diaphragm and washer a ball-valve a^{11}, having a stem a^{12}, which is connected to the washer a^{10}.

a^{13} is a closing-plate which in this instance is threaded on its periphery and is screwed into the open end of the shell or casing a, as shown in Figs. 3 and 4, (being provided with suitable apertures to receive a wrench or spanner,) thereby clamping the parts together and forming a chamber between the recess a^7 of the block a^4 and the metal diaphragm. This recess is filled with a liquid and hermetically sealed. In the drawings I have shown the block a^4 provided with a tapped hole a^{14} in its periphery registering with a larger aperture in the casing a and communicating at its lower end through a horizontal aperture with the recess a^7. Through this means the said chamber, which I will hereinafter refer to as the "expansion-chamber," is filled with the liquid, which may be water or some more volatile liquid, as preferred, and the said chamber is sealed by means of a screw-plug a^{15}, having an enlarged head to fit the aperture in the casing a, beneath which head is placed a washer a^{16}.

a^{17} represents a valve-chamber which is screwed into a central aperture in the closing-plate a^{13} and is provided internally with a valve-seat a^{18} and externally with an inlet-aperture a^{19} and outlet-aperture a^{20}. In this instance the valve a^{11}, consisting, preferably, of a ball, is located within the valve-chamber a^{17}, and its stem a^{12} passes through an aperture in the back wall of the valve-chamber.

It will be seen from an examination of Figs. 3 and 4 that the valve a^{11} is normally in open position and is moved against the valve-seat a^{18} by the expansion of the fluid in the expansion-chamber acting on the flexible diaphragm a^9. It will also be obvious that the device may be arranged so that the valve will be normally in closed position and will be opened by the expansion of the fluid in the expansion-chamber. Such a device is shown at A′ in Fig. 5. This device is constructed exactly like the device A, previously described, except that a different form of valve-chamber is employed. In this construction the valve-chamber a^{21} has an inlet a^{22} and outlet a^{23} and the valve-seat a^{24} arranged so that the valve a^{25} is moved away from the body of the device to open, the stem a^{26} being slightly longer than the stem a^{12}.

In operation the device A is connected to a steam-generator by means of pipe a^8, and its operation depends upon whether steam or water enters the steam-space a^5. Supposing that the pipe a^8 is connected to the boiler (or a water-column in communication therewith) at the level at which it is desired to keep the water in the boiler and supposing that the water has fallen below the level of the upper edge of the pipe a^8, steam would enter the steam-space a^5 and keep said space continually filled with steam at substantially the same temperature as the steam in the boiler, the condensation running back through pipe a^8. The heat of the steam in the steam-space a^5 will raise the fluid in the expansion-chamber to substantially the same temperature, thereby vaporizing it and creating pressure in said chamber which will deflect the diaphragm outward and move the valve in a direction to close it. If, however, the water in the boiler rises above the level of the top of the pipe a^8, no more steam will pass into the steam-space, and as the steam therein condenses by reason of its loss of heat due to radiation the steam-space a^5 will fill with water. This water will be gradually cooled by radiation of its heat and will extract heat from the contents of the expansion-chamber, thus reducing the pressure therein and causing the diaphragm to retract and open the valve.

It will be noted that there is a space a^6 in rear of the steam-chamber which is provided with outlets a' a^2. These outlets will permit a circulation of air through the space a^6 to facilitate the radiation of heat from the steam-chamber, and said outlets may be connected with water-pipes, if desired, to convert said space a^6 into a water-jacket to facilitate radiation and cause the device to act more quickly, if desired.

The operation of the device A′ (shown in Fig. 5) is identical with that just described, except that the movements of the valve are reversed.

