

R. M. HUNTER.
FEED WATER REGULATOR.
APPLICATION FILED MAR. 17, 1909.

968,948.

Patented Aug. 30, 1910.

2 SHEETS—SHEET 1.

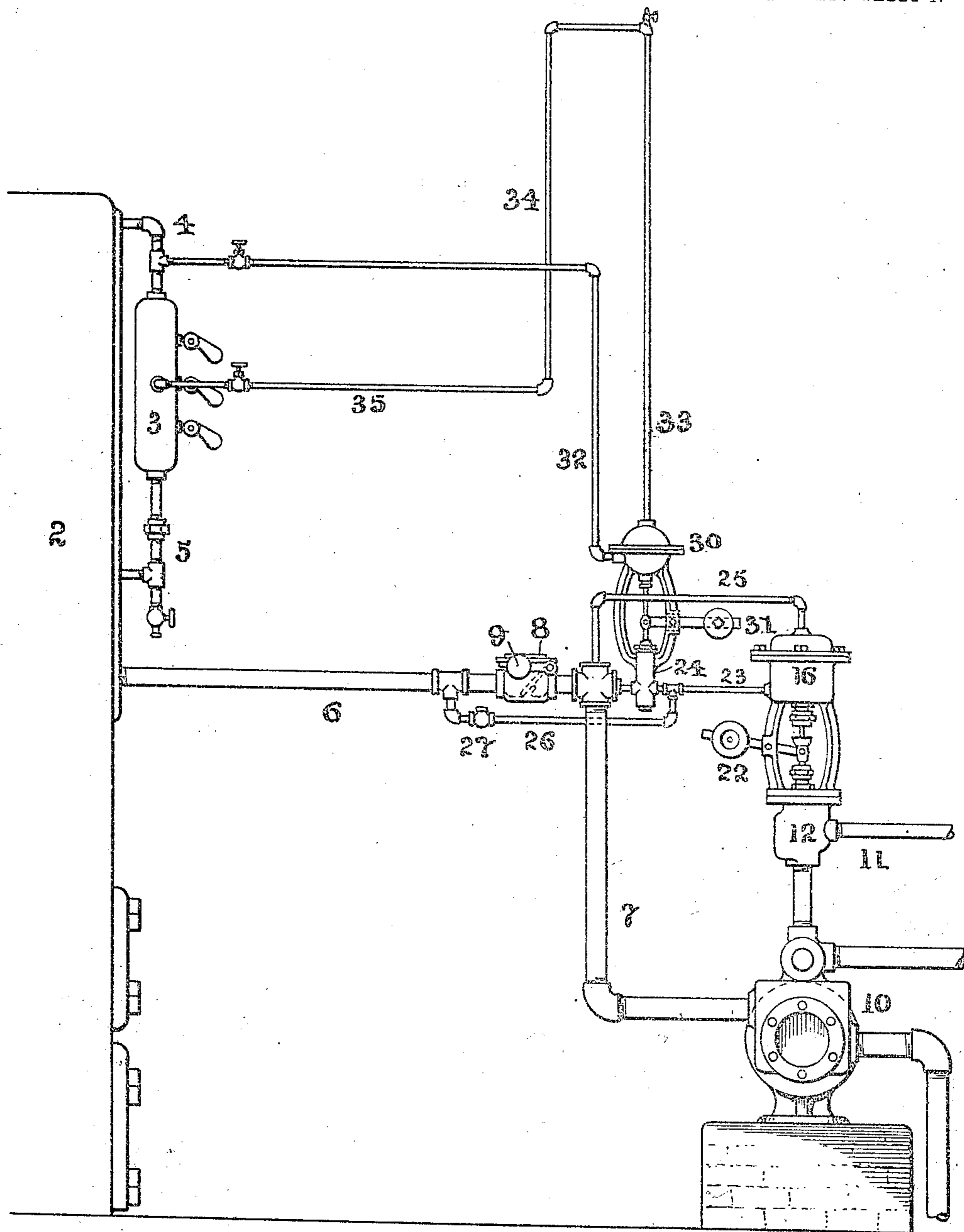


FIG. 1

WITNESSES

Daniel Webster, Jr.
R. M. Kelly

INVENTOR

R. M. Hunter

R. M. HUNTER.
FEED WATER REGULATOR.
APPLICATION FILED MAR. 17, 1909.

968,948.

Patented Aug. 30, 1910.

