No. 662,488.

Patented Nov. 27, 1900.

L. B. FULTON.

WATER REGULATOR.

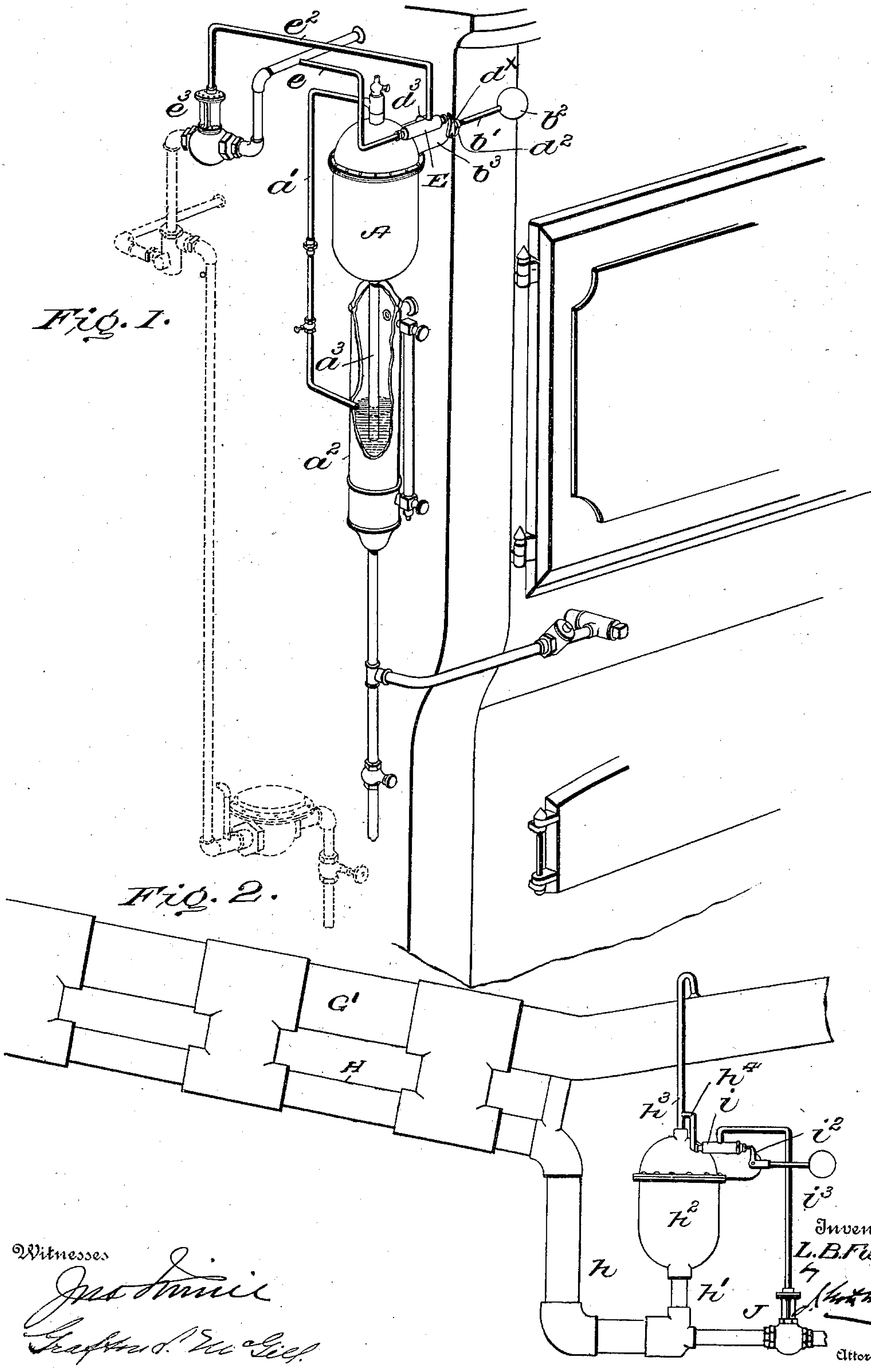
(Application filed Nov. 6, 1897.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.

Fig. 2.



Witnesses
Jno Finnie
Grafton L. McGill

Inventor
L. B. Fulton
by [signature]
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 662,488. Patented Nov. 27, 1900.

L. B. FULTON.

WATER REGULATOR.

(Application filed Nov. 6, 1897.)

(No Model.) 3 Sheets—Sheet 2.

