No. 726,792. PATENTED APR. 28, 1903.

W. H. BERRY.

FEED WATER REGULATOR.

APPLICATION FILED JUNE 2, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 2.

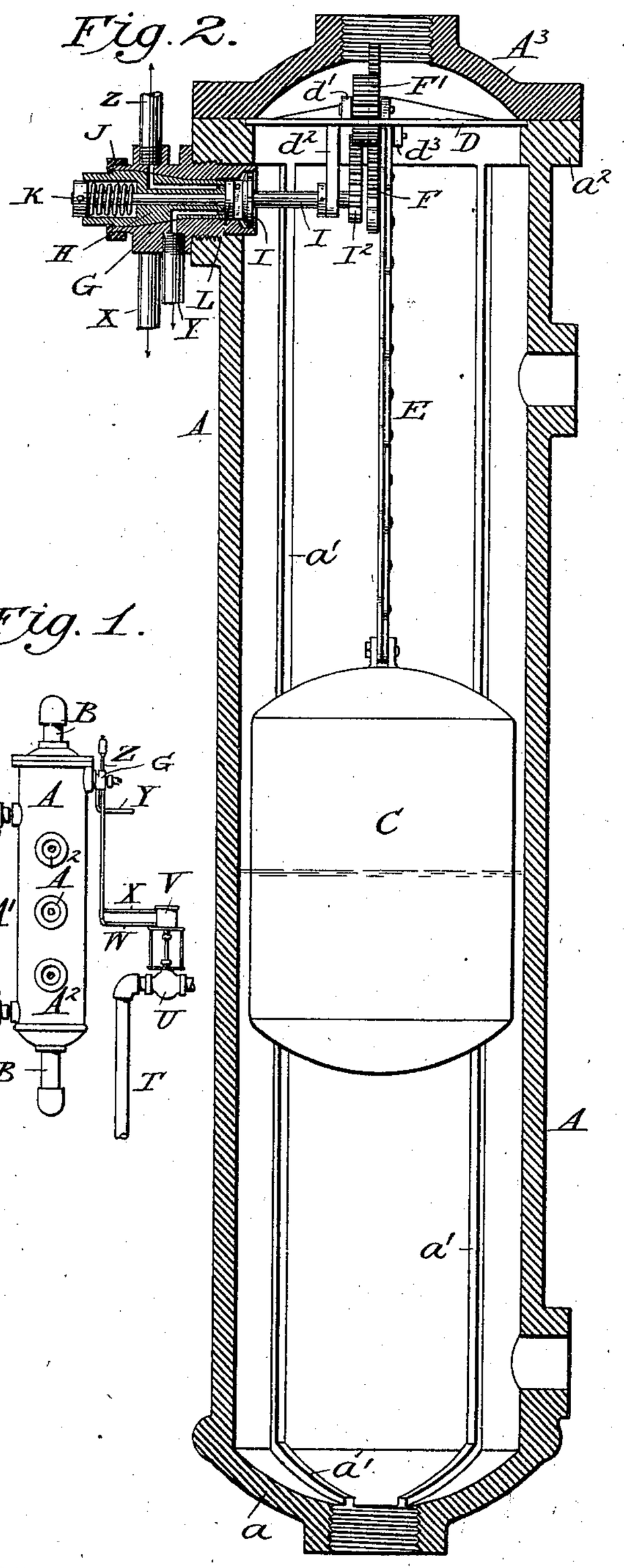

Fig. 3.