In Fig. 1 I have shown a feed-water system for a steam-boiler with my improved valve-operating devices applied thereto, the arrangement being particularly adapted for use in steam-propelled automobiles, although it is equally well adapted for stationary boilers. In this figure, B represents the boiler, and C the water-column connected therewith. 1 represents what may be termed the "normal" water-line, indicating the level at which it is desired to hold the water-level in the boiler. P represents the feed-pump for feeding water to the boiler from the tank or reservoir, said pump drawing the water from pipe T through check-valves v and forcing it through check-valve v', pipes t t', and check-valve v^2 into the boiler. A by-pass is provided from the pump back to the tank, (as the pump is operated continuously while an automobile is in motion,) so that when a sufficient amount of water has been pumped into the boiler, by opening a valve in the by-pass the water pumped will follow the line of least resistance and return to the tank through the by-pass instead of passing into the boiler against the steam-pressure therein. I advantageously employ my improved valve-operating device to operate this valve in the by-pass automatically when the water in the boiler reaches a given level. In this instance I have shown the device A connected to the boiler (in this instance to the water-column C thereof) at the normal water-level 1. The by-pass is formed by a pipe t^2, connected with pipe t and extending to the inlet a^{19} of the valve-chamber of the device A, and a pipe t^3, extending from the outlet a^{20} to the tank, the valve operated by the device A, as hereinbefore described, controlling the by-pass. It being understood that the pump P is running all the time the automobile is in operation, being driven from the engine or running-gear, if the water in the boiler is below the normal water-level 1 steam is admitted to the device A and, as previously described, will cause the closing of the valve, thus closing the by-pass and forcing the water pumped to enter the boiler through the check-valve v^2. When the water in the boiler rises above the normal level 1, the water will enter the device A and on cooling cause the opening of the valve, thus opening the by-pass, when the water will pass from the pump back to the tank and will not enter the boiler.

As there is a considerable loss of water when an automobile remains standing for a considerable period, it is desirable to provide means for supplying water in such cases. To this end I arrange a steam-pump S, adapted to be operated by steam from the boiler and connected with the tank-pipe T by a pipe s and by a pipe s' with the pipe t', leading to the boiler. At the desired level, which I will term the "medium" low-water level, (indicated at 2 on the drawings,) I attach the device A, the valve of which is normally closed and controls the admission of steam to the steam-pump S.

D represents a steam-pipe leading from the upper end of the boiler, having a branch d

leading to the inlet a^{22} of the valve-operating device A′, and a pipe d' leads from the outlet a^{23} to the steam-cylinder of the pump S. The valve, as shown in Fig. 5, remains closed so long as the device is filled with water from the boiler; but when the water-level falls below the desired level, so as to admit steam to the device A′, the valve will be opened, admitting steam to the steam-pump, the valve being closed when the water rises in the boiler above the level of the pipe connecting the device A′ therewith.

Dotted line 3 in the drawings indicates the high-water level, and at this point I prefer to provide a second valve-operating device A, the valve-chamber of which is connected by a pipe d^2 with steam-supply pipe D and is provided with an indicator, signal, or other device, (in this instance a whistle W.) When the water reaches the level 3, it will enter the device A and on cooling will cause the valve to open and the whistle to sound.

4 represents the low-water level, and at this point I prefer to employ a second valve-operating device A′, connected by a pipe d^3 to the steam-pipe D and provided with a whistle W′ or other indicating or signaling device. The valve of this device A′ will be normally closed and will open and admit steam to the whistle in case the water falls below the level 4 and admits steam to the valve-operating device.

It is obvious that by employing whistles of different tones the operator will be advised whether high or low water is indicated.

It will be obvious that my improved valve-operating device can be used in other connections than those herein indicated to operate a valve in the manner described, which valve may control the flow of fluid for any desired purpose.

What I claim, and desire to secure by Letters Patent, is—

1. The combination with a steam-generator, of a feed-water pump connected therewith, a valve for controlling the admission of water to the generator from said pump, a valve-operating device comprising a steam and water chamber communicating with the generator adjacent to the normal water-chamber and an expansion-chamber adapted to receive heat from said steam and water chamber, operative connections between said expansion-chamber and said controlling-valve, an auxiliary steam-pump connected with the generator, a steam-supply pipe connected to said steam-pump, a valve for controlling the supply of water from said steam auxiliary pump to the generator, a second valve-operating device comprising a steam or water chamber communicating with the generator in a different vertical plane from the connection of the first-mentioned valve-operating device, an expansion-chamber adapted to receive heat from said second steam or water chamber, and operative connections between said expansion-chamber and the valve controlling the water connection between said steam-pump and the generator, substantially as described.

