

No. 834,795.

PATENTED OCT. 30, 1906.

L. B. FULTON.  
FEED WATER REGULATOR.  
APPLICATION FILED JAN. 17, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

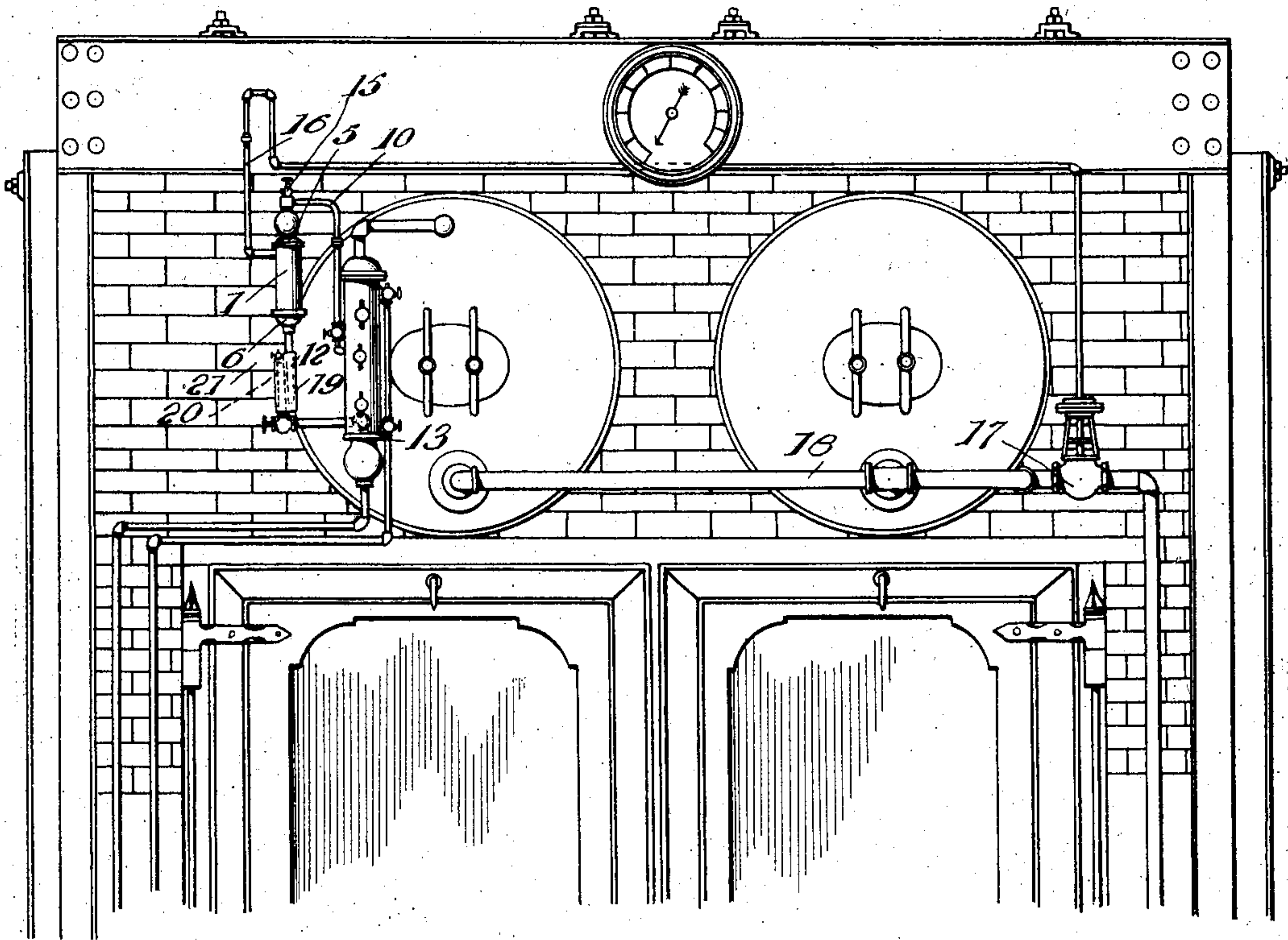


Fig. 5.