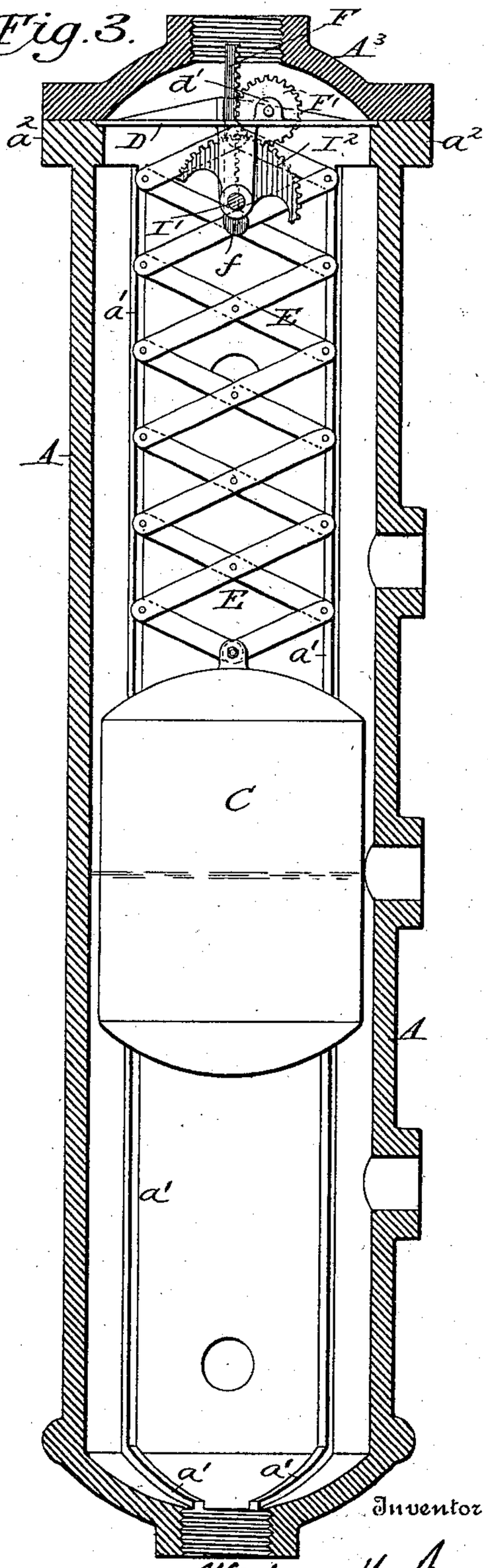

Fig. 1.

Witnesses

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4.

