No. 661,906. Patented Nov. 13, 1900.

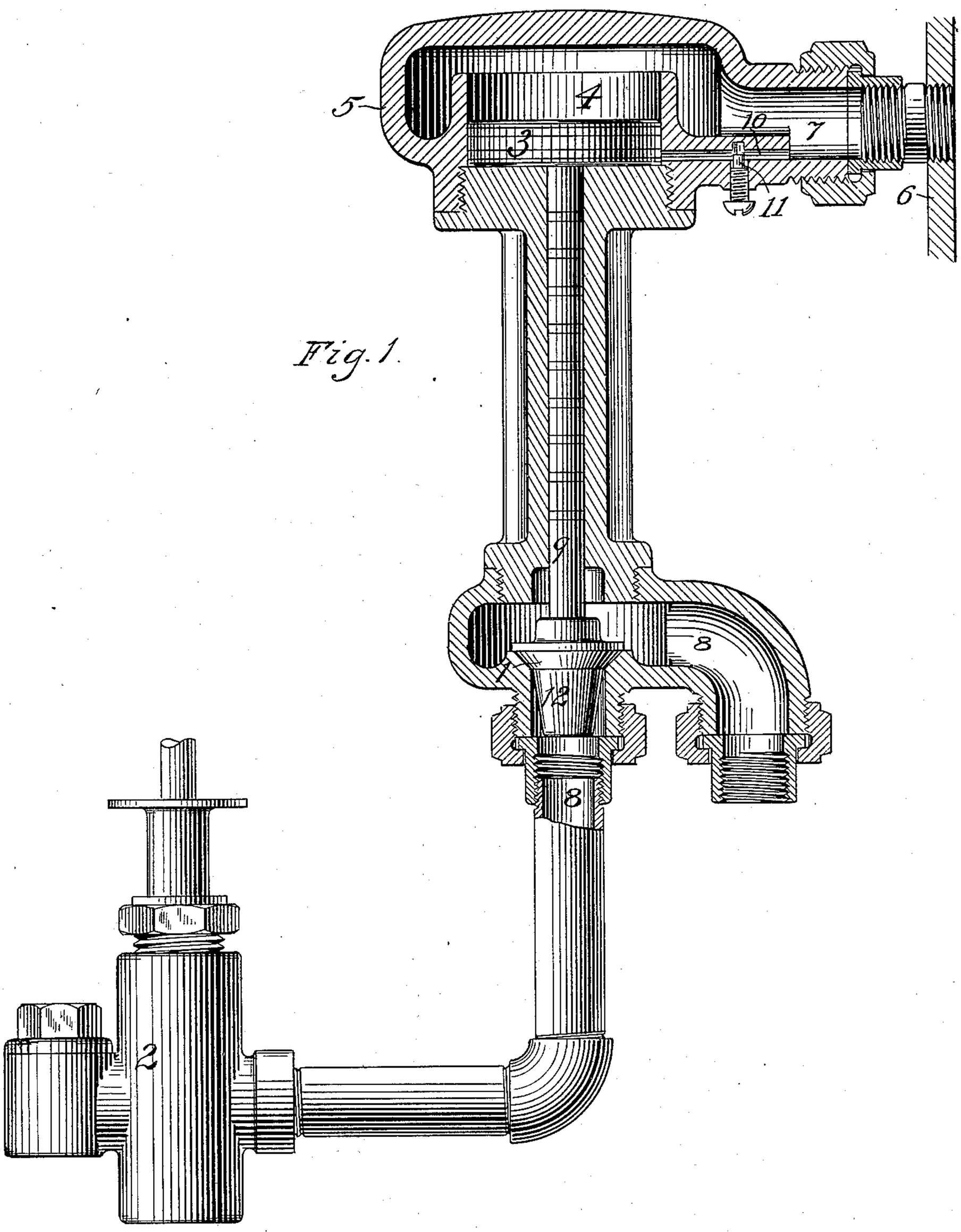
# I. H. DAVIS.