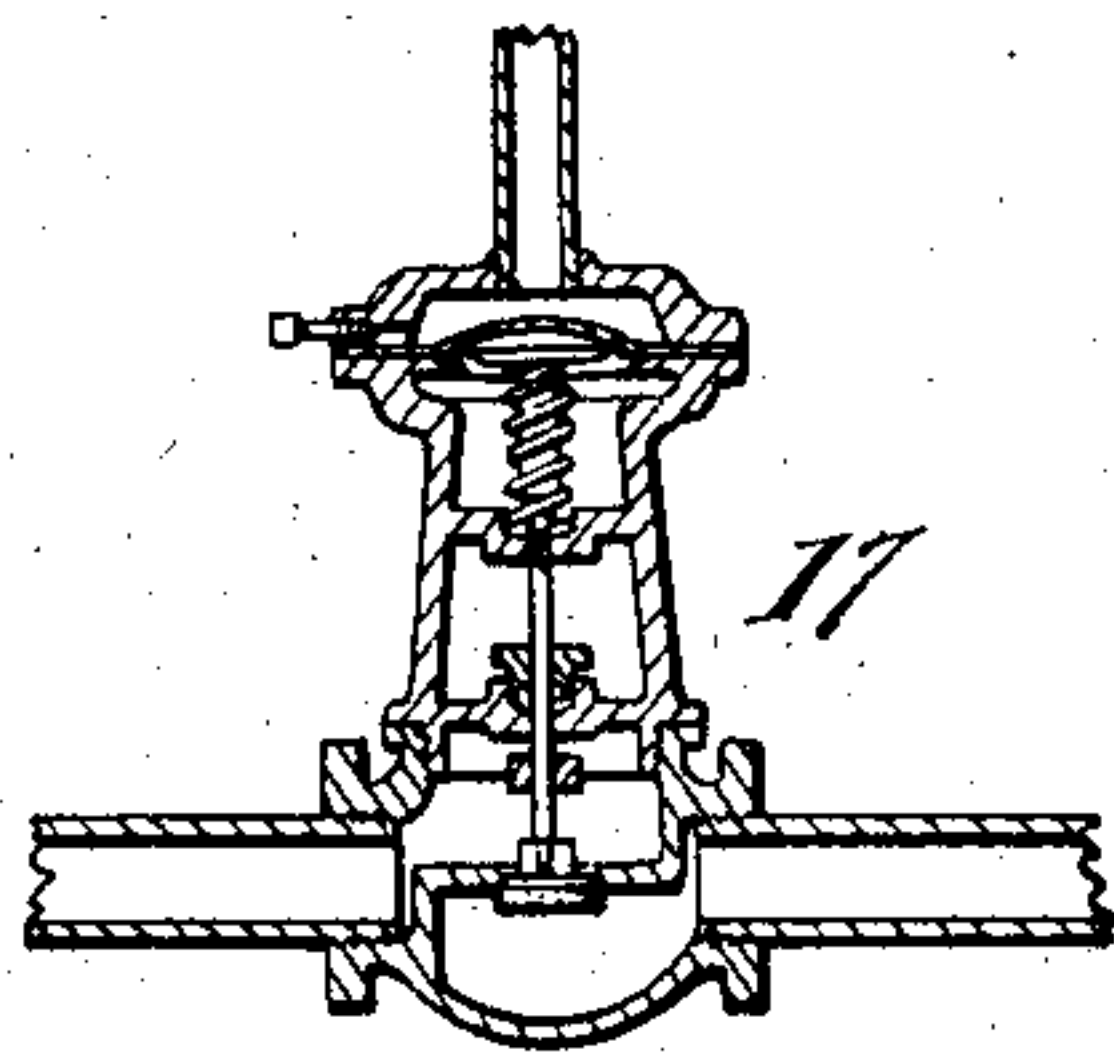
