

993,628.

Fig. 1.

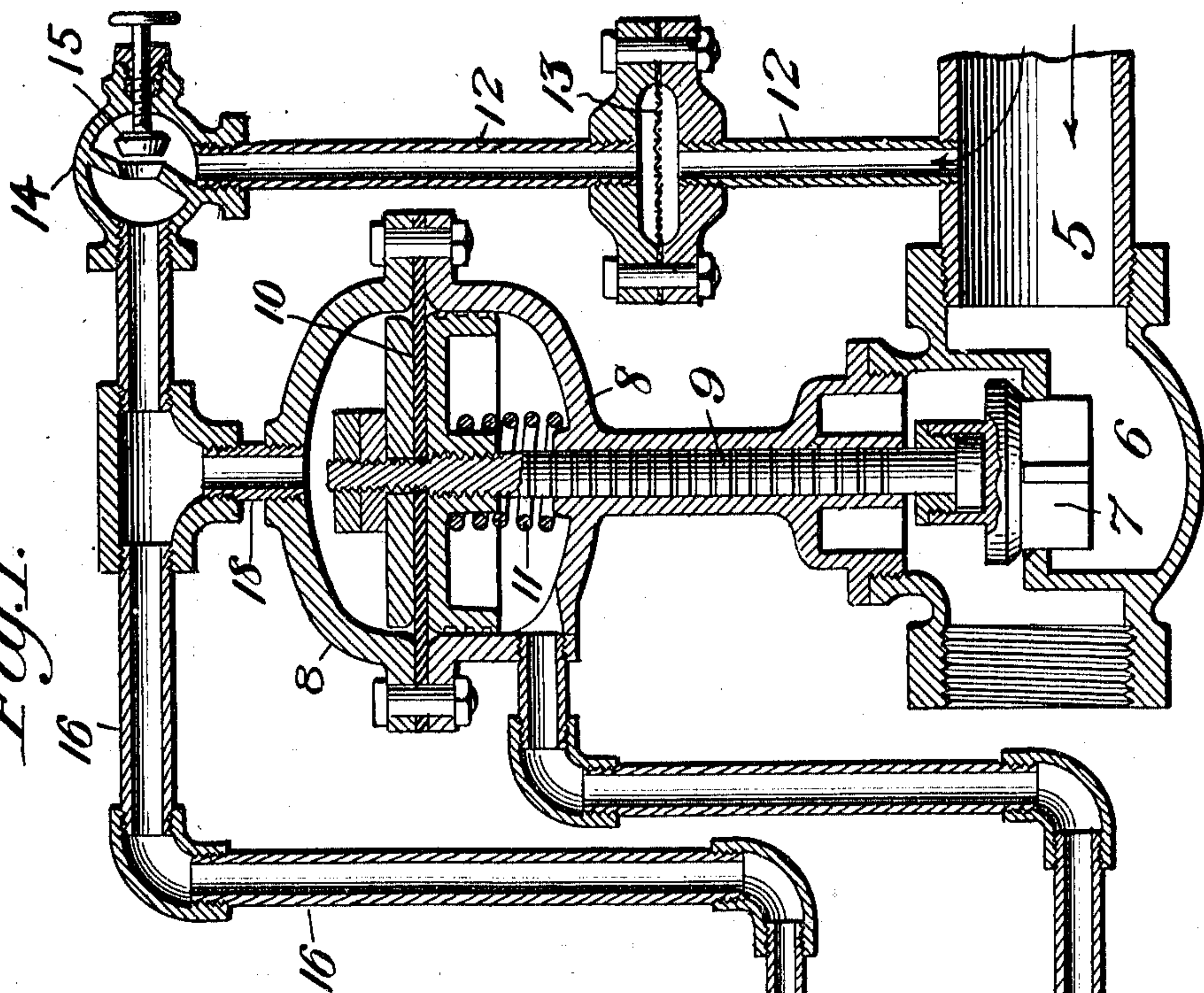