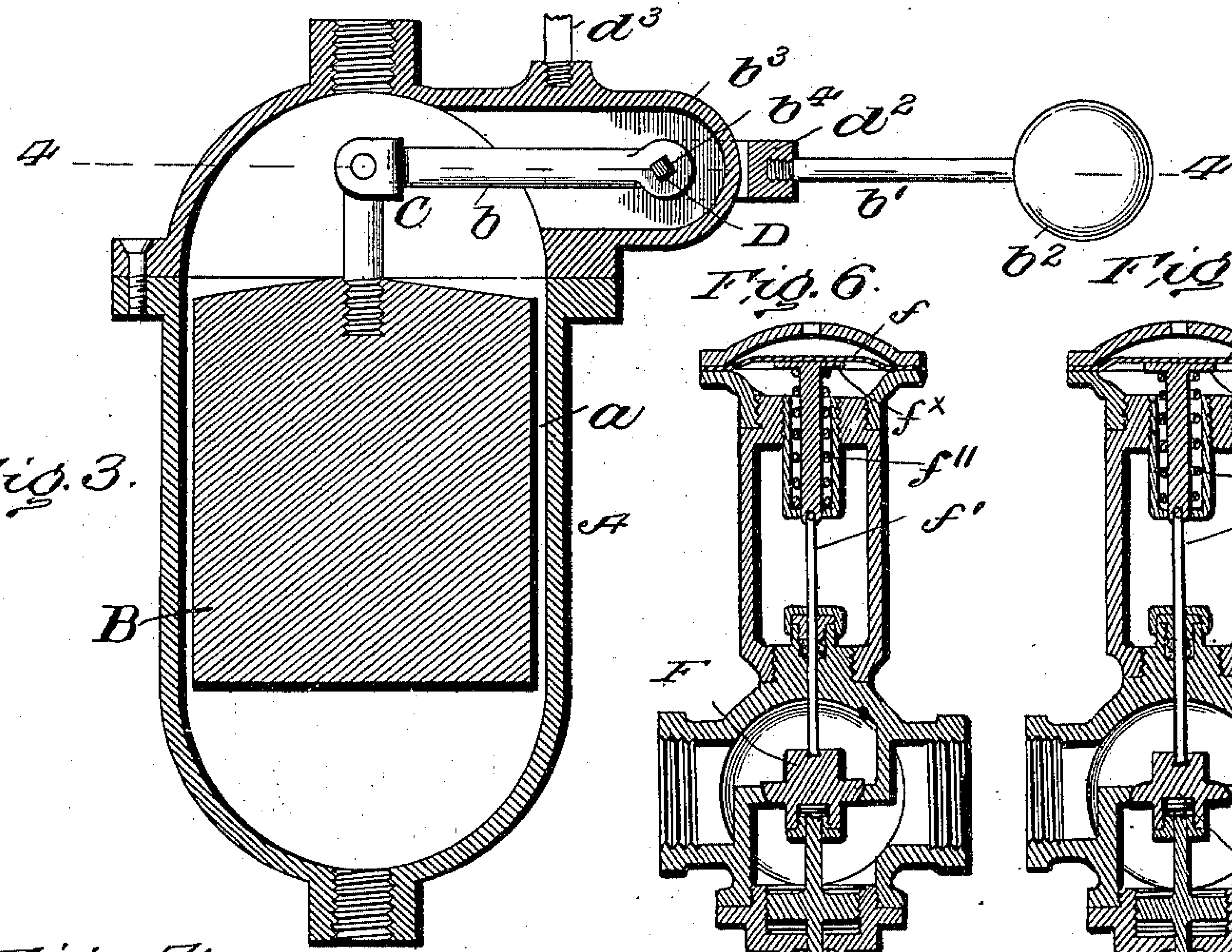


Fig. 3.

Fig. 6. Fig. 7.