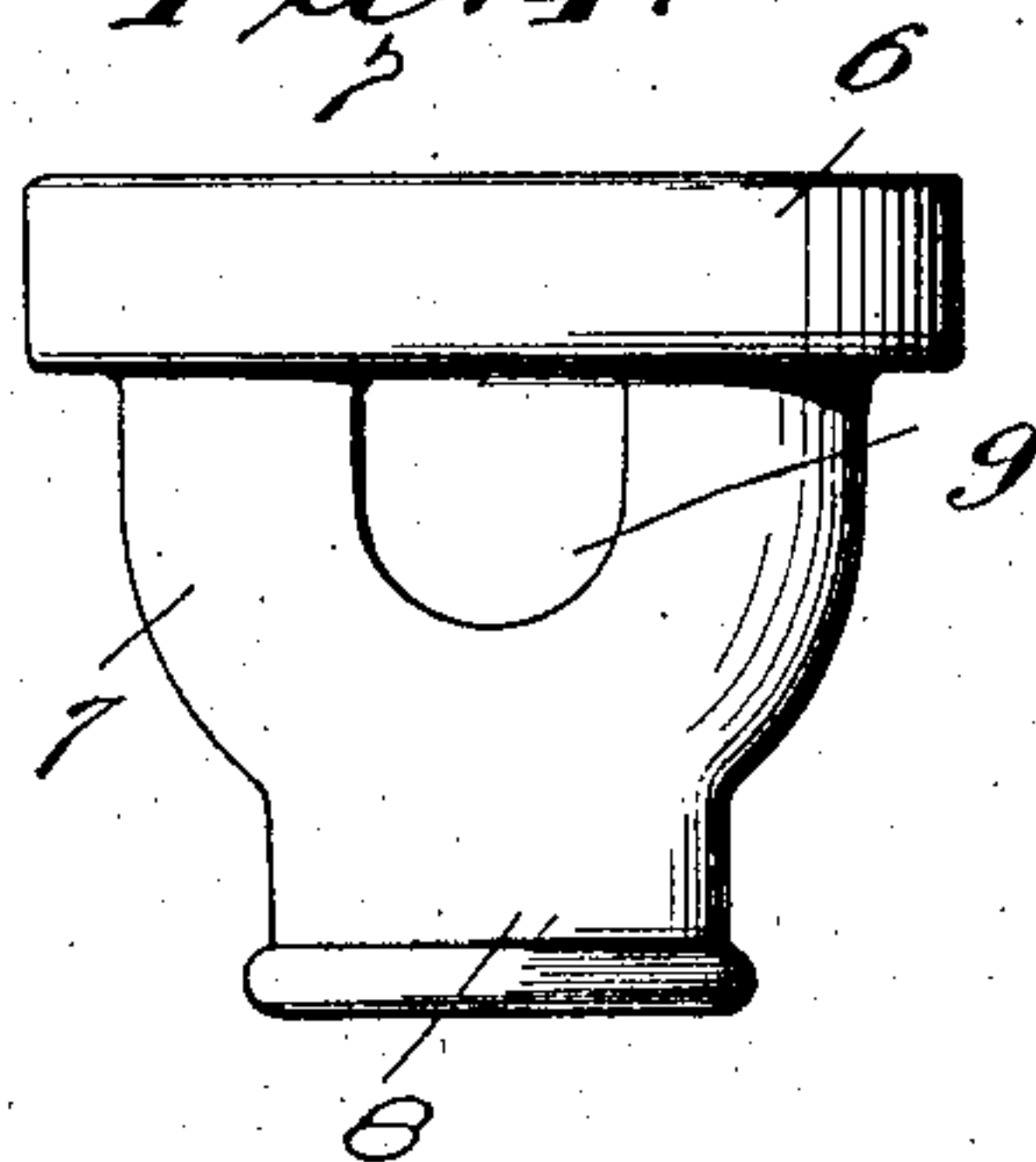