2 SHEETS—SHEET 2.

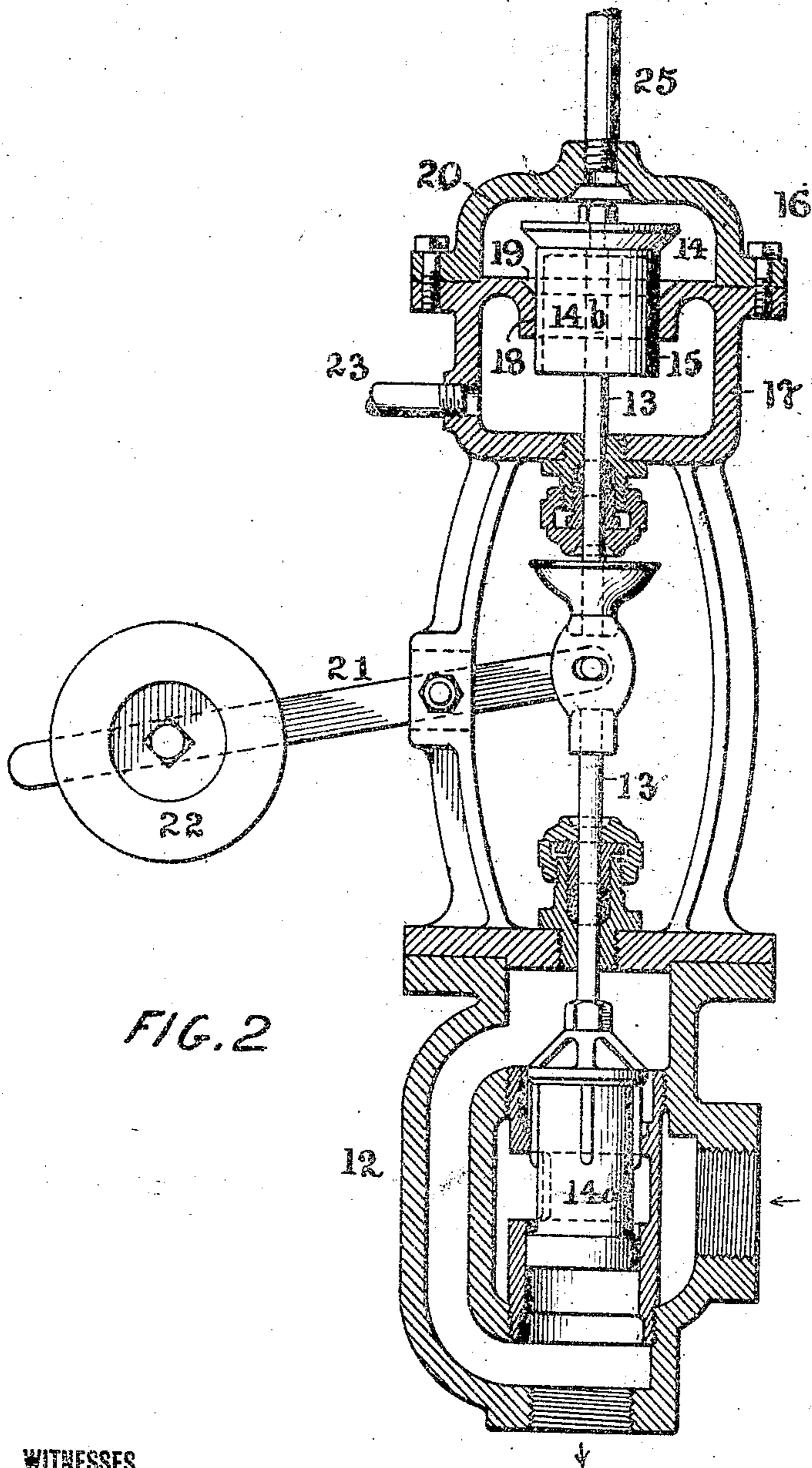


FIG. 2

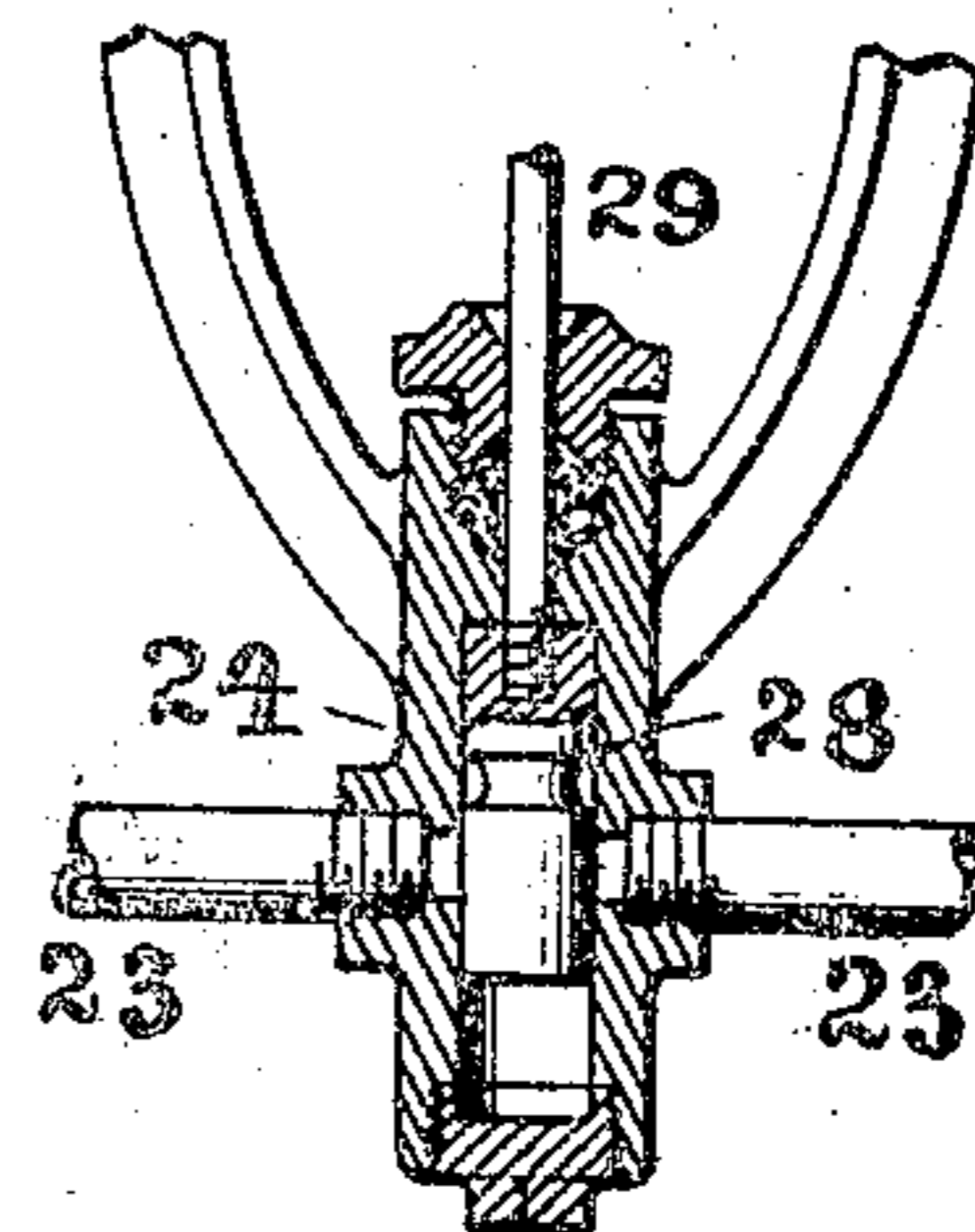


FIG. 3

WITNESSES

Daniel Webster, Jr.
A. M. Kelly.

INVENTOR

R. M. Hunter

UNITED STATES PATENT OFFICE.

RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO CHARLES MOTLEY CLARK, OF PHILADELPHIA, PENNSYLVANIA.

FEED-WATER REGULATOR.

968,948.

Specification of Letters Patent. Patented Aug. 30, 1910.

Application filed March 17, 1909. Serial No. 483,911.

To all whom it may concern:

Be it known that I, RUDOLPH M. HUNTER, a citizen of the United States, and resident of the city and county of Philadelphia, State of Pennsylvania, have invented an Improvement in Feed-Water Regulators, of which the following is a specification.

My invention has reference to feed water regulators and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings which form a part thereof.

The object of my invention is to provide automatic means for maintaining a proper supply of feed water to the boiler, said means being controlled by the variations in the level of the water in the boiler relatively to the normal level which is to be maintained.