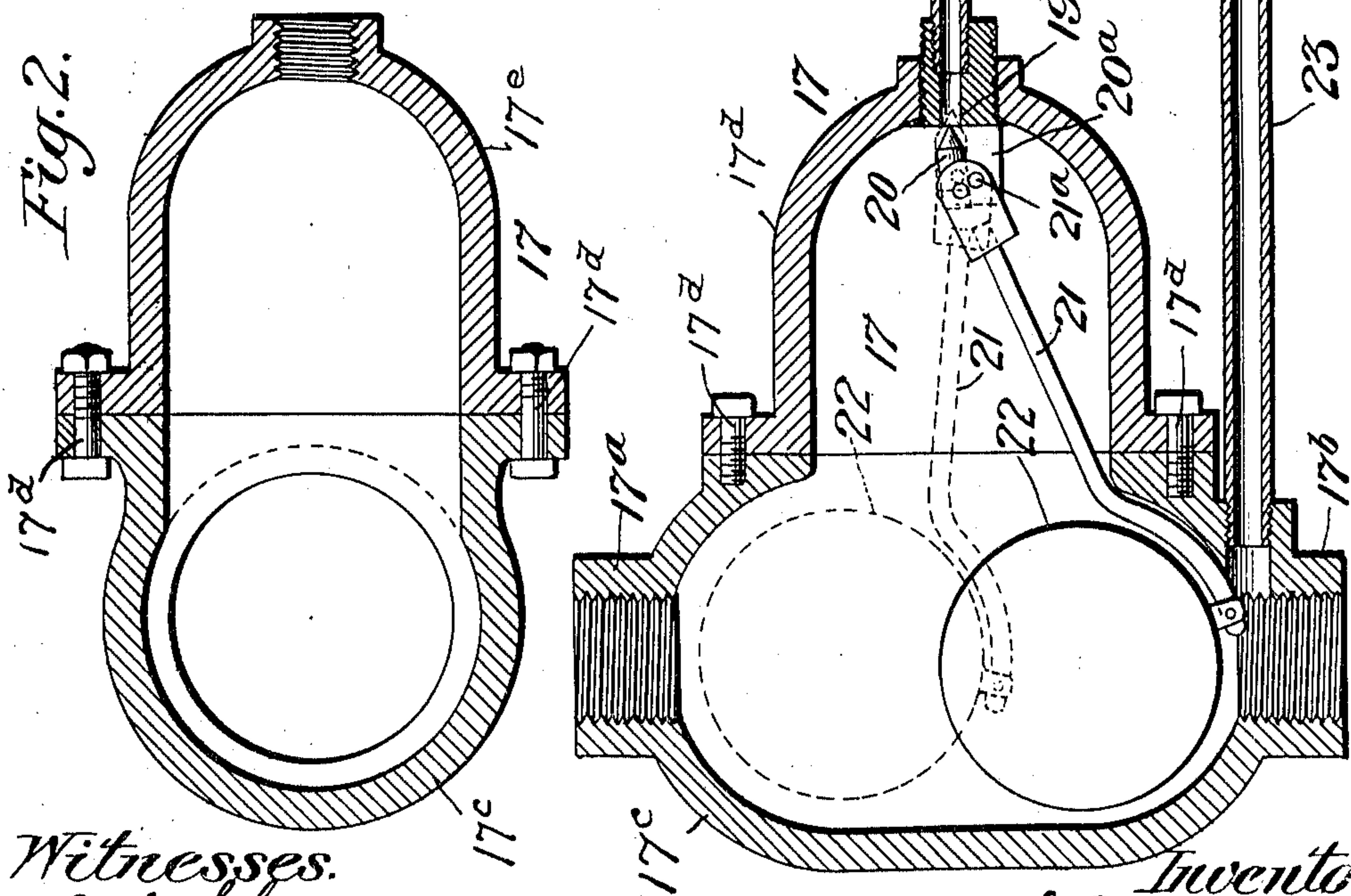