Fig. 4.



Inventor

Louis B. Fulton.

Witnesses

*Francis S. Chagnier*

By

*John W. Sullivan*

Attorney

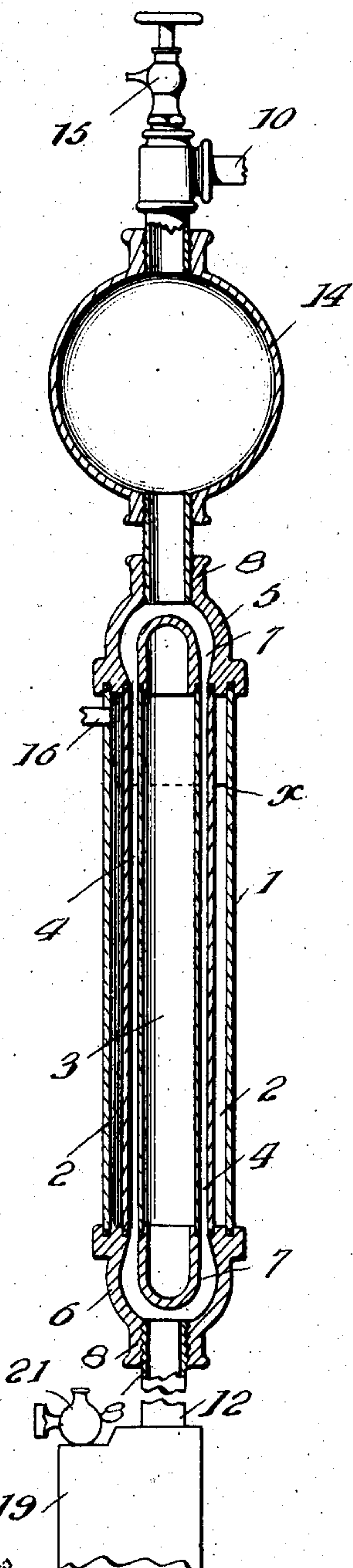
No. 834,795.

PATENTED OCT. 30, 1906.

L. B. FULTON.  
FEED WATER REGULATOR.  
APPLICATION FILED JAN. 17, 1906.

2 SHEETS—SHEET 2.

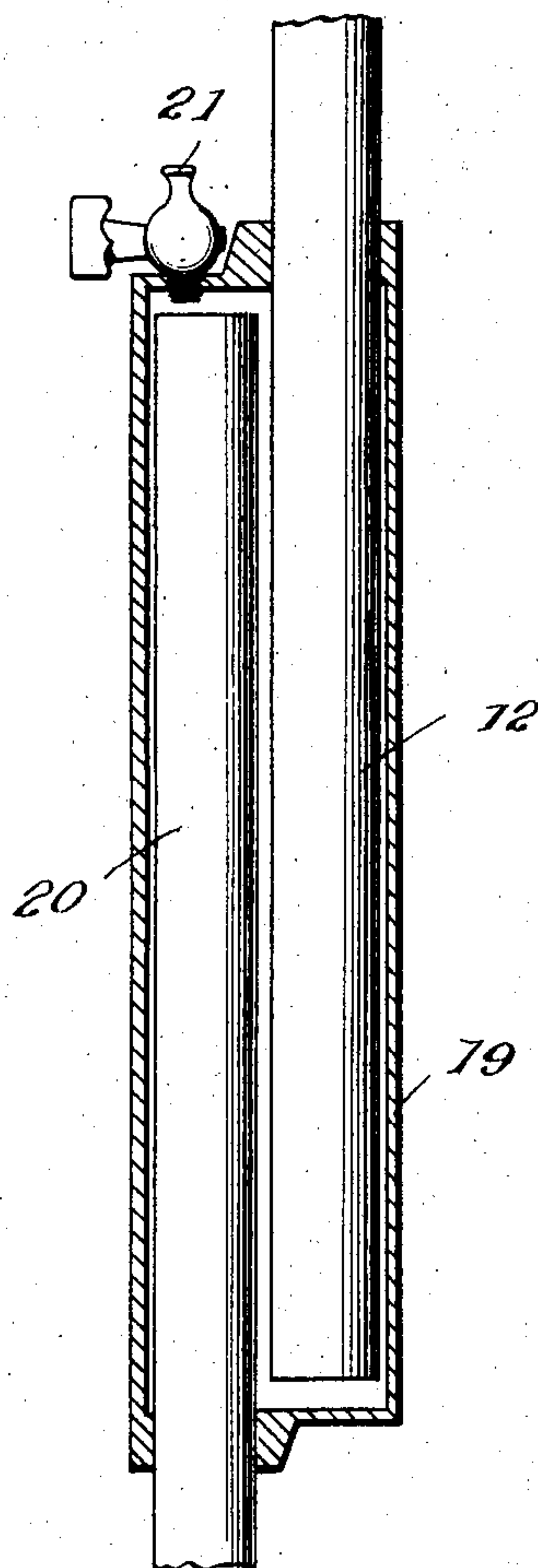
Fig. 2.