My invention consists of a pump to force water into the boiler against the pressure therein, combined with a pump governor to control the operation of the pump and operated by water pressure, and means for producing a differential of water pressures for operating the pump governor consisting of a pipe connecting with the boiler below the water level for supplying water under boiler pressure to operate the pump governor in one direction, a pipe connecting with the discharge pipe of the pump for supplying water under the pump pressure to operate the pump governor in the other direction, means controlled by the level of the water in the boiler to equalize the water pressures supplied to the pump governor, and means for operating the pump governor when the water pressures thereto are equalized, or made more nearly equal.

My invention further consists in forming the pump governor with an operating means comprising a chamber having a diaphragm provided with an opening and an annular seat, combined with a piston rod, a piston device therefor having a cylindrical part fitting the opening in the diaphragm and terminating in a valve piece adapted to close tightly upon the seat on the diaphragm, and pipes for supplying a fluid under pressure to the chamber above and below the diaphragm.

My invention also comprehends other features of construction which, together with

those above specified, will be better understood by reference to the drawings in which:

Figure 1 is an elevation of a boiler feed water regulating apparatus embodying my invention; Fig. 2 is a sectional elevation of the pump governor thereof; and Fig. 3 is a sectional elevation of the by-pass control valve for the pump governor.

2 is the boiler and 3 is its water column having the usual gage cocks. The column 3 is connected at the bottom with the boiler below the water level by a pipe 5 and at the top with the steam space by a pipe 4. The boiler feed pump 10 supplies feed water to the boiler by pipes 6 and 7 having a check valve 8 and is controlled by a pump governor 11 comprising a steam valve device 12 having its valve piece 14^a operated by motor 16 and weighted lever 22 under the control of the water level in the boiler. The valve device 12 and 14^a may be a balanced valve of any suitable construction for controlling the supply of steam to the pump, the steam being supplied by a steam pipe 11. The valve piece 14^a is moved by a piston rod 13 connected at its top with a piston device 14^b comprising a cylindrical part 15 having at its top an annular valve 14. The piston works through a diaphragm 18 of considerable depth and having at its top a valve seat 19 for the valve 14. This diaphragm separates a lower chamber 17 from an upper chamber 20. The piston 15 need not be a very close fit to the cylinder 18 because during the operation some leakage of water from the upper chamber to the lower chamber will not interfere with the proper operation; but when the steam valve 14^a is closed tight to stop the pump, then the valve 14 is tight upon its seat 19 and no leakage between the chambers 20 and 17 is possible. This form of motor overcomes the necessity of packing or close fitting, reduces friction and is inexpensive. The steam valve 14^a and its piston rod 13 are lifted by a lever 21 counter-weighted at 22 and are depressed or lowered by an excess of pressure in the chamber 20 acting upon the piston device 14^b.

The chamber 20, of the motor device 16 of the pump governor is connected with the boiler feed pipe 7, between the pump 10 and check valve 8, by a pipe 25, so that at all times it is subjected to the pressure of the

water upon the discharge side of the pump. This pressure is normally greater than the boiler pressure by several pounds, the excess being determined by the weighting at 9 of the check valve 8.

The chamber 17, of the motor device 16 of the pump governor, is connected with the boiler feed pipe 6, between the boiler and check valve 8, by pipes 23, and 26 containing a check valve 27, which latter opens toward the boiler so as to prevent the water pressure in the chamber 17 rising above that in the boiler. When this condition prevails, the superior pressure in the chamber 20 forces the piston device 14^b down and closes the steam valve 14^a to stop the pump 10. In this action the lever 21 is rocked and the weights 22 lifted.

To cause the pump to be started, it is necessary to increase the pressure in the chamber 17 so that the pressures upon each side of the piston device 14^b will be such that the weight 22 may lift the piston rod 13 and its valve 14^a. These pressures may be equalized if so desired. To accomplish this result, I provide the following means. A by pass valve 24 is provided to connect the pipe 23 with the boiler feed pipe 7 with which the pipes 25 connect so that by this valve the water of the same pressure may be delivered to both chambers 20 and 17. This by pass valve is shown in section in Fig. 3, in which the valve piece 28 is moved by a valve rod 29, which is operated by a diaphragm or other motor 30 (Fig. 1). A weighted lever 31 may be used to normally lift the valve 28 to the closed position as shown in Fig. 3 so as to supply water from pipe 7 to the chamber 17 for equalizing the pressures in both chambers 20 and 17.