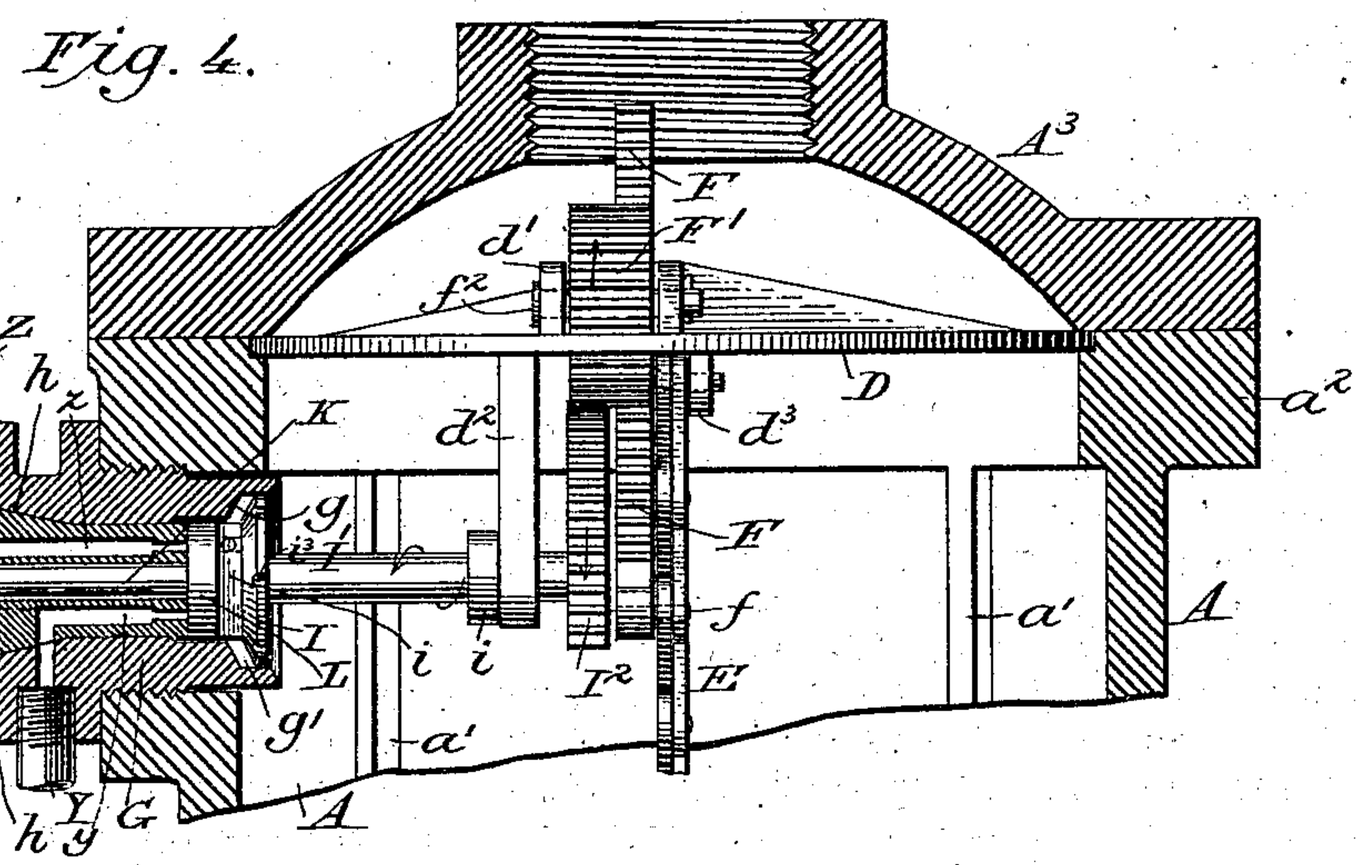


Fig. 6.

Fig. 5.