Witnesses

*Francis S. Harmon*

Fig. 3.



Inventor

*Louis B. Fulton*

By

*Robert W. Hill*

Attorney



# UNITED STATES PATENT OFFICE.

LOUIS B. FULTON, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE  
CHAPLIN-FULTON MANUFACTURING COMPANY, OF PITTSBURG, PENN-  
SYLVANIA, A CORPORATION OF PENNSYLVANIA.

## FEED-WATER REGULATOR.

No. 834,795.

Specification of Letters Patent.

Patented Oct. 30, 1906.

Application filed January 17, 1906. Serial No. 296,513.

*To all whom it may concern:*

Be it known that I, LOUIS B. FULTON, of  
Pittsburg, in the county of Allegheny and  
State of Pennsylvania, have invented cer-  
tain new and useful Improvements in Feed-  
Water Regulators; and I do hereby declare  
the following to be a full, clear, and exact de-  
scription of the invention, such as will enable  
others skilled in the art to which it apper-  
tains to make and use the same.

The object of this invention is to provide a  
water-regulator for steam-boilers capable of  
quickly starting and cutting off the feed-sup-  
ply and enabling the water in the boiler to be  
maintained at a practically constant level.

The invention comprehends a generator  
having a chamber containing a small volume  
of water capable of being quickly converted  
into steam by steam admitted to a second  
chamber of the generator when the water in  
the boiler falls below a predetermined point.  
When the proper quantity of water has been  
supplied to the boiler, the steam in the gener-  
ator is entrapped, and its immediate conden-  
sation causes cold water to take its place in  
the generator, which latter is connected with  
the boiler at or beneath the water-level and  
also at a point lower down. The water first  
lifted into the steam and water chamber of  
the generator passes immediately into a res-  
ervoir of greater cubical capacity than said  
chamber, allowing still cooler water to enter  
the latter, while that contained within the  
reservoir is cooled by radiation. The air  
which accumulates within the device is en-  
trapped within the reservoir, from which it  
may be periodically released.

The invention further comprehends an im-  
proved trap from which cold water will al-  
ways be supplied to the generator and from  
which accumulated air may be readily re-  
leased.

The invention will be hereinafter fully set  
forth, and particularly pointed out in the  
claims.

In the accompanying drawings, Figure 1  
shows in elevation my improvement applied  
to two boilers. Fig. 2 is an enlarged longi-  
tudinal section of the generator. Fig. 3 is a  
similar view of the trap and a portion of the  
water-column. Fig. 4 is a view of one of the  
end casings of the generator. Fig. 5 is a sec-  
tional view of the controlling-valve.