2. The combination with a steam-generator, of a feed-water pump connected thereto, a valve controlling the supply of feed-water to the generator, an auxiliary steam-actuated pump connected with the generator, a steam-supply for said auxiliary pump, a valve controlling the supply of steam to said steam-pump, separate valve-controlling devices for said valves, each provided with an expansion device adapted to be operated when the water in the generator is at different levels, and operative connections from each of said expansion devices to one of said valves, substantially as described.

3. The combination with a steam-generator, of a feed-water pump connected therewith, a water-supply therefor, a by-pass connected with the pump for discharging the water therefrom without delivering it to the generator, a valve in said by-pass, and a valve-operating device connected with the generator at the normal water-level, and provided with a steam and water space, in communication with the generator and an expansion-chamber entirely outside of but adjacent to said steam or water space and connections between a part of said expansion-chamber and the said by-pass valve, an auxiliary steam-actuated pump connected with the generator, a steam-supply pipe therefrom extending to said pump, a normally closed valve in said steam-pipe, a second valve-operating device connected to the generator at a point below the normal water-level, and provided with a steam and water space communicating with the generator, and with an expansion-chamber having a part operatively connected with said steam-valve, substantially as described.

4. The combination with a steam-generator, of a feed-water pump connected therewith, a water-supply therefor, a by-pass connected with the pump for discharging the water therefrom without delivering it to the generator, a valve in said by-pass, and a valve-operating device connected with the generator at the normal water-level, and provided with a steam and water space in communication with the generator and an expansion-chamber entirely outside of but adjacent to said steam or water space, and connections between a part of said expansion-chamber and the said by-pass valve, an auxiliary steam-actuated pump connected with the generator, a steam-supply pipe therefrom extending to said pump, a normally closed valve in said steam-pipe, a second valve-operating device connected to the generator at a point below the normal water-level, and provided with a steam and water space communicating with the generator, and with an expansion-chamber having a part operatively connected with said steam-valve, steam-actuated high or low water indicating devices, connections from said devices to said steam-supply pipe for said

steam-pump, independent valves controlling the steam-supply to said devices, and independent valve-operating devices connected to the generator at high and low water levels, each provided with a steam and water space and an expansion-chamber having a part operatively connected with one of said steam-controlling valves, substantially as described.

5. A valve-operating device provided with a steam and water space, having a single aperture therein for connecting it to a steam-generator, an expansion-chamber adjacent to but entirely outside of said steam and water space, having a wall adapted to receive heat from said steam and water space, and a contiguous flexible diaphragm forming a wall of said chamber, a valve-chamber provided with a valve-seat, a valve for engaging said seat and a movable part interposed between said diaphragm and said valve, substantially as described.

6. A valve-operating device provided with a steam and water space, having a single aperture therein for connection with a steam-generator, an expansion-chamber adjacent to but entirely outside of said steam and water space, one of the walls of said chamber being a wall of said space, said chamber having a flexible diaphragm directly contiguous to said common wall, a valve-chamber adjacent to said expansion-chamber, provided with a valve-seat, a valve for engaging said seat and a movable part interposed between said diaphragm and said valve, substantially as described.

7. A valve-operating device comprising among its members an inclosing shell or casing, a hollow block within said casing provided with an internal steam and water space, adapted to be placed in communication with a steam-generator and having an external recess, a flexible diaphragm engaging said block and covering said recess to form a sealed expansion-chamber, a closing-plate secured to said shell and engaging said diaphragm, a valve-casing provided with a valve-seat, a valve for engaging said seat, and operative connections between said valve and said diaphragm, substantially as described.

8. A valve-operating device comprising among its members, a cylindrical casing closed at one end, and open at the other and provided at its closed end with inlet and outlet apertures, a hollow block located within said casing having an internal steam and water space adapted to be placed in communication with a steam-generator and provided on its rear face with a recessed portion to engage the closed end of said casing to form a cooling-space, and on its front face with a recessed portion, a flexible diaphragm engaging the front face of said block and forming with the recessed portion thereof a sealed expansion-chamber, a closing-plate for the open end of said casing, engaging said diaphragm and clamping it against said block, means for securing said closing-plate to said casing, a valve-casing provided with a valve-seat, a valve for engaging said seat and operative connections between said diaphragm and said valve, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

JAMES EDWARD BALDWIN.

Witnesses:

W. M. HADDOCK,

CLARENCE A. BROWN.