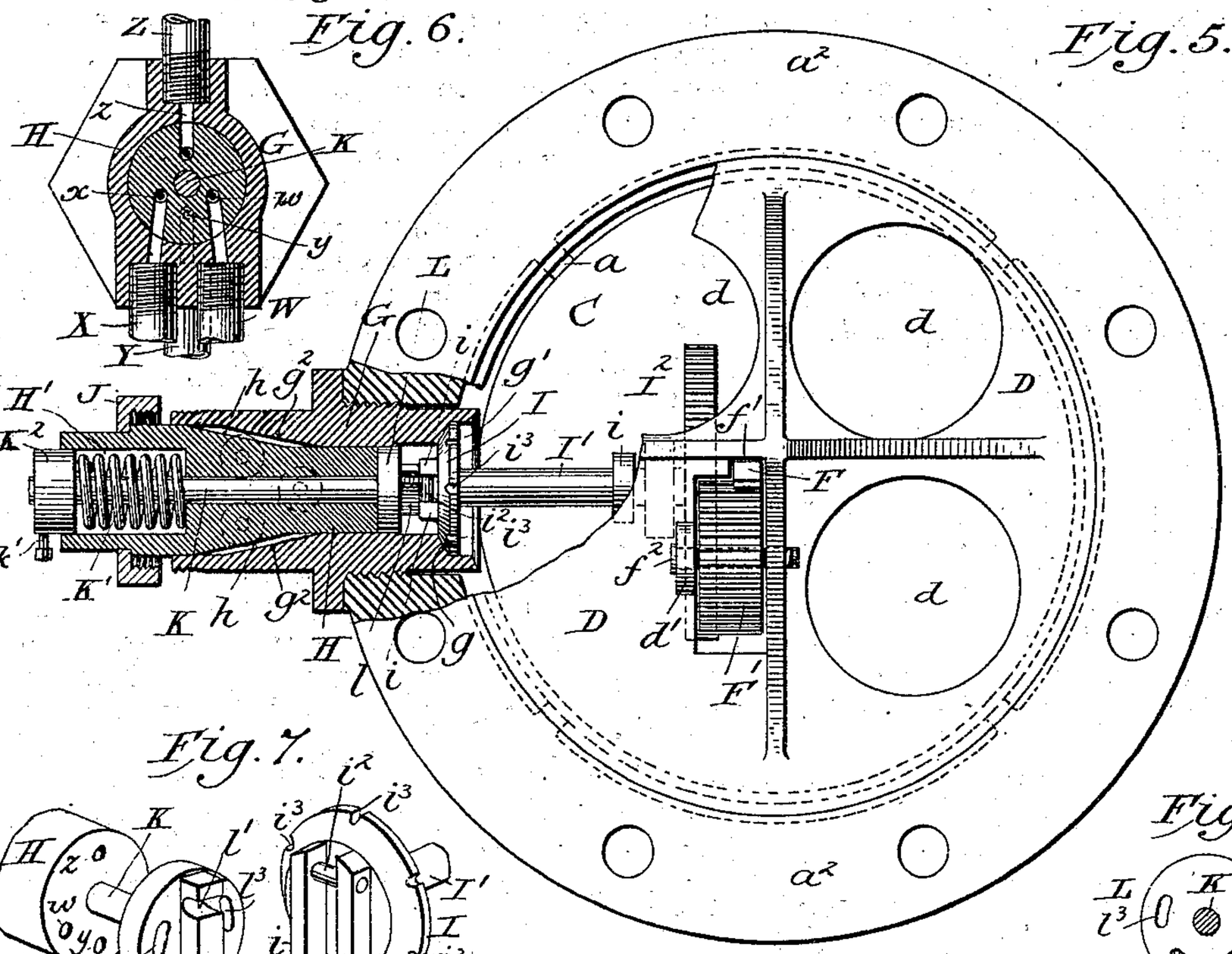


Fig. 7.

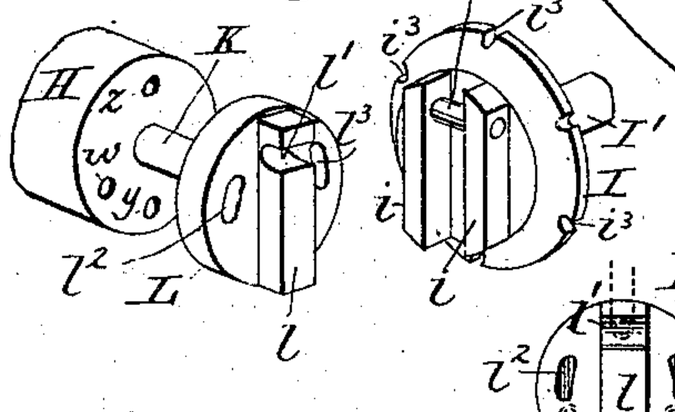


Fig. 8.

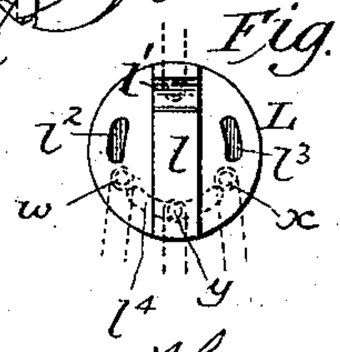


Fig. 9.

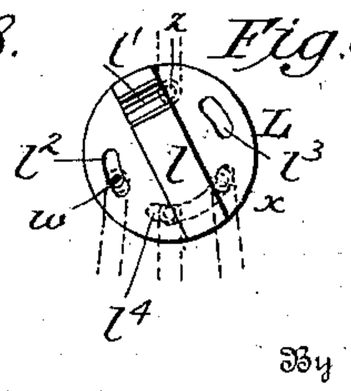


Fig. 11.

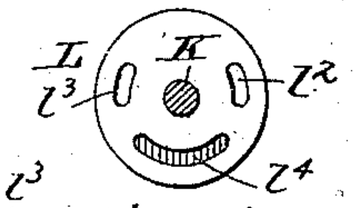
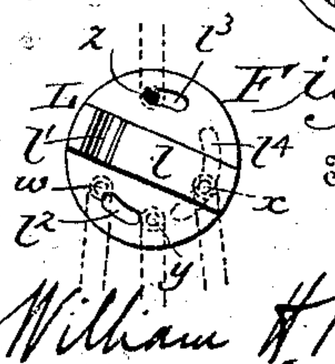


Fig. 10.