To operate the diaphragm motor 30, I may employ the following means. A pipe 32 leads from the steam space of the boiler and connects with the lower chamber of the motor 30 by an upright section which constitutes a stand pipe giving a water column of suitable height. A second stand pipe 33 opening from the upper chamber of the motor 30 provides a second water column of approximately twice the height of the stand pipe 32. This pipe 33 connects at its top with a downwardly extending pipe 34 which connects at its lower end with the water column 3 at the normal water level by a pipe 35.

Assuming that the water is above the normal level, we will have pipes 34 and 33 full of water, so that the full height of the water column 33 is not available for pressure. As the column 34 counterbalances an equal height of column 33, the available pressure is due to the difference of the columns 33 and 34, or about one-half the column 32. Pipe 32 is always full of water from condensation and maintains a constant

upward pressure on the motor to assist the weighted lever 31. These overbalance the available pressure of column 33, and the valve piece 28, is forced up and the by pass closed. The pressure in chamber 20 of the pump governor will then cause the piston device 14^b to be depressed and the pump stopped. If now, the water level in the boiler gets below the normal, the pipe 35 will be unsealed and drain; the water in column 34 will descend leaving column 33 of its full height and available to operating the diaphragm motor 30; and the valve piece 28 of the by pass will be depressed and opened. The pressure in the chamber 17 will then increase to counterbalance the pressure in chamber 20, and because of this the weighted lever 21 will raise the valve 14^a and start the pump 10. This operation will continue until the end of the pipe 35 is sealed and the normal water level in the boiler restored, after which the first operation will take place and the pump be stopped. Should the pressure in the pipe 7 be reduced to boiler pressure by leakage through the pump governor to the pipe 6, the weighted lever 21 will then automatically start the pump to raise the pressure in the pipe 7, but the pump will then stop if the water is at or above the normal level in the boiler.

The differential action of the pressures in the pump governor motor may be secured in any other manner desired as may also the equalization of pressures therein, as the same result will be secured if the pressure in the chamber 20 is reduced instead of the pressure in the chamber 17 being increased.

It will be observed that all of the working parts are subject to water pressures and hence the objection to the use of steam operated parts for the motors is obviated. All thermostatic devices are omitted and only positive pressures exerted through the water are relied upon for the operation and control of the pump governor.

It is evident that the various parts may be modified without departing from the spirit of the invention, hence I do not restrict myself to the details shown.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an apparatus of the character described, the combination of the boiler, boiler feed pump, feed water pipe from the pump to the boiler, a check valve in the feed water pipe, a pump governor to control the operation of the pump, having a pressure actuated device, means for supplying a pressure greater than the boiler pressure to the pressure actuated device to move in one direction, means for supplying a pressure corresponding to the boiler pressure to the pres-

sure actuated device to move it in the other direction, and means controlled by the variations in the water level in the boiler to change the relative differences in the pressures supplied to the opposite sides of the pressure actuated devices, whereby the pump is put into operation when the level of water in the boiler falls below the normal level.

2. In apparatus of the character described, the combination of the boiler, boiler feed pump, feed water pipe from the pump to the boiler, a check valve in the feed water pipe, a pump governor to control the operation of the pump having a pressure actuated device, means for supplying a pressure greater than the boiler pressure to the pressure actuated device to move it in one direction, means for supplying a pressure corresponding to the boiler pressure to the pressure actuated device to move it in the other direction, and means controlled by the variations in the water level in the boiler to change the relative differences in the pressures supplied to the opposite sides of the pressure actuated devices consisting of a by pass and valve for increasing the pressure upon the side of the pressure actuated device which is subjected to the lower pressure, whereby the pump is put into operation when the level of water in the boiler falls below the normal level.

3. In apparatus of the character described, the combination of the boiler, boiler feed pump, feed water pipe from the pump to the boiler, a check valve in the feed water pipe, a pump governor to control the operation of the pump having a pressure actuated device to regulate the operation of the pump and also put it out of operation and a counter weight normally operating to put the pump into operation, means for supplying a pressure greater than the boiler pressure to the pressure actuated device to move it in one direction to put the pump out of operation, means for supplying a pressure corresponding to the boiler pressure to the pressure actuated device to move it in the other direction to assist the counter weight in putting the pump into operation, and means controlled by the variations in the water level in the boiler to change the relative differences in the pressures supplied to the opposite sides of the pressure actuated devices, whereby the pump is put into operation when the level of water in the boiler falls below the normal level.

4. In apparatus of the character described, the combination of the boiler, boiler feed pump, feed water pipe from the pump to the boiler, a check valve in the feed water pipe, a pump governor to control the operation of the pump, having a pressure actuated device, means for supplying a pressure greater than the boiler pressure to the pressure actuated device to move it in one direc-

tion, means for supplying a pressure corresponding to the boiler pressure to the pressure actuated device to move it in the other direction, and means controlled by the variations in the water level in the boiler to change the relative differences in the pressures supplied to the opposite sides of the pressure actuated devices consisting of a by pass and valve for increasing the pressure upon the side of the pressure actuated device which is subjected to the lower pressure, a motor for operating the by pass valve and a variable water column to operate the motor controlled by the water level in the boiler, whereby the pump is put into operation when the level of water in the boiler falls below the normal level.

5. In apparatus of the character described, the combination of the boiler, boiler feed pump, feed water pipe from the pump to the boiler, a check valve in the feed water pipe, a pump governor to control the operation of the pump having a pressure actuated device, means comprising a pipe connecting with the feed water pipe between the pump and check valve for supplying pressure for operating the pump governor to stop the pump, a pipe from the pump governor and connecting with the feed water pipe between the check valve and boiler for supplying pressure for operating the pump governor to put the pump into operation, a weight device to assist the pump governor in putting the pump into operation, a by pass pipe and valve for supplying water under pressure from the feed water pipe between the pump and check valve to the pipe connecting the pump governor with the feed water pipe between the check valve and boiler, and means controlled by the level of the water in the boiler for operating the by pass valve, whereby the pump is put into operation automatically whenever the level of the water in the boiler gets below the normal level.

6. In apparatus of the character described, the combination of the boiler, boiler feed pump, feed water pipe from the pump to the boiler, a check valve in the feed water pipe, a pump governor to control the operation of the pump having a pressure actuated device, means comprising a pipe connecting with the feed water pipe between the pump and check valve for supplying pressure for operating the pump governor to stop the pump, a pipe from the pump governor and connecting with the feed water pipe between the check valve and boiler for supplying pressure for operating the pump governor to put the pump into operation, a weight device to assist the pump governor in putting the pump into operation, a by pass pipe and valve for supplying water under pressure from the feed water pipe between the pump and check valve to the pipe con-

necting the pump governor with the feed
water pipe between the check valve and
boiler, a pressure motor for operating the
by pass valve, and means consisting of a
5 water column of varying pressure controlled
by the level of the water in the boiler for
operating the motor which operates the by
pass valve, whereby the pump is put into
operation automatically whenever the level
10 of the water in the boiler gets below the
normal level.

7. In apparatus of the character described,
a boiler, combined with a feed water pump
for supplying water to the boiler, and a
15 pump governor consisting of a steam valve
to control the steam supplied to the pump,
a counter weight to open the steam valve,
two chambers separated by a diaphragm
having a valve seat, a piston working
20 through the diaphragm and having a valve
piece to seat upon the valve seat when the
piston is at the termination of its stroke,
a piston rod connecting the piston with the
steam valve, water pipes for supplying
25 water to the two chambers, and means con-
trolled by the water level of the boiler for
varying the difference in the pressures of
the two chambers.

8. Feed water pump controlling means

consisting of two chambers separated by a 30
diaphragm having a valve seat, a piston
working through the diaphragm and having
a valve piece to seat upon the valve seat
when the piston is at the termination of its
stroke, a piston rod connected with the pis- 35
ton, and pipes respectively connecting with
the two chambers for supplying fluid pres-
sures above and below the piston.

9. Feed water pump controlling means
consisting of two chambers separated by a 40
diaphragm having a valve seat, a piston
working through the diaphragm and having
a valve piece to seat upon the valve seat
when the piston is at the termination of its
stroke, a piston rod connected with the pis- 45
ton, and pipes respectively connecting with
the two chambers for supplying fluid pres-
sures above and below the piston and a
counter weight connecting with the piston
rod for lifting it and the pistons when 50
permitted by the cooperating pressures with-
in the chambers.

In testimony of which invention, I here-
unto set my hand.

RUDOLPH M. HUNTER.

Witnesses:

R. M. KELLY,

E. G. FARLEY.