Fig. 2.



*Witnesses.*

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# UNITED STATES PATENT OFFICE.

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## FEED-WATER REGULATOR.

993,628.

Specification of Letters Patent.

Patented May 30, 1911,

Application filed June 4, 1910. Serial No. 564,974.

*To all whom it may concern:*

Be it known that I, ORBERT E. WILLIAMS, a citizen of the United States, and resident of Scranton, county of Lackawanna, and State of Pennsylvania, have invented certain new and useful Improvements in Feed-Water Regulators; 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.

This invention relates to feed water regulators for steam boilers, and the object of the invention is to furnish a simple, reliable and yet sensitive regulating device of this kind in which the regulation is effected under small differences of fluid pressure and wherein packing glands, stuffing boxes and similar parts, subject to leakage and wear, are dispensed with.

In another application, filed of even date herewith, I have described a regulator for dampers, steam valves, feed water purposes and the like, in which a suitable controlling means builds up and relieves fluid pressure on a loaded piston or diaphragm by restricting and relieving in consonance with the movements of said controlling means, a constantly flowing stream of water or other suitable fluid. The damper or other device to be controlled is actuated by the pressure created on the piston or diaphragm, to which such damper or other device is more or less directly connected.

The present improvements relate to the application of a system of this general character, to feed water regulation, and in the present instance the device to be regulated is the water inlet valve in the main feed line of a boiler. The invention is not limited to this particular application however, and may be used to advantage in other connections.

In the accompanying drawing, Figure 1 is a diagrammatic sectional view of a feed water regulator embodying the invention, and Fig. 2 is a section of the float-valve casing at right angles to Fig. 1.

In the drawings, 5 indicates the main feed line or pipe of the boiler, which is provided at a suitable point with a valve casing 6 in which operates an inlet valve 7, controlling the supply of water to the boiler. Screwed into the upper end of the valve casing 6 is a diaphragm housing or casing 8 in which the stem 9 of the inlet valve is guided, and with-

in the main part of said housing is a diaphragm 10 of any suitable character, to which the upper end of the valve stem 9 is secured, as shown. A helical spring 11, embracing the valve stem and reacting against the bottom of the diaphragm chamber urges the diaphragm and valve stem in an upward direction, and tends to hold the inlet valve 7 open.

Leading from the feed main 5 in advance of the inlet-valve is a by-pass pipe 12 consisting of two sections having an interposed strainer 13, and the pipe connects with a valve casing 14 in which a manually adjusted valve 15 is movable. Said valve casing is connected with a pipe 16 forming a continuation of the by-pass and leading to a float-valve casing 17 which in practice is connected at its upper and lower ends (17<sup>a</sup> and 17<sup>b</sup> respectively) with the steam and water spaces, respectively, of the boiler. Leading from the intermediate portion of the pipe 16 is a branch 18 which communicates with the chamber in the upper part of the diaphragm housing 8, above the diaphragm, whereby the upper surface of said diaphragm may be subjected to pressure of feed water passing out of the main feed-pipe through the by-pass 12 toward the float-valve casing. A valve seat or bushing 19 is placed at the end of the pipe 16 which communicates with said valve-casing, and coacting with said seat is a needle valve 20, mounted on a bracket 20<sup>a</sup> and operated in any suitable way by a lever 21 pivoted at 21<sup>a</sup> on the bracket 20<sup>a</sup> and having a terminal float 22. The position of the float 22 in its casing, is, of course, determined by the water level, in the latter, and this therefore determines the position of the needle valve with respect to its seat. However, in all of the positions of the float the valve is open to a certain extent, to permit a small quantity of water to pass constantly into the float casing, where it mingles with the boiler water already there, and eventually finds its way into the boiler. The lower end 17<sup>b</sup> of the float-valve casing communicates by means of an equalizer pipe 23 with the diaphragm housing at a point below the diaphragm, so that the pressure on the latter is somewhat equalized.

The operation of the apparatus is as follows:—The by-pass valve 15 is opened and water passes continuously from the main feed line, by way of the by-pass pipes 12, 16 and valve casing 17, into the boiler. The diame-