Witnesses

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UNITED STATES PATENT OFFICE.

WILLIAM H. BERRY, OF CHESTER, PENNSYLVANIA.

FEED-WATER REGULATOR.

SPECIFICATION forming part of Letters Patent No. 726,792, dated April 28, 1903.

Application filed June 2, 1902. Serial No. 109,952. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. BERRY, a citizen of the United States, residing at Chester, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Feed-Water Regulators, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

My invention relates principally to a feed-water regulator for steam-boilers in which a vertical water-column in communication with a steam-boiler above and below the water-line serves as a guide and chamber for a float connected by suitable mechanism to an oscillating disk valve having ports therein which as the float rises and falls register with suitable passages leading to a pressure-operated valve in a feed-water pipe or by-pass, a pressure-operated throttle-valve, belt-shifter, or other mechanism similarly operated and which more or less remotely governs the automatic means for regulating the quantity of water entering the boiler.

My invention also includes an alarm which is caused to sound when the water-level in the boiler approaches the danger-point, either above or below normal, by an increased movement of the oscillating disk valve produced by excessive rise or fall of the float.

Other important features of my invention will be described hereinafter and pointed out in the claims.

Referring to the drawings, Figure 1 represents, on a reduced scale, an elevation of my invention as it appears when in use. Figs. 2 and 3 are vertical sections thereof on larger scale, the views being at right angles to each other. Fig. 4 is an enlarged sectional view, similar to Fig. 2, of the upper end of the water-column. Fig. 5 is a plan view of my invention, on the same scale as Fig. 4, with the cap removed and certain parts shown in section. Fig. 6 is a cross-section on the line 6 6 of Fig. 4. Fig. 7 is a perspective view of the valves detached and separated. Figs. 8, 9, and 10 illustrate different positions assumed by one of the valves in the operation of the invention. Fig. 11 is a view of the opposite side of said valve.

Similar letters of reference indicate similar parts in the respective figures.

A tubular water-column A, to which the sight-gage A′ and try-cocks A^2 are attached, is preferably formed or cast integrally with the bottom and the internally-projecting ribs a'. A cap A^3, bolted to a flange a^2, closes the top of the water-column A. Pipes B B′ connect the water-column at its top and bottom, respectively, to a boiler in a manner well understood, the pipe B entering the boiler above the water-level and the pipe B′ below it.

Within the water-column A is placed a float C, adapted to rise and fall as the water in the boiler increases or diminishes, the ribs a' serving to guide the float and hold it in vertical position and prevent it from closing any of the openings in the side and bottom of the said column. A plate D, strengthened by ribs on its upper surface and having openings d for the passage of steam, is secured to the top of the water-column by the cap A^3. A lug d' is formed on the top of the plate D, while from its under side depend projections d^2 d^3. To the projection d^3 is pivoted one end of a series of jointed compound levers or a "lazy-tongs" E, the opposite end being pivotally connected to the top of the float C. As the float rises and falls the lazy-tongs will close or extend in the usual manner.

A toothed rack F, pivoted at f to the lazy-tongs, projects upwardly through a hole or guide f' in the plate D and engages with a broad-faced gear-wheel F′, mounted on a pin f^2, between the lug d' and one of the ribs on the top of the plate D. The rise and fall of the float C, operating the lazy-tongs, imparts to the rack F a vertically-reciprocating movement, which in turn oscillates the gear-wheel F′.