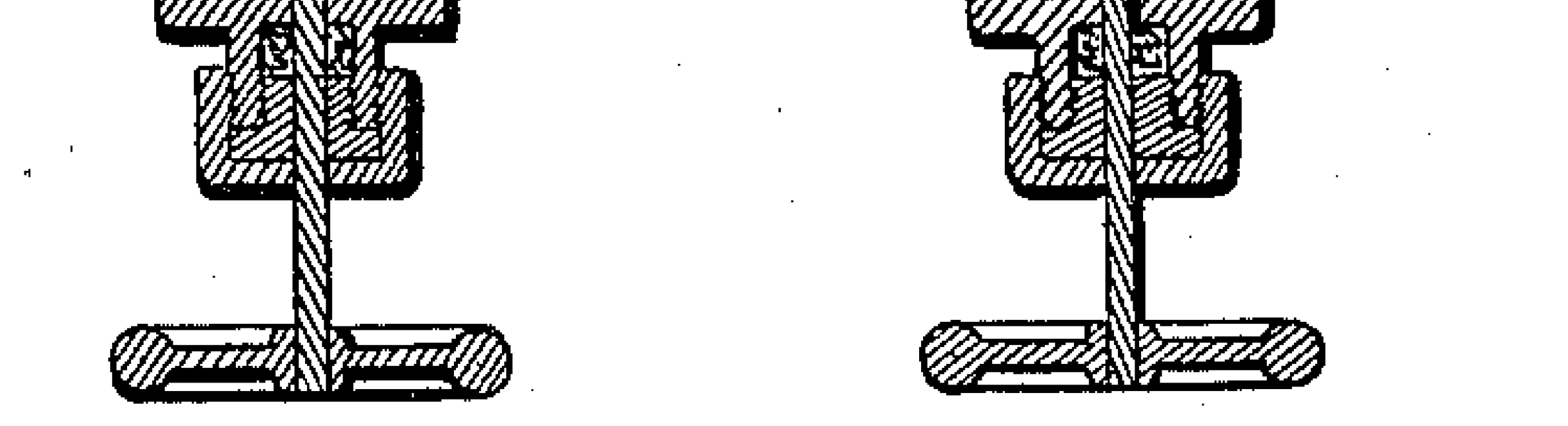


Fig. 4.

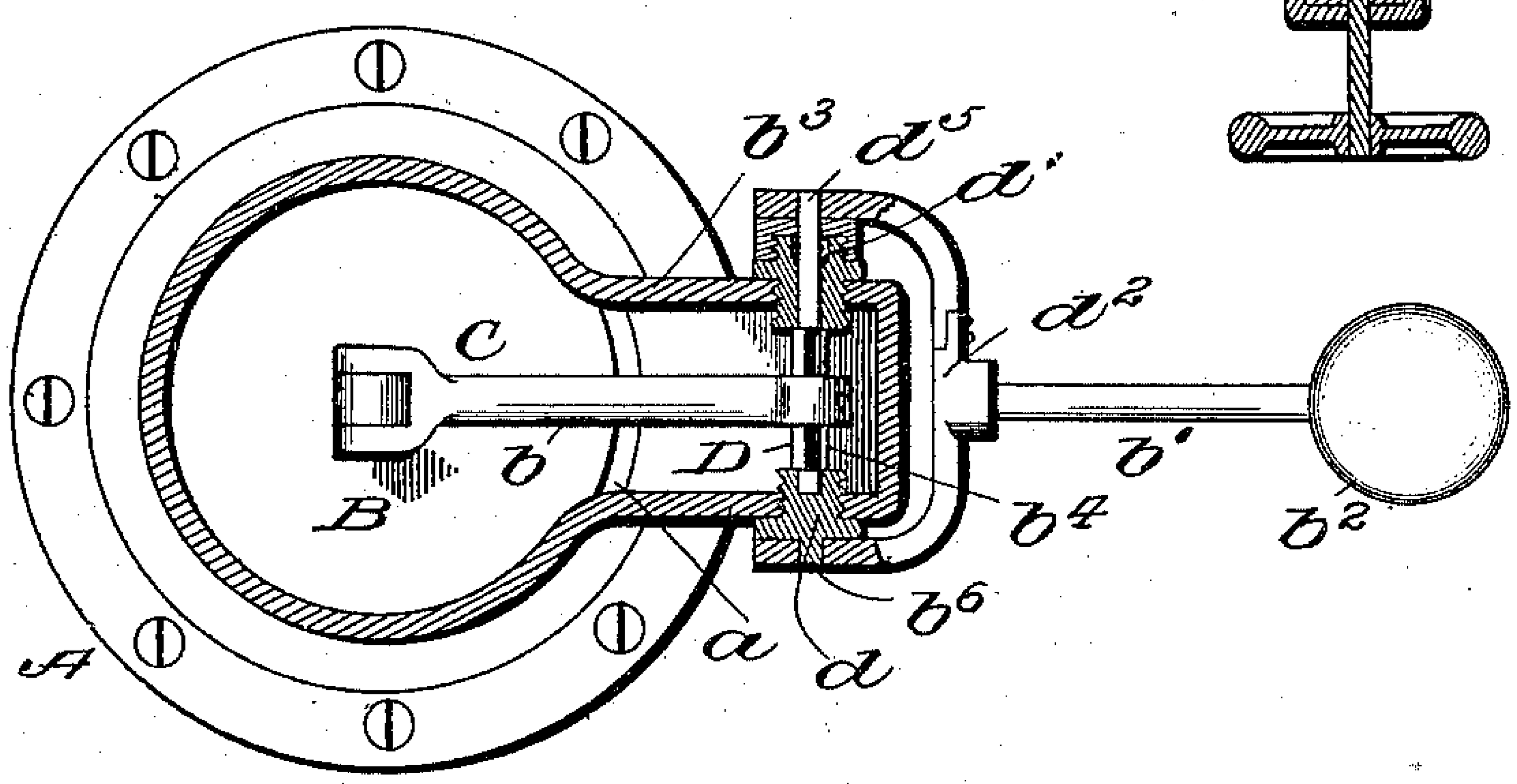
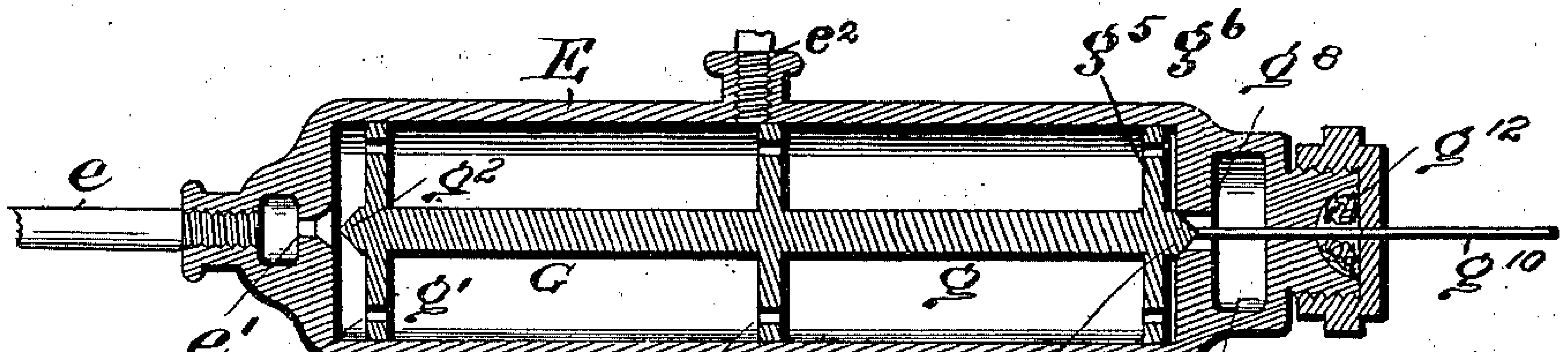