ter of the pipes 12, 16 is so chosen, however, and the by-pass valve 15 is so adjusted, that this flow is never great enough to cause the flooding of the boiler, or in other words, a continuous stream of water of such quantity is always needed in the operation of the boiler. Of course, when the boiler is not in operation this small stream of water may be cut off by the by-pass valve 15, as will be understood. With the boiler in operation, and water passing continuously into the boiler in a small amount through the valve casing 17, the float valve 22 will rise and descend in correspondence with the water level in the boiler. When the level is at about the right height, the float 22 will hold the needle valve 20 at such a distance away from its seat 19 that the pressure generated in the upper part of the diaphragm housing and between the restricted passage 19 and the restricted passage formed by the by-pass valve 15, and acting against the upper face of the diaphragm 10, is greater than the pressure acting on the under surface of the diaphragm, and therefore partially closes the main inlet valve. If the water rises a little higher in the boiler the rising of the float further restricting the passage 19, causes a higher water pressure to be generated in the upper part of diaphragm housing and tends to close valve 7 till the amount of water entering the boiler is shut off to just the amount required. As soon as the water level falls, however, the float 22 will descend and move the needle valve still farther away from its seat, so that the pressure in the by-pass 12, 16 is relieved and the water may pass through this by-pass more freely. A corresponding decrease of pressure on the upper diaphragm face is therefore produced, and such pressure is reduced to nearly equal that acting on the lower diaphragm face, so that the spring 11 can move the valve 7 farther away from its seat and admit additional water to the boiler through the feed main. The water passing through the by-pass is strained by the strainer 13, which prevents impurities from entering and fouling the regulating device. As soon as the water in the boiler reaches the proper level again, the needle valve 20 will close to such an extent as to create sufficient pressure on the upper diaphragm face to partially seat the valve against the action of its spring, whereby the main feed is sufficiently restricted to hold the water at its proper level, and the water still passes through the by-pass continuously.

The fact that the needle valve does not contact, in the normal operation of the device, with the restricted passage which it controls, is an important feature of the invention, as the sticking of the valve, which is a great disadvantage of the ordinary devices of this kind, cannot take place. The apparatus does not operate under great dif-

ferences of pressure *e. g.*, such as are produced by exhausting high pressure steam or water at boiler or feed line pressure into the atmosphere, thus eliminating the cutting of needle common in nearly all other types of feed water regulator, and it responds with remarkable quickness to the smallest variations requiring regulation. It is of considerable advantage to have the small stream of water to operate the fluid pressure valve-actuating device pass into the boiler from the main feed line, as indicated, because this simplifies the construction and operation of the apparatus and there is absolutely no waste of water; but so far as the broader aspects of the invention are concerned, such stream may be supplied from a different source and it may likewise be disposed of differently.

The means for communicating a fluid pressure equal to the boiler pressure to the under side of the casing or housing containing the diaphragm of the main inlet valve viz., the equalizer pipe 23 is an important feature, as it is impossible to discharge the water used for operating said main valve into the boiler without the pressure under the diaphragm to balance the boiler pressure, thus allowing excess pressure in the feed line to operate the valve and then discharge water into the boiler. As heretofore indicated, the main inlet valve as well as the needle valve is always more or less open when the boiler is in operation. This prevents the sudden and often repeated shocks to the piping caused by the frequent shutting off of the water supply as is the case in other feed water regulators. Only in case of the boiler ceasing to evaporate water will the main inlet valve be entirely closed, and in this event it will be closed automatically by the water rising slightly above normal. If the by-pass valve 15 is not closed when the boiler is out of service the water will continue to rise slowly until the float reaches its extreme upper position, when the needle valve 20 will close and thereby arrest the flow completely.

In order to facilitate access to the parts in the float casing 17, for inspection, repairs and the like, said casing is formed in two separable sections 17<sup>c</sup>, 17<sup>e</sup>, as shown, which are connected by means of bolts 17<sup>d</sup>. In this way, the casing need not be removed bodily from position with respect to its connections when it is desired to inspect the interior mechanism.

It is to be understood that I have not attempted to describe the numerous modifications of the apparatus that may be made without digressing from my inventive idea, the scope of which is defined in the claims.

What I claim is:—

1. The combination with the main feed line of a boiler, and an inlet valve therein,



of means to operate said valve, comprising a diaphragm subjected to pressure generated from a constantly flowing stream of fluid, and means to control automatically the valve operating pressure by changes of conditions attendant on the operation of the boiler.

2. The combination with the main feed line of a boiler, and an inlet valve therein, of a diaphragm to operate said valve, connections for a constantly flowing stream of fluid acting on said diaphragm, and means to restrict the flow of such fluid and thereby build up pressure on said diaphragm.

3. The combination with the main feed line of a boiler, and an inlet valve therein, of a fluid pressure device to operate said valve, acted on by fluid from a constantly flowing stream, and means operated by changes of water level in the boiler to restrict such stream of fluid to varying degrees.

4. The combination with a valve operating fluid pressure device comprising a diaphragm, of connections for a constantly flowing stream of fluid having access to said diaphragm, the diaphragm being loaded by the restriction of the flow, and controlling means to restrict the flow of fluid.