Threaded or otherwise secured to the water-column A near its upper end is a valve-casing G, centrally bored to receive a tapered plug H. The inner end of the valve-casing G is formed with a tapered valve-seat g and a cylindrical bearing g', within which bearing a check-valve I, the outer face of which is beveled to fit the seat g, is adapted to oscillate and move freely in an axial direction. The check-valve I is rigidly attached to one end of a rock-shaft I′, journaled in the depending projection d^2, and on the opposite end of said shaft is fixed a toothed segment I^2 in engagement with the broad-faced gear-

wheel F'. A collar *i* limits the end movement of the shaft I' in one direction, its movement in the opposite direction being arrested when the valve I abuts against the valve-seat *g*. The gear-wheel F' is of sufficient width to permit the toothed segment I^2 to move with the shaft I' without becoming disengaged therefrom. The oscillation of the gear-wheel F' through the segment I^2 gives the shaft I' and the check-valve I a similar movement, for a purpose hereinafter explained.

The plug H has a central external tapered portion *h*, ground to fit a similarly-tapered bore g^2 in the valve-casing G, and cylindrical ends of different diameters which fit easily within suitable bores in the valve-casing. The plug H is held in place by means of a nut J, threaded on the outer end of the valve-casing and bearing against a shoulder *h'* on the plug H.

Extending longitudinally through the plug H is a shaft K, axially in line with the shaft I', on the inner end of which is secured a disk valve L, its flat outer face being ground to fit steam-tight against the inner end of the plug H. An axial socket H' in the outer end of the plug H receives a coiled torsional spring K', which surrounds the shaft K, one end of said spring being attached to a pin *k*, fixed to the plug H, and the other end to an adjustable collar K^2 on the outer end of the shaft K. A screw-bolt *k'* holds the collar in such position that the torsional strain of the spring K' will overcome any friction and take up all lost motion in the parts.

From the inner face of the disk valve L projects a rib *l*, Fig. 7, adapted to fit when the parts are in operative position between two ribs *i'* on the check-valve I. When the valves are properly assembled, a pin i^2 extends between the ribs *i'* and enters a notch *l'* in the rib *l*. Two short curved ports l^2 l^3 extend through the disk valve L, (see Figs. 7 to 11,) while a third and longer port l^4 in the bearing-face of the valve extends but partly through it. The periphery of the valve I is notched, as at i^3, for the passage of steam from the water-column A.

Ports or passages *w* *x* are formed in the plug H and valve-casing G, (see Figs. 4, 5, and 6,) connecting, respectively, with pipes W and X, leading to opposite ends of a cylinder V, (see Fig. 1,) within which is a piston adapted to open and close a valve U of the feed-water pipe T. The port *y* connects with an exhaust-pipe Y, and the port *z* to a pipe Z, to which a whistle is attached.

In the following description of the operation of my invention let it be assumed that the parts are in their normal position, as shown in Figs. 2, 3, 4, 6 and 8, the water in the boiler being on a level with the middle try-cock. As evaporation progresses the water-level falls and the float C moves with it, lengthening the lazy-tongs connection and drawing down the rack F, which latter turns the gear-wheel F' in the direction of the arrow in Fig. 3. The segment I^2 in gear with said wheel moves at the same time in an opposite direction, the shaft I' and check-valve I turning with it. Through the medium of the connecting-ribs *i i* and *l* the disk valve L turns in unison with the check-valve I against the torsion of the spring K'. The float continuing to fall as the water evaporates, the disk valve L will finally be moved to the position shown in Fig. 9, which represents the passage *w* in the plug H opening through the port l^2 into the steam-space of the water-column by way of the notches i^3 around the check-valve I and the passage *x* brought into communication with the exhaust-passage *y* by the port l^4. In this position of the valve I steam will pass through the pipe W to the cylinder V of the feed-water valve U, raise the piston in the cylinder, and open the valve for the passage of water to the boiler. Any air or steam above the piston will escape through the pipe X and exhaust-pipe Y. If the valve U fails to operate or from some other cause water cannot enter the boiler in sufficient quantity to equalize the evaporation, the float C will continue to fall and turn the valve L to the position shown in Fig. 11, bringing the port l^3 into communication with the passage *z*, leading to the whistle, which will sound a warning and continue to sound until the defect has been corrected. As the boiler gradually fills the float rises, the disk valve L closes the passages, and the parts resume their normal position. Should water rise too high in the boiler, the disk valve L will be turned in the opposite direction, admitting steam through the port l^3, the passage *x*, and the pipe X to the cylinder above the piston, closing the valve U. Continued increment of water in the boiler will cause the valve L to turn sufficiently far to open the passage *x* through the port l^2 and sound the alarm, as before. The continued oscillation of the disk valve L on the inner end of the plug may in time cause unequal wear and leakage of steam. It is important, therefore, that the plug H and the valve L may be capable of ready removal from the casing G without reducing the pressure of steam within the column and that they may be replaced accurately with reference to the position of the check-valve I. This I accomplish in a manner now to be described. When the plug H and disk valve are to be withdrawn, the nut J is unscrewed and the plug, with the valve L attached, drawn out. The check-valve I is immediately forced to its seat *g* in the valve-casing G by the pressure of steam behind it, effectually closing the bore from which the plug was removed. After grinding the valve L to its seat the plug is replaced within the valve-casing. The parts are so proportioned that the nut J cannot be screwed to the valve-casing unless the valves I and L are in proper relation to each other, as the ribs *i i* and *l* abut. (See Fig. 5.) The valves must be in such relation that the rib *l* may pass between