Fig. 5.



Witnesses

Inventor

L. B. Fulton

Attorney

No. 662,488. Patented Nov. 27, 1900.

L. B. FULTON.
WATER REGULATOR.

(Application filed Nov. 6, 1897.)

(No Model.) 3 Sheets—Sheet 3.

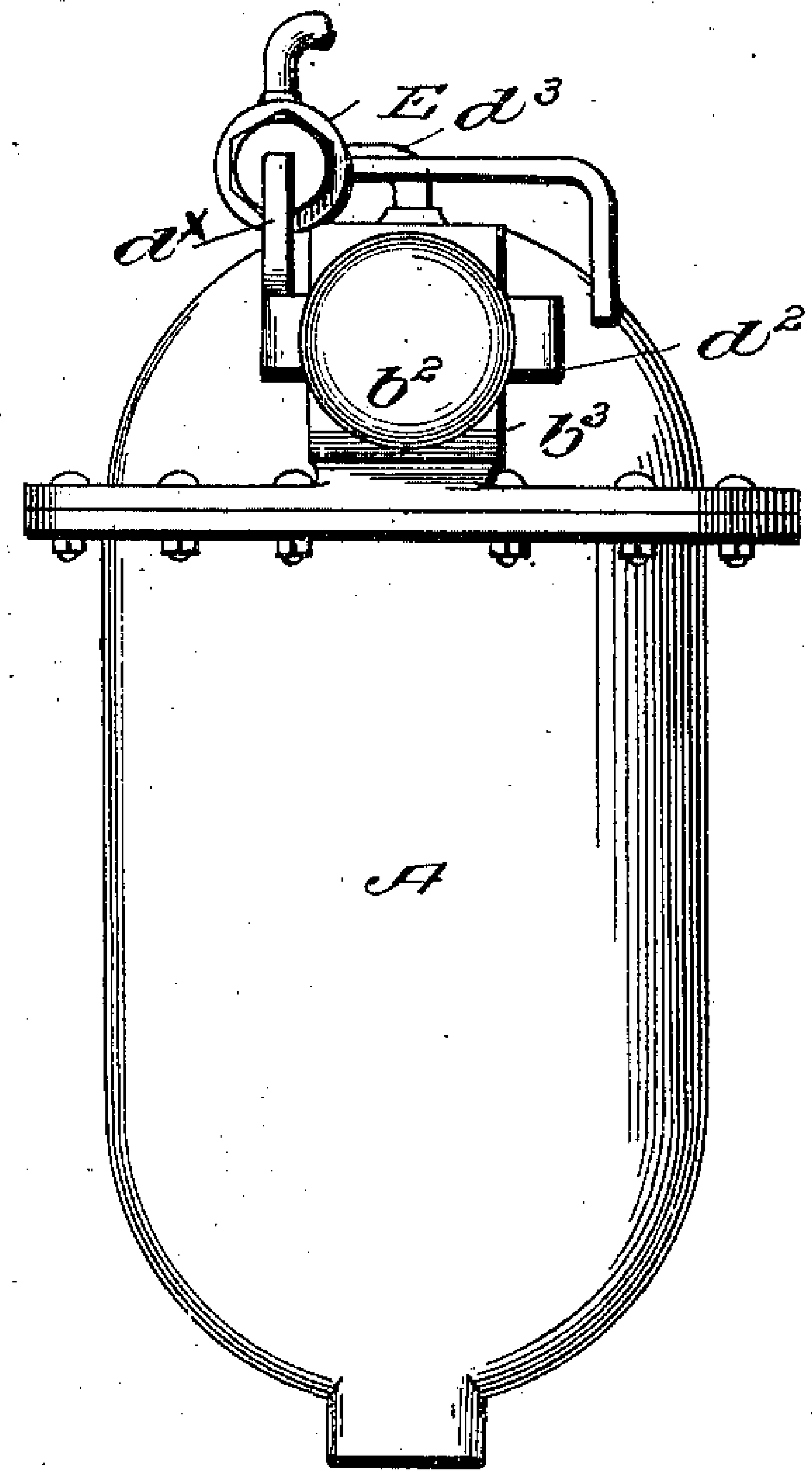


Fig. 8.

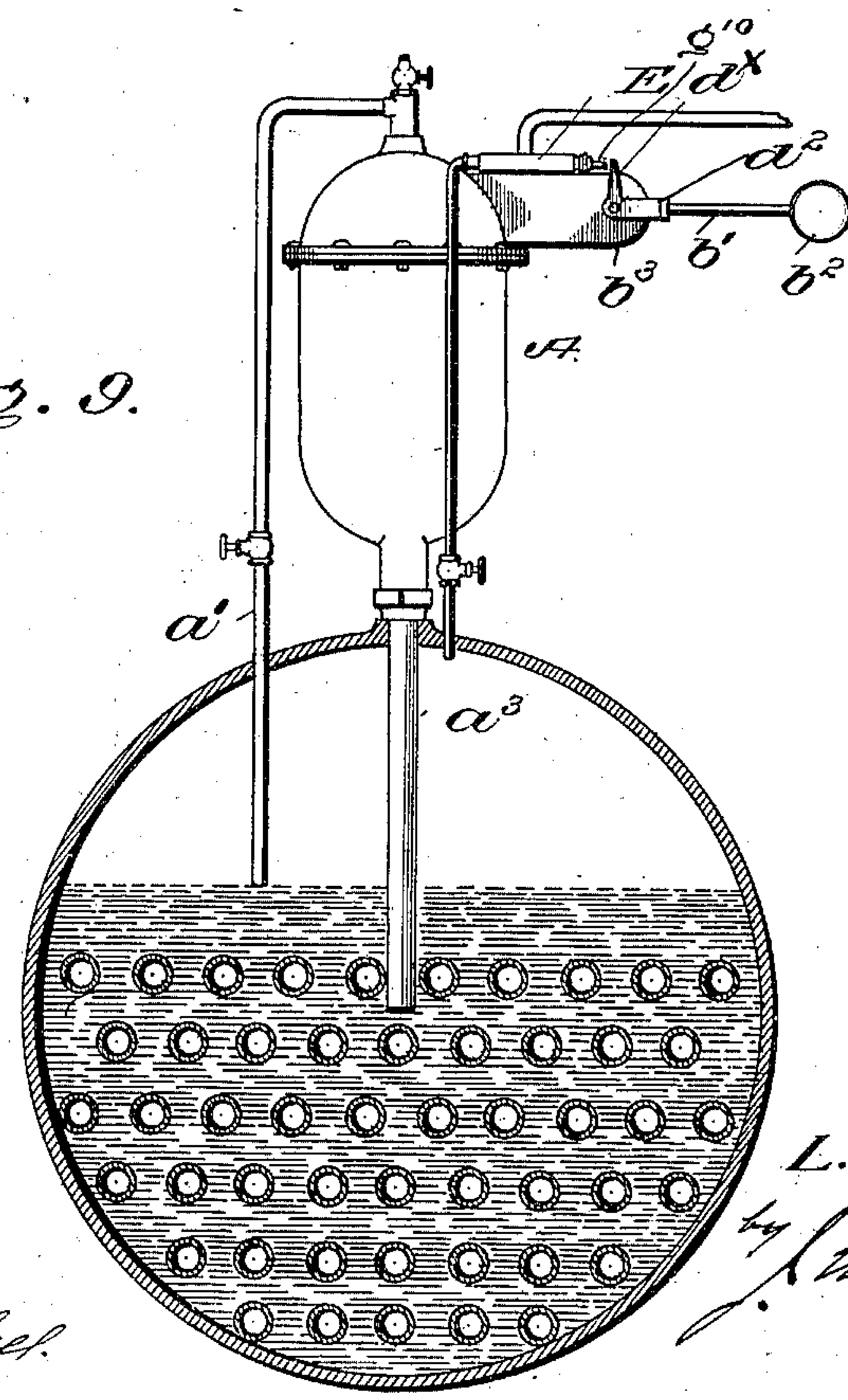


Fig. 9.