5. The combination with a controlling means operated by changes of water level, of a fluid pressure valve-operating device comprising a casing and a diaphragm therein, connections for a continuous flow of fluid, arranged to create pressure in said casing as the flow of fluid is restricted, and flow-restricting means operated by said controlling means.

6. The combination with a valve operated by fluctuations of water level in a boiler, of a fluid pressure device to operate the main feed valve of the boiler, acted on by a constantly flowing stream of fluid restricted, without total stoppage, by said valve.

7. The combination with a valve operated by fluctuations of water level, of a regulating device comprising a casing and a pressure element therein, and connections to supply a constantly flowing stream of fluid, controlled by said valve and arranged to produce pressure on said pressure element in proportion as the flow of fluid is restricted by said valve.

8. The combination with a valve operated by fluctuations of water level, of a regulating device comprising a diaphragm acted on by pressure generated by the restriction of a constant flow of fluid by said valve, and a boiler inlet valve operated by said diaphragm.

9. The combination with the main feed line of a boiler, and an inlet valve therein, of means to divert a continuous stream of water around the valve and into the boiler,

a diaphragm to operate said inlet valve and accessible to such stream of water, and means to restrict the flow of water as called for by conditions in the boiler and thereby build up and relieve the pressure on said diaphragm.

10. The combination with the main feed line of a boiler, and an inlet valve therein, of a by-pass around said valve, a fluid pressure operating device for said valve in said by-pass and subjected at one side to the pressure therein, and means to subject the other side of said fluid pressure device to the boiler pressure.

11. The combination with the main feed line of a boiler, and an inlet valve therein, of a by-pass around said valve, a fluid pressure operating device for said valve in said by-pass and comprising a diaphragm subjected at one side to the pressure in the by-pass, and means to subject the other side of the diaphragm to the boiler pressure.

12. The combination with the main feed line of a boiler, and an inlet valve therein, of a by-pass around said valve, a casing or housing in said by-pass, a diaphragm in said casing or housing and connected with said inlet valve, one side of said diaphragm being subject to the pressure in the by-pass, and means to subject the other side of the diaphragm to the pressure in the boiler.

13. The combination with the main feed line of a boiler, and an inlet valve therein having a stem, of a by-pass around said valve leading to the boiler, a casing or housing in said by-pass, and a diaphragm in said casing or housing directly connected with the valve stem.

14. The combination with the main feed line of a boiler, and an inlet valve therein, of a by-pass around said valve leading to the boiler, a fluid pressure operating device for said valve in said by-pass, and a strainer in said by-pass in advance of said fluid pressure device.

15. The combination with the main feed line of a boiler and an inlet valve casing and valve therein, of means to operate said valve comprising a diaphragm subjected to pressure generated from a constantly flowing stream of fluid, a casing having connections with the boiler and diaphragm, and means mounted therein to control automatically the valve operating pressure by changes in the boiler water level.

16. The combination with the main feed line of a boiler, having an uninterrupted flow of water therethrough, of means for varying the volume of flow according to changes of conditions attendant on the operation of the boiler.

17. The combination with the main feed line of a boiler, having an uninterrupted flow of water therethrough, and a valve therein to vary the volume of flow, and



means to change the position of said valve by pressure generated from a constantly flowing stream of fluid, and means to control the valve operating pressure automatically by changes in the boiler water level.

18. The combination with the main feed line of a boiler, having an uninterrupted flow therethrough, and a valve therein to vary the volume of flow, of means to operate said valve, without closing, comprising a diaphragm subjected to pressure generated from a constantly flowing stream of fluid, and means to control automatically the valve operating pressure by changes in the boiler water level.

19. The combination with the main feed line of a boiler, and an inlet valve therein, of means to positively operate said valve to increase or decrease the flow of water in said feed line, said means being operated by pres-

sure generated from a constantly flowing stream of fluid, and means to control the valve operating means by changes in the boiler water level.

20. The combination with the main feed line of a boiler, and an inlet valve therein, of means to positively operate said valve to increase or decrease the flow of water in said feed line, said means comprising a diaphragm subjected to pressure generated from a constantly flowing stream of fluid, and means to control the valve operating pressure by changes in the boiler water level.

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

ORBERT E. WILLIAMS.

Witnesses:

ALMA M. LOVERING,  
HUGH B. ANDREWS.