Referring to the drawings, 1 designates the  
generator, which comprises three concentric-  
ally-arranged cylindrical shells of equal  
length. The outer and intermediate shells  
form a water-chamber 2, the level of the  
water in which is normally at the line *x*, Fig.  
2. Between the intermediate shell and the  
inner shell 3 is a water and steam chamber 4.  
These several shells are preferably of brass  
and at their upper and lower ends are se-  
cured with steam-tight joints to brass cas-  
ings 5 and 6, having lateral ports 7 leading  
from their end tubular openings 8 into the  
water and steam chamber 4. Through the  
openings 9 (see Fig. 4) in these casings air is  
admitted to the interior of the shell 3. The  
end casing 5 is connected, through a pipe 10,  
to the boiler, or rather to the water-column,  
while the lower casing 6 is connected, through  
a pipe 12, to the pipe 13, which forms the  
lower connection between the water-column  
and the boiler.

The pipe 12 is in practice of greater diam-  
eter than the pipe 10. The pipe 10 opens  
into the water-column at a point at or be-  
neath the water-level, with the result that  
when the proper quantity of water is in the  
boiler the chamber 4 will be filled with water;  
but the moment the lower end of pipe 10 is  
unsealed by the falling of the water-level in  
the boiler steam will pass through pipe 10  
and displace the water in chamber 4, causing  
it to return to the boiler through pipe 12.  
This return movement is accelerated by rea-  
son of the fact that the generator is itself lo-  
cated some distance above the water-level in  
the boiler, so that gravity will hasten the  
emptying of the water from the chamber 4  
the moment steam passes into the top there-  
of through pipe 10. I have shown above the  
generator a dome 14 to allow of the accumu-  
lation of air, which may be periodically dis-  
charged by opening petcock 15. This dome  
also serves as a reservoir or receptacle for the  
water which is first lifted into the steam and  
water chamber, thereby enabling cooler  
water to rise from the trap.

When the lower end of pipe 10 is unsealed  
and steam displaces the water in chamber 4,  
the water in chamber 2 will be converted into  
steam, which will exert pressure, through  
pipe 16, on the diaphragm or piston of a con-  
trolling-valve 17, mounted in the feed-line



18, effecting the unseating of such valve and allowing water to be fed to the boiler. As soon as the proper quantity has been supplied the steam entrapped by the sealing of  
 5 the lower end of pipe 10 will immediately condense, creating a partial vacuum, and pipe 12 being of greater diameter than pipe 10 water will immediately rise into chamber 4 from the trap. This immediately effects a  
 10 lowering in temperature in chamber 2 and the steam in pipe 16 will condense, allowing valve 17 to be seated in a manner well known in the art. The water first to rise is instantly heated by contact with the shells of the  
 15 steam and water chamber, and passing into dome 14 allows cooler water to enter such chamber. In this way the steam is condensed almost immediately.

To the end that cool water will be drawn  
 20 into chamber 4 when the steam in pipe 10 is entrapped and at the same time to prevent air from entering the generator and affecting the temperature of the shells thereof I provide beneath the generator a cylindrical  
 25 casing 19, through the top of which pipe 12 passes, said pipe opening just above the bottom of the casing. Through such bottom extends a second pipe 20, and it is this pipe which leads from the water-column pipe 13.  
 30 The upper end of pipe 20 opens just beneath the top of casing 19. In this way the entrapped water is never disturbed by the incoming water, and its temperature cannot be increased by the latter to any material extent, and the water drawn into chamber  
 35 4 upon the condensation of steam therein is taken from the bottom of the trap-casing, where it is coldest. In the top of trap-casing 19 is located a petcock 21 to permit of the  
 40 occasional release of the air which will collect in the top of the trap. It will be noted that by having the pipes 12 and 20 open at opposite ends of the casing the air is prevented from entering the generator. From time to  
 45 time the cock 15 is opened to release the air, which accumulates wherever there is an alternate generation and condensation of steam.