Witnesses

Inventor
L. B. Fulton,
by
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

LOUIS B. FULTON, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE CHAPLIN-FULTON MANUFACTURING COMPANY, OF SAME PLACE.

WATER-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 662,488, dated November 27, 1900.

Application filed November 6, 1897. Serial No. 657,631. (No model.)

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 certain new and useful Improvements in 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 contemplates certain new and useful improvements in water-regulators—such, for example, as are used in connection with a boiler for automatically controlling the feed-water supply—and likewise trap attachments for natural-gas mains for automatically effecting the outflow of accumulated water.

The object of the invention is to provide a device embodying simplicity of construction for effectually controlling the passage of water under the counterbalance of fluid-pressure, such as gas and steam.

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

In the accompanying drawings, Figure 1 is a view in perspective of a portion of a boiler provided with my improved attachment. Fig. 2 is a view showing the attachment applied to a natural-gas main. Fig. 3 is an enlarged vertical longitudinal sectional view. Fig. 4 is a horizontal sectional view on line 4 4, Fig. 3. Fig. 5 is an enlarged longitudinal sectional view of the controller-valve. Figs. 6 and 7 are views of pressure-valves. Fig. 8 is an elevation of the regulator detached. Fig. 9 shows a modified application of the regulator to a boiler.

Referring to the drawings, A designates a casing having an interior chamber a. Into the upper end of this casing is secured a pipe a', the other end of which may open direct into the boiler, as shown in Fig. 9, or into a water-column a^2, as indicated in Fig. 1. In both cases the inner end of the pipe is on the low-water line. From the lower opening of this casing extends a pipe a^3, which opens into the boiler, Fig. 9, or into the water-column, Fig. 1, below the water-line. When the water falls below the low-water line, steam will pass through pipe a' into casing A. The casing A is located outside of the boiler and some distance above the maximum water-level.

B designates a displacement-body, which may be composed of a block of wood or any other suitable material. It is located within casing A and is of such size as to leave a continuous surrounding space. This body is centrally suspended from the inner end of a lever C, which is composed of an inner arm b and an outer arm b', a weight b^2 being mounted on the latter.

The arm b is extended longitudinally in an upper horizontal branch b^3 of casing A. It is secured on the squared portion b^4 of a pivot-rod D, which latter at one end fits in a boss d, while its other end d^5 is projected through a stuffing-box d'. A yoke d^2 spans the outer end of the branch b^3. One end of this yoke is mounted on the end d^5 of rod D, while the other end is loose on a lug b^6 of boss d. From the yoke projects the arm b'. A finger $d^\times$ extends upwardly from the yoke d^2.

E is a controller-valve casing. It is supported in a horizontal position by a right-angular arm d^3, projecting from the top of the branch b^3. Into one end of this casing opens in line with a reduced inlet-port e' a section of a steam-pressure pipe e, which leads from the steam-space of the boiler. From the casing E extends another section e^2 of the pressure-pipe, which after being carried upward and thence horizontally terminates in a vertical portion which opens into the casing e^3 of a pressure-valve F. This valve controls the passage of steam to a feeder or of water if located in the feed-water pipe. It is provided with a diaphragm f, against which the head $f^\times$ on the upper end of valve-stem f' is held by a spring f''. In boiler attachments this valve is held down against its seat (see Fig. 6) by pressure against the diaphragm—that is, steam acting on the water of condensation within the vertical portion of pipe e^2 directly above valve F. When this pressure is released, the pressure against the lower face of the valve, together with the lifting action of spring f'', will unseat said valve, allowing steam to pass to the pump or injector by which water is fed to the boiler. In gas-main attachments the valve is normally held up

against its seat, Fig. 7, by the water-pressure and the spring f''' and is unseated by the gas-pressure on the diaphragm.

G is a controller-valve located within casing E. This valve is composed of a longitudinally-disposed body g, having at one end a circular flange g' and a pointed lug g^2, which latter when moved into port e' will cut off the steam-supply to the section e^2 of the pressure-pipe. In this flange are one or more holes or ports g^3. At about its center this body has guiding-lugs g^4. A second circular flange g^5, formed with body g near its other end, is also provided with one or more ports g^6. This end of the valve-body is formed with a lug g^7, designed to close the exhaust-port g^8, which opens into an exhaust-chamber g^9. The exhaust-port g^8 is larger in diameter than the inlet-port e'. A reduced extension g^{10} of the valve-body projects outwardly through a stuffing-box g^{12}. With this extension the finger $d^\times$ is designed to engage and effect the longitudinal movement of valve G, thereby cutting off the steam-inlet through port e' and allow the exhaust through chamber g^9, relieving the diaphragm of the pressure-valve F, whereupon the latter will open up, and thus establish communication between the boiler and the feeder.