## FEED WATER REGULATOR.

(Application filed Dec. 4, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

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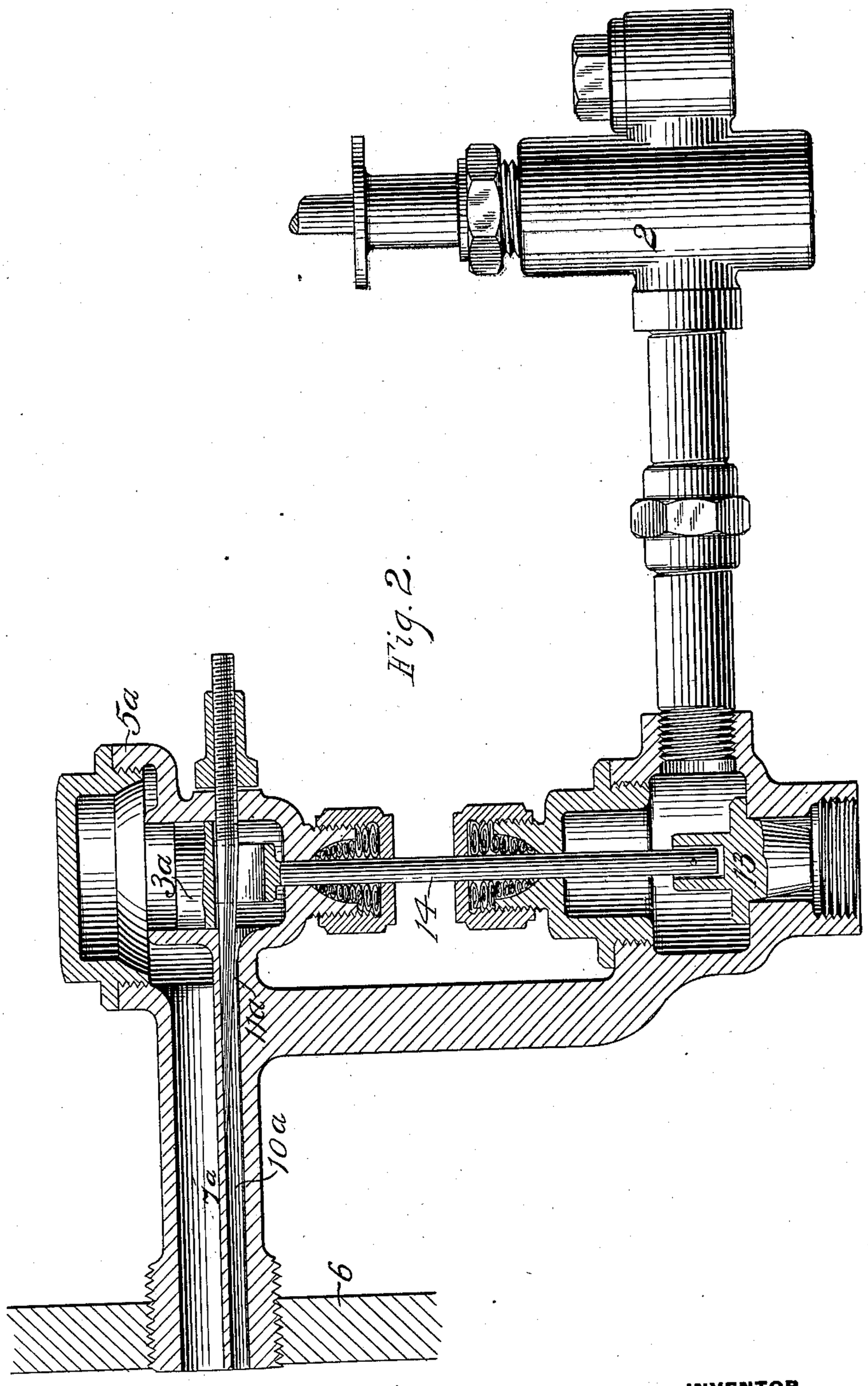


Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## FEED-WATER REGULATOR.

SPECIFICATION forming part of Letters Patent No. 661,906, dated November 13, 1900.

Application filed December 4, 1899. Serial No. 739,085. (No model.)

*To all whom it may concern:*

Be it known that I, ISAAC H. DAVIS, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented or discovered a certain new and useful Improvement in Feed-Water Regulators, of which improvement the following is a specification.

The object of my invention is to provide an improvement in feed-water-regulating apparatus for reservoirs or boilers; and to this end my invention consists in new and improved means whereby the supply of water to a reservoir or boiler may be regulated by varying the operation of the valve mechanism of the water-supplying apparatus.