In practice chamber 2 is filled to the point indicated, and when the proper quantity of  
 50 water is in the boiler the controlling-valve 17 is seated and the chamber 4 is filled with cool water. When the water-level in the boiler is lowered, by the evaporation of the water into steam, the lower end of pipe 10 will be unsealed, allowing steam to rush upwardly  
 55 through such pipe and into chamber 4 of the generator, displacing the water therein, and by its heating action the temperature of the water in chamber 2 will be instantly raised,  
 60 so as to generate a pressure of sufficient power to effect the unseating of the controlling-valve, and thereby allow the water to pass to the boiler. When the proper quantity of water has been supplied the boiler,  
 65 the steam entrapped in pipe 10 will immedi-

ately condense, causing water to be lifted from the trap-casing 19 into chamber 4, and this water being of lower temperature than that of the steam will, with the aid of the atmosphere acting on the surfaces of the inner  
 70 and outer shells, cause the steam generated in chamber 2 to condense, relieving the diaphragm of the controlling-valve of pressure and allowing the same to seat. Not only does the dome receive the water first entering  
 75 the steam and water chamber and which contacts with the heated shells, but the cubical capacity of such dome being greater than that of the steam and water chamber the very  
 80 coolest water from the trap is allowed to rise in such chamber. In other words, there is a constant current until the dome is filled. The water within the latter is cooled by radiation and precipitated to the bottom of the  
 85 trap, thus insuring cool water being supplied the generator when the steam-pipe is again sealed.

From what has been stated the advantages of my invention will be apparent. In the first place, the cylindrical formation of the gen-  
 90 erator provides extended heating and cooling surfaces, requiring but a small quantity of either heating or cooling agencies to effect in the one instance the generation of steam and in the other the condensation thereof. By  
 95 locating the generator above the level of the water in the boiler the admission of steam and the emptying of water are accomplished in the shortest possible time, and the action of the steam is not delayed by any portion of  
 100 the water remaining in the water and steam chamber, as would be the case if the generator were located on the same level as the water in the boiler.

I claim as my invention—

1. A feed-water regulator comprising a generator located above the water-level in a boiler and connected to the latter at two points, one point of connection being at or  
 105 beneath the water-level and the other at a point lower down, an air-receptacle interposed within the line of the first-noted connection, and means for releasing the air therefrom and a valve in the feed-line designed to be actuated by pressure from said  
 110 generator, steam being admitted to the latter to effect the generation of such pressure when the water-level in the boiler falls below the upper one of said connections between the generator and boiler.  
 120

2. A feed-water regulator comprising a generator located above the water-level in the boiler, two connections between said generator and the boiler, one leading from the top of the generator and opening into the  
 125 boiler at or beneath the water-level therein, and the other leading from the lower end of the generator and opening into the boiler at a point lower than the upper connection, said generator having a water-containing cham-  
 130



ber and a water and steam chamber concentrically arranged with respect to each other, steam being admitted to said latter chamber when the water-level in the boiler falls below the upper one of said connections, and water being lifted into such chamber when the water in the boiler seals the lower end of said upper connection, means located above the generator for receiving and confining the water first so lifted into such chamber, a controlling-valve in the feed-line, and a pressure-pipe leading from said water-containing chamber to said valve.

3. The generator herein described comprising three cylindrical metallic shells, of corresponding lengths arranged concentrically, a water-containing chamber being formed between two of such shells, and a water and steam chamber between one of such latter shells and the third shell, and end casings to which said shells are secured having openings from the atmosphere leading into the interior of the central shell.

4. In a feed-water regulator, a water and steam chamber located above the water-level in a boiler and having upper and lower connections with the water-space of such boiler, said upper connection being at or beneath the water-level in the boiler, a feed-controlling valve operated by changes in said water and steam chamber, a trap-chamber within said lower connection of said water and steam chamber, a pipe leading from near the bottom of such trap-chamber into said water and steam chamber, and a second pipe leading from the boiler and opening into said trap-chamber near the top thereof.

