No. 716,982. Patented Dec. 30, 1902.

J. A. BALDWIN.

AUTOMATIC BOILER FEED CONTROLLING VALVE.

(Application filed Nov. 29, 1901.)

(No Model.) 3 Sheets—Sheet 1.

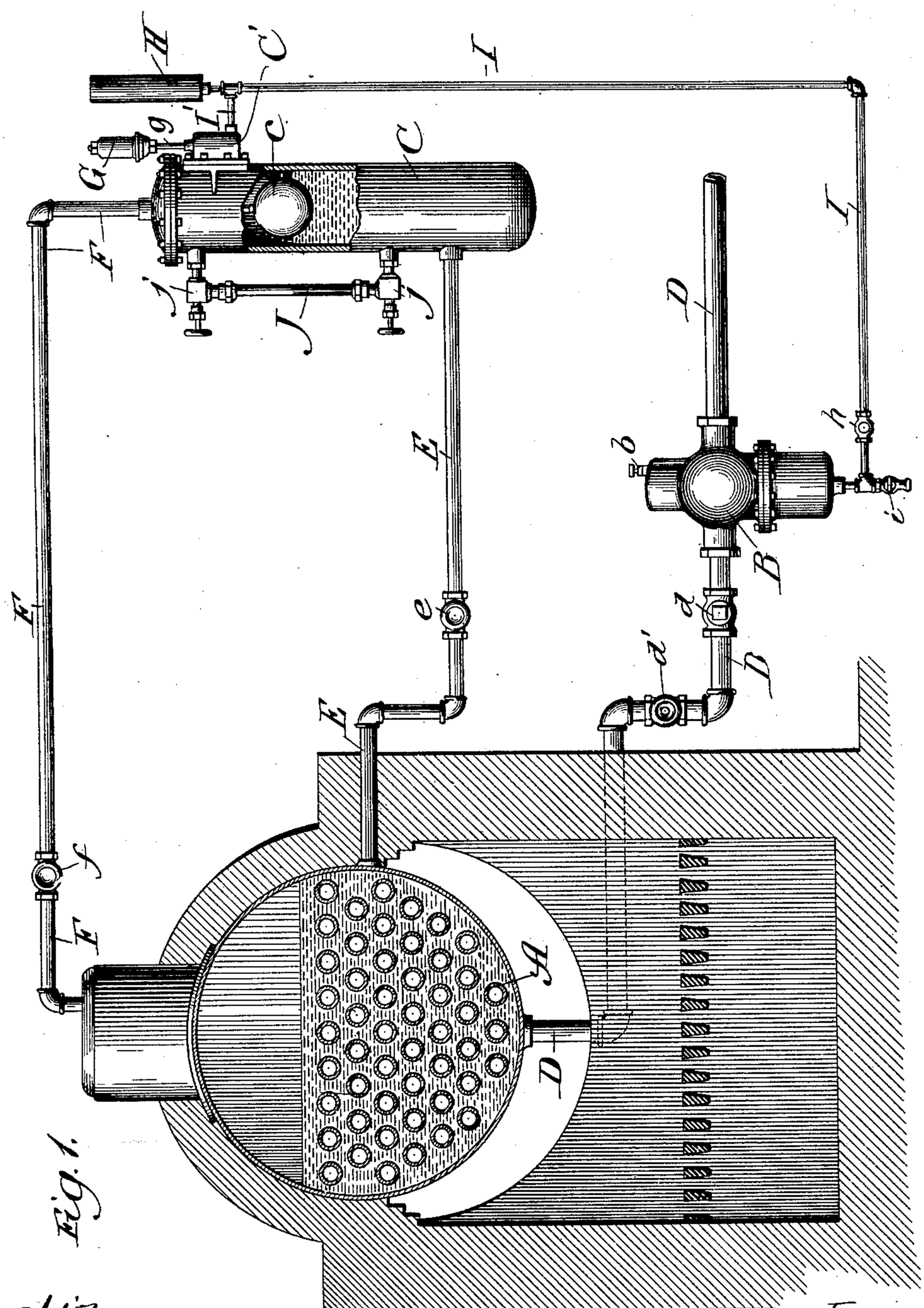

Fig. 1.

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Fig. 2.