the ribs *i i* and the pin i^2 enter the notch *l'* in the rib *l*. The plug must, therefore, be rotated until the parts are in proper position, when it may be pushed in place and secured by the nut J. The act of pushing the plug home unseats the check-valve I, permitting steam to pass, as before, through the notches around said valve I. The width of the gear-wheel F' is such that the segment I^2 always remains in engagement therewith.

The plug H may be rotated within certain limits to adjust or vary the water-level in the boiler without necessarily shutting off steam to the pipes W, X, Y, and Z, the limit of movement being determined by the size of the passages *w*, *x*, *y*, and *z* where they pass through the plug H and valve-casing G. These openings being larger than necessary, they are therefore not required to register exactly.

Rotation of the plug H to the right or the left will change the relation of the entrances to the passages *w*, *x*, *y*, and *z* with the ports in the valve L, which change will cause an increase or decrease in the height of water in the boiler by advancing or retarding the flow of steam to the piston-operated valve U.

I do not restrict myself to the exact details of construction, combination, and arrangement herein set forth, it being obvious that minor variations thereof not involving the exercise of invention may be made by the skilled mechanic, and such departures from what is herein described and claimed not involving invention I consider as within the scope and terms of my claims.

Having thus described my invention, I claim—

1. In a boiler-feed regulator, the combination of a water-column having longitudinal ribs disposed around its inner surface; a cylindrical float guided and centralized throughout its movement by said ribs, an oscillating disk valve in which are formed ports adapted to control passages leading to a pressure-operated feed-valve, and an exhaust therefrom, and means operated by the float for oscillating said valve to open and close said passages, substantially as set forth.

2. In a boiler-feed regulator, the combination of a water-column, a float therein, an oscillating disk valve in which are formed ports adapted to control passages leading to a pressure-operated feed-valve, an alarm, and an exhaust-passage from said pressure-operated valve, and means operated by the float for oscillating said valve to open and close said passages, substantially as set forth.

3. In a boiler-feed regulator, the combination of a water-column, a float therein, a removable plug having a valve-seat on one end and passages formed therein opening onto the valve-seat, an oscillating disk valve provided with ports and adapted to control said passages, and means operated by the float for oscillating said valve to open and close said passages, substantially as set forth.

4. In a boiler-feed regulator, the combination of a water-column, a float therein, a removable plug having passages therein, a valve guarding said passages and having a stem passing axially through said plug, a spring connected to the plug and to the valve-stem, and means operated by the float for opening and closing said passages through the movement of said valve, substantially as set forth.

5. In a boiler-feed regulator, the combination of a water-column, a float therein, a check-valve I normally held away from its seat but adapted to be oscillated by the rise and fall of the float, a removable plug having passages therein, a valve L guarding said passages, and a connection between the two valves whereby they are caused to oscillate in unison, substantially as set forth.