In practice, the casing A being located some distance above even the high-water level in the boiler, the water will not unaided by other agencies rise in pipe a^3 above its level in the boiler or the communicating water-column. When the water falls so as to expose the lower end of pipe a', steam entering said pipe will pass up into the top of casing A, causing the water therein to flow back to the boiler or water-column through pipe a^3, the displacement-body B in its descent serving to aid the outflow of the water from the casing. The downward movement of the displacement-body effects the tilting of lever C as against its counterweight, and the finger $d^\times$ will move valve G longitudinally, thereby cutting off the pressure against the diaphragm of valve F. This valve being thus relieved of pressure will be instantly unseated by the combined action of pressure against its under side and the spring f''', which presses upwardly on the head $f^\times$. As the port e' is closed the exhaust-port g^8 is opened, allowing of the escape of any water of condensation forced outward consequent upon the upward movement of the diaphragm. As soon as the proper quota of water has been fed to the boiler the lower end of pipe a' will be sealed by the water, thereby cutting off steam to the top of the casing A. The steam confined in the latter will then condense, and a partial vacuum being created in said casing the water will rise through pipe a^3 into casing A, and the impetus thereof, together with the agency of the counterbalancing-weight, will cause the elevation of the displacement-body, and consequently the tilting of lever C. This will withdraw finger $d^\times$ from engagement with the extension g^{10} of the controller-valve, allowing pressure to move the valve G, so as to uncover port e' and exert itself on the diaphragm of the valve F—that is, upon the water of condensation within the vertical portion of pipe e^2 above said valve.

In the employment of this regulator as a trap attachment for natural-gas mains the purpose is to insure the automatic discharge of water which naturally accumulates in the pipes or mains. The latter are usually in country districts extended over fields by being positioned directly over or immediately beneath the ground, and hence there are numerous bends or inclinations in the pipes. Water will always accumulate at the juncture or ends of inclines, such as are between or at the base of hills. Heretofore it has been necessary for an attendant to periodically open up valves located at the ends of inclined piping to allow water to escape; but by my invention this may be accomplished automatically. Each main is paralleled by a lower water-pipe having periodical connections therewith. In Fig. 2 the former is indicated as G′ and the latter as H. The water-pipe is provided at any desirable or necessary point with an extension h, upon a branch h' of which is mounted the casing h^2 of one of my attachments, water being designed to pass through said branch h' to and from the casing. The casing h^2 is disposed parallel with the downward extension h, and being at the lower end of the incline of pipe H water will, if checked at the other side of branch h', rise in the casing h^2. A pipe h^3 connects the upper end of the casing with the gas-main G′, and a branch pressure-pipe h^4 opens into the casing i of the controller-valve. This valve is closed by the lever i^2, which, with its adjuncts, is constructed similarly to that before described. The casing i is connected by a section i^3 of the pressure-pipe with the pressure-valve J above the diaphragm thereof. This valve, being constructed as shown in Fig. 7, is positively unseated by the gas-pressure—that is, water is allowed to escape only while the gas-pressure exerted on the diaphragm f holds valve J unseated. As soon as the discharge has taken place the lever acts on the controller-valve, cutting off the gas-supply to the pressure-valve, and instantly said valve is positively reseated by the pressure against its under side plus the action of its spring. In thus employing my improvements for periodically discharging trapped water from gas-mains it is obvious that until sufficient water is accumulated within casing h^2 to elevate the displacement-body B the controller-valve G will prevent the passage of gas to the diaphragm of the pressure-valve. In consequence the latter is held up against its seat by its spring f''. While this pressure-valve is seated, the water will rise through branch h' into casing h^2, causing the upward movement of the displacement-body, which when sufficient water

has been accumulated will relieve the controller-valve G and allow the gas to pass through pipe-section i^3 and exert pressure on valve J. The latter being thus positively and instantly forced from its seat, so as to allow of the escape of the water, the displacement-body moving downward forces the water outward, gas being always admitted to the top of the casing. In this way most, but not all, of the accumulated water is forced out before the gas-pressure is cut off from valve J. This occurring the valve is reseated and so remains until sufficient water again accumulates to cause the operation before described to be repeated.

It will be noticed that the valve J is on the discharge side of the trap and that its seating and unseating are rendered certain and positive. In all traps as heretofore constructed the discharge-controlling valves and their seats soon become worn by the continued flow of the water when the valves should be seated. Their action is not positive. By my invention this "wiredrawing," as it is termed in the art, is prevented, the action of the valve in seating and unseating being such that from the time it begins to move in either direction there is not sufficient escape of water to cut out the valve or its seat.

The displacement-body B is not a float. In cross-section it nearly equals the interior area of the casing in which it is located. It is suspended from one end of a lever, on the other end of which is a counterweight of less actual gravity than the displacement-body. In other words, the lever is about five pounds out of balance by the body B and weight b^2, and the shifting of this lever is caused by the presence and absence of water within the casing. To shift the lever so as to relieve the controller-valve, only enough water is required against the body to allow the counterweight to overcome the excess weight of the displacement-body.