In the accompanying drawings, which illustrate applications of my invention, Figure 1 is a view, partly in section and partly in elevation, showing my invention as applied to the discharge-valve of the feed-pump; and Fig. 2, a similar view showing it applied to the suction-valve of the pump.

In Fig. 1 of the drawings the discharge-valve 1 of the feed-pump 2 is shown connected by a rod 9 to a piston 3, which is fitted to work in a cylindrical chamber 4, formed in a casing 5, which is connected to the shell 6 of the boiler in such a position that the lower side of the passage 7 shall be on a line with the desired water-level in the boiler. A small or restricted passage 10 forms a communication between the steam-space of the boiler and the lower portion of the chamber 4 when the water is at or below the desired level and is so located that it may be partially or wholly covered at one end by the piston 3 when the piston is in its lowest position. The pump delivers water to the boiler through the discharge-passage 8, and in doing so the discharge-valve 1 is lifted from its seat and the piston 3 is moved upward. So long as the water in the boiler does not rise above the desired level the piston 3 may rise and fall with the opening and closing movements of the valve 1 without any appreciable resistance, because the piston is then exposed on both sides to direct contact with the steam in the boiler, which is compressible and may pass into and out of the lower part of the chamber 4 through the passage 10 with sufficient freedom and rapidity to permit the desired operation of the valve 1.

When the water in the boiler rises above the desired level, so that it seals the right-hand end of the small passage 10, water will flow into the chamber 4 below the piston 3 when the piston rises, and on account of the restricted capacity of the passage 10 and the incompressibility of the water the resistance of the water to displacement by the piston 3 will retard or prevent the closing of the valve 1, so as to permit water to return to the pump through the passage 8 when the pump plunger or piston is making its suction-stroke. The result is that on the return stroke of the pump plunger or piston the water which had been withdrawn from the boiler is returned thereto instead of an additional quantity which might have been drawn into the pump through its suction-valve if the discharge-valve 1 had remained closed. The operation of the pump 2 will continue to move the water back and forth through the passage 8 so long as the water in the boiler is high enough to seal the passage 10 and flow into the chamber 4, and when the water falls below that height the water in the lower part of the chamber 4 will drain into the boiler and permit the steam to have access to the under side of the piston 3 when it rises. In order to insure the proper drainage of the chamber 4, the passage 10 is slightly inclined downward to the right.

When the water-level is low enough to permit the drainage of the chamber 4 and the piston 3 is again in contact with steam only on its under side, the valve 1 is free to seat and close the passage 8 when the pump is making its suction-stroke, so as to retain in the boiler the water which has been delivered thereto by the pump, and this operation will continue until the water-level in the boiler again rises high enough to cause the water to enter the chamber 4 through the passage 10 when the piston 3 makes its upstroke.

In order to regulate the capacity of the passage 10, I provide a small valve 11, which may be adjusted so as to restrict the flow therethrough to any desired degree.

If an ordinary form of valve be employed as a discharge-valve, the lift of the valve nec-

essary to secure an opening or passage equal in capacity to the passage 8 might be comparatively small, and therefore the lift or upward movement of the piston 3 might be so small that only a small quantity of water could enter the chamber 4 below the piston or such a quantity as might be quickly displaced by the downward pressure of the piston thereon, so as to permit a comparatively quick closing of the valve. In order to insure the holding open of the valve at the proper time, I provide for a considerable upward movement of the piston by employing on the lower side of the valve 1 a tapered extension 12, which when the valve is raised from its seat serves to restrict the capacity of the port controlled by the valve in such a manner that a considerable lift of the valve is necessary or a greater lift than would be necessary without the extension 12, or if the valve were made in any of the usual forms, so long as the capacity of the port uncovered by the valve in its upward movement is less than the capacity of the passage 8 below the valve, the pressure below the valve will tend to lift it, and the effect of the extension 12 will be to insure a considerable upward movement of the valve and of the piston 3 or such a movement as will permit a considerable quantity of water to enter the chamber 4 below the piston when the water in the boiler rises above the desired level.