6. In a boiler-feed regulator, the combination of a water-column, a float therein, a check-valve I normally held away from its seat but adapted to be oscillated by the rise and fall of the float, a removable plug having passages therein, a valve L guarding said passages, and holding the check-valve I away from its seat, and a connection between the two valves whereby they are caused to oscillate in unison, substantially as set forth.

7. In a boiler-feed regulator, the combination of a water-column, a float therein, a check-valve I adapted to be oscillated by the rise and fall of the float, a seat for the valve I, a removable plug, a valve L having a stem journaled in said plug, the check-valve I being adapted to move axially to its seat when the plug is removed, and means for connecting the valves to cause them to oscillate in unison, said means being operative only when said valves are in proper working relation to each other, substantially as set forth.

8. In a boiler-feed regulator, the combination of a water-column, a float therein, a removable plug, a valve L journaled in the plug, a check-valve I adapted to be oscillated by the rise and fall of the float and to close the bore when the plug and valve L are removed, and means for connecting the valves to cause them to oscillate in unison, only when said valves are in proper working relation to each other, substantially as set forth.

9. In a boiler-feed regulator, the combination of a water-column, a float therein, a removable plug, a valve L journaled in the plug, a check-valve I adapted to be oscillated by the rise and fall of said float, and to close the bore when the plug and valve L are removed, means for connecting the valves to cause them to oscillate in unison, and means for preventing the seating of the plug in its bore only when the connecting means between valves I and L are in operative position, substantially as set forth.

10. In a boiler-feed regulator, the combination of a water-column, a float therein, a removable plug having ports or passages therein, and a valve-seat on one end, a valve guarding said ports or passages operated by varia-

tions in height of the water-level through the medium of the float and its connections, and means for preventing the escape and thereby lowering the boiler-pressure when the aforesaid plug and valve are removed, substantially as set forth.

11. In a boiler-feed regulator, the combination with a water-column of a plug having steam-passages therein and a valve for guarding said passages removably connected to said water-column, and means for preventing the escape of steam when said plug and valve are removed, substantially as set forth.

12. In a boiler-feed regulator, the combination with a water-column, of a plug having steam-passages therein and a valve for guarding said passages removably connected to said water-column, means for rocking said valve, and means for preventing the escape of steam when said plug and valve are removed, substantially as set forth.

13. In a boiler-feed regulator, the combination of a water-column, a float therein, a system of compound levers or lazy-tongs attached to the float and to a fixed part of the water-column, an oscillating check-valve, gear mechanism between the lazy-tongs and said check-valve, and means operated by said check-valve for controlling the admission and exhaust of steam to and from a pressure-operated valve on the feed-water pipe, substantially as set forth.

14. In a boiler-feed regulator, the combination of a water-column, a float therein, a system of compound levers or lazy-tongs attached to the float and to a fixed part of the water-column, an oscillating check-valve normally held unseated, and steam-balanced gear mechanism operated by said lazy-tongs for oscillating said check-valve, and means connected to said valve for controlling the admission and exhaust of steam to and from a pressure-operated valve on the feed-water pipe, substantially as set forth.

15. In a boiler-feed regulator, the combination of a water-column, a float therein, a system of compound levers or lazy-tongs attached to the float and to a fixed part of the water-column, a check-valve arranged to be oscillated by means of gearing operated by the lazy-tongs as the float rises and falls, and a disk valve oscillated by the check-valve, to control ports leading to and from a pressure-operated valve on the feed-water pipe, substantially as set forth.

16. In a boiler-feed regulator, the combination of a water-column, a float therein connected to the top of the water-column by a system of compound levers, a check-valve arranged to be oscillated by means connected to said compound levers, a removable plug having passages formed therein seated in the water-column axially in line with the check-valve, and a disk valve controlling the passages in the plug and adapted to be oscillated by the check-valve, substantially as set forth.

In testimony whereof I hereunto set my hand and seal.

WILLIAM H. BERRY. [L. S.]

Witnesses:

HENRY W. JONES,

FRANK INNIS.