Heretofore floats and buckets have been very generally employed for aiding in controlling the operation of water-regulators. They have usually been inclosed either within a boiler or a chamber connected thereto. A hollow float has been found to possess many disadvantages, and regulators depending upon them for their operation have not gone into general use. The great pressure to which a float is subjected is liable to and frequently does cause leakage, resulting in the float filling with water. Then, again, a float is liable to collapse, and should it be indented or injured in handling its resistance-power is greatly weakened. In natural-gas lines the pressure is very great, often as high as four or five hundred pounds to the square inch. At such pressure it is almost impossible to provide a float that will maintain its strength. In case of a suspended bucket freezing is liable to occur in exposed situations, causing the bucket to burst, and thereby destroying its effectiveness. Then, again, in boiler attachments if the bucket be suspended for a long interval the temperature of the steam being greater than that of the contained water evaporation will result, causing the machine to operate prematurely. All these objections are overcome by the use of a solid displacement-body, such as herein described. Such body insures the proper operation of the regulator under all circumstances.

I claim as my invention—

1. The combination with a casing, a water-pipe leading from the lower end of said casing and a fluid-supply pipe opening into the top of said casing, of a lever fulcrumed on said casing and having a displacement-body located within the latter, a pressure-valve, a pressure-pipe leading to said pressure-valve, and a controller-valve in the pressure-pipe normally held unseated and allowing the pressure to act on the pressure-valve, said controller-valve being seated to cut off pressure to the pressure-valve when the displacement-body is lowered within the casing.

2. The combination with the casing having water and fluid pipes opening, respectively, into the lower and upper ends thereof, a lever fulcrumed on said casing and having a finger projecting therefrom, a weight on said lever, a displacement-body carried by the lever and located within the casing, a controller-valve mounted in juxtaposition to the casing and having a projecting portion with which the finger is designed to engage, a pressure-valve, the seating or unseating of which is regulated by the controller-valve, and a pressure-pipe in which the latter valve is located, said pressure-pipe being connected to the pressure-valve, substantially as set forth.

3. The combination with the casing having water and fluid pipes opening, respectively, into the lower and upper ends thereof, a lever fulcrumed on said casing, one arm of said lever being within, and the other arm without, said casing, a lateral projection carried by said inner arm to which said outer arm is secured, a weight on said outer arm, a displacement-body carried by said inner arm, a pressure-valve, a pressure-pipe leading thereto, and a sliding controller-valve located in said pressure-pipe in juxtaposition to said casing, said lever being designed to engage and seat said controller-valve, substantially as set forth.

4. The combination with the casing having a lower water-pipe and an upper fluid-pipe, a lever-arm located within said casing, a fulcrum pivot-rod for said arm mounted within said casing and projecting at one end through said casing, an outer lever-arm fast on said pivot-rod, a weight on said outer lever-arm, a displacement-body carried by said inner arm, a finger carried by said outer arm, a pressure-valve, a pressure-pipe leading thereto, and a sliding controller-valve in said pres-

sure-pipe having a projection designed to be engaged by said finger, substantially as set forth.

5. The combination with the casing having water and fluid pipes opening therein, a lever mounted in said casing having an arm outside of the latter, a displacement-body carried by said lever and located within said casing, a finger carried by said outer arm, a pressure-valve, a pressure-pipe leading thereto, a valve-casing mounted in said pressure-pipe and having inlet and outlet ports, and a sliding controller-valve located in the last-mentioned casing for controlling the ports thereof and having a projection designed to be engaged by said finger, substantially as set forth.

6. The controller-valve herein described comprising a casing having inlet and exhaust ports at opposite ends, a valve in said casing having lugs for closing said ports, and flanges adjoining said lugs formed with ports, substantially as set forth.

7. The combination with the casing, a fluid-pipe opening into the upper end of said casing, and a water-pipe leading from a lower point of said casing, of a displacement-body and lever, a finger carried by the latter, a pressure-pipe, a valve at the end thereof, a controller-valve in said pipe having reduced ends, apertured flanges adjoining said ends, a casing for said valve having inlet and exhaust ports at its opposite ends, and a projection extending from said valve designed to be engaged by said finger, substantially as set forth.

8. The combination with a trap-casing, and water and fluid pipes, of a valve adapted to be positively seated and unseated by pressures acting in opposite directions, and means, operated by the water in said trap-casing, for directly controlling one pressure medium, as set forth.

9. The combination with a trap-casing, of a pressure-valve in a pipe leading from such casing, the seating of said valve being effected by pressure against its under side, a diaphragm to which such valve is connected, a pressure-pipe opening at one end adjacent to the diaphragm, and means for admitting pressure against the latter to effect the positive unseating of the pressure-valve, substantially as set forth.

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

LOUIS B. FULTON.

Witnesses:
M. B. CHAPLIN,
C. W. TOWNSEND.