In Fig. 2 of the drawings my improvement is shown in combination with the suction-valve 13 of the feed-pump 2, the piston $3^a$ of the regulating device being connected with the valve by means of a rod 14, so that they move upward and downward together. The casing $5^a$ is connected with the shell 6 of the boiler, so as to admit steam above and below the piston $3^a$ when the water in the boiler is at or below the desired level and so as to permit water to flow through the passage $10^a$ into the chamber below the piston when the water in the boiler rises above the desired level. So long as the piston $3^a$ is exposed on both sides to contact with the steam in the boiler the valve 13 is free to move up and down in accordance with the operation of the pump plunger or piston; but when the water in the boiler rises high enough to close the passage $10^a$ to the entrance of steam water will flow into the chamber below the piston $3^a$ and check its downward movement, so as to hold the valve 13 open, thereby permitting water which had been drawn into the pump to be discharged through the suction-valve 13, so as to reduce or stop the supply to the boiler.

For the purpose of adjusting the capacity of the passage $10^a$ I employ a tapered needle-like valve $11^a$.

It will be understood that my improvement is equally applicable to a boiler or to a reservoir either open or closed and that it is immaterial what the liquid may be the height of which is to be regulated.

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

1. In a water or other liquid regulator for reservoirs or boilers, means for regulating the supply of water or other liquid, comprising a piston adapted to be exposed to contact with the liquid only when the level of the liquid reaches or exceeds a certain height, and a connection from the piston to a valve of the feed-pump, whereby the operation of the valve may be varied by the action of the liquid in the reservoir or boiler on the piston.

2. The combination with a feed-pump and a reservoir or boiler to which water or other liquid may be supplied by the pump, of a piston, a valve controlling a passage through which water or other liquid may pass on its way to the reservoir or boiler, and means whereby the piston, when acted on by water or other liquid in the reservoir or boiler, may hold the valve open to permit a return flow of liquid through the passage controlled by the valve.

3. The combination, with a reservoir or boiler and a feed-pump for supplying water or other liquid thereto, of a regulating device connected to pump-valve and comprising a piston which is exposed to contact with the steam, vapor, air, or gas above the level of the liquid in the reservoir or boiler, when the level of the liquid is below a certain height, and which is exposed on one side to contact with the liquid in the reservoir or boiler when it reaches or exceeds a certain height, and means whereby the resistance of the liquid to movement of the piston may retard or prevent the closure of the valve.

4. The combination, with a reservoir or boiler and a pump for supplying water or other liquid thereto, of a piston connected to the discharge-valve of the pump, a chamber or space into which water or other liquid may be admitted below the piston and a restricted passage connecting the chamber or space with the interior of the reservoir or boiler, whereby the resistance to displacement of the liquid may cause the valve to be held open.

5. The combination with a feed-pump and a reservoir or boiler, of a piston having its faces exposed to contact with the steam, air or other gas in the reservoir when the liquid-level is below a certain height, and having one face exposed to contact with the liquid when its level reaches or exceeds that height, and a connection from the piston to a valve of the feed-pump whereby the action of the valve may be varied by the resistance of the liquid to movement of the piston.

6. The combination with a feed-pump and a reservoir or boiler, of a chamber connected to the interior of said reservoir or boiler, a piston in said chamber the movement of which is adapted to be retarded by liquid therein and a connection from the piston to a valve of the feed-pump.

7. The combination with a feed-pump and a reservoir or boiler, of a piston adapted to

be exposed to contact with water or other liquid only when the level of such liquid reaches a certain height in the reservoir and a connection from said piston to a valve of the feed-pump, said valve being provided with an extension beyond its seat whereby a considerable movement of the piston is secured.

8. A casing adapted to be attached to a boiler or reservoir, a chamber in the casing, a piston in the chamber, a passage from the chamber to the boiler or reservoir connection, whereby the piston may be exposed on one side to liquid in the boiler or reservoir and on the other side to steam, air, or other gas or vapor, and a valve, operative by the action of the pump, connected to the piston and controlling a passage through which water flows to the boiler.

9. A casing adapted to be attached to a boiler or reservoir, a chamber in the casing, a piston in the chamber, a passage from the chamber to the boiler or reservoir connection, whereby the piston may be exposed to steam, air, gas or vapor above the liquid-level in the boiler or reservoir, and a restricted passage through which the piston may be exposed to the action of liquid, or of steam, air, gas, or vapor, in the boiler or reservoir, when the casing is connected with the boiler, a valve connected to the piston and controlling the supply of liquid to the boiler or reservoir.

In testimony whereof I have hereunto set my hand.

ISAAC H. DAVIS.

Witnesses:
C. F. BROWN,
H. L. ROBBINS.