5. In a feed-water regulator, a water and steam chamber located above the water-level in a boiler and having upper and lower connections with the water-space of such boiler, said upper connection being at or beneath the water-level in the boiler, a feed-controlling valve operated by changes in temperature in said water and steam chamber, a trap-chamber within said lower connection of said water and steam chamber, a pipe leading from near the bottom of such trap-chamber into said water and steam chamber, a second pipe leading from the boiler and opening into said trap-chamber near the top thereof, and a vent-valve in the top of said trap-chamber.

6. In a feed-water regulator, a generator comprising a cylindrical water-containing chamber, a water and steam chamber within and surrounded by said water-containing chamber, an open-ended air-space being formed longitudinally of and surrounded by said water and steam chamber, upper and lower connections between the upper and lower ends of said water and steam chamber and the water-space of a boiler, said upper connection being at or beneath the water-level in the boiler, a feed-controlling valve

operated by the changes of temperature in said water and steam chamber, and a trap-chamber within said lower connection.

7. A feed-water regulator comprising a generator located above the water-level in the boiler, two connections between said generator and the boiler, one leading from the top of the generator and opening into the boiler at or beneath the water-level therein, and the other leading from the lower end of the generator and opening into the boiler at a point lower than the upper connection, said generator having a water-containing chamber and a water and steam chamber concentrically arranged with respect to each other, steam being admitted to said latter chamber when the water-level in the boiler falls below the upper one of said connection, and water being lifted into such chamber when the water in the boiler seals the lower end of said upper connection, a dome or reservoir located above and in communication with said latter chamber, a controlling-valve in the feed-line, and a pressure-pipe leading from said water-containing chamber to said valve.

8. A feed-water regulator comprising a generator located above the water-level in the boiler, two connections between said generator and the boiler, one leading from the top of the generator and opening into the boiler at or beneath the water-level therein, and the other leading from the lower end of the generator and opening into the boiler at a point lower than the upper connection, said generator having a water-containing chamber and a water and steam chamber concentrically arranged with respect to each other, steam being admitted to said latter chamber when the water-level in the boiler falls below the upper one of said connections, and water being lifted into such chamber when the water in the boiler seals the lower end of said upper connection, a dome or reservoir located above and in communication with said latter chamber, said dome being of greater cubical capacity than such chamber, for the purpose set forth, a controlling-valve in the feed-line, and a pressure-pipe leading from said water-containing chamber to said valve.

9. A feed-water regulator comprising a generator located above the water-level in the boiler, two connections between said generator and the boiler, one leading from the top of the generator and opening into the boiler at or beneath the water-level therein, and the other leading from the lower end of the generator and opening into the boiler at a point lower than the upper connection, said generator having a water-containing chamber and a water and steam chamber concentrically arranged with respect to each other, steam being admitted to said latter chamber when the water-level in the boiler falls below the upper one of said connections, and water being lifted into such chamber when the wa-



ter in the boiler seals the lower end of said upper connection, a dome or reservoir located above and in communication with said latter chamber, said dome serving to receive and  
5 retain water lifted through the water and steam chamber and also to collect the entrapped air, a vent-cock therefor, a controlling-valve in the feed-line, and a pressure-pipe leading from said water-containing  
10 chamber to said valve.

10. In a feed-water regulator, a water and steam chamber located above the water-level in a boiler and having upper and lower connections with the water-space of such boiler,  
15 said upper connection being at or beneath the water-level in the boiler, a feed-control-

ling-valve operated by changes in said water and steam chamber, a trap-chamber within said lower connection of said water and steam chamber, and a reservoir above and in  
20 communication with said latter chamber wherein the water first lifted into such chamber from said trap will be cooled before being returned to the trap.

In testimony whereof I have signed this  
25 specification in the presence of two subscribing witnesses.

LOUIS B. FULTON.

Witnesses:

CHAS. W. TOWNSEND,  
THOMAS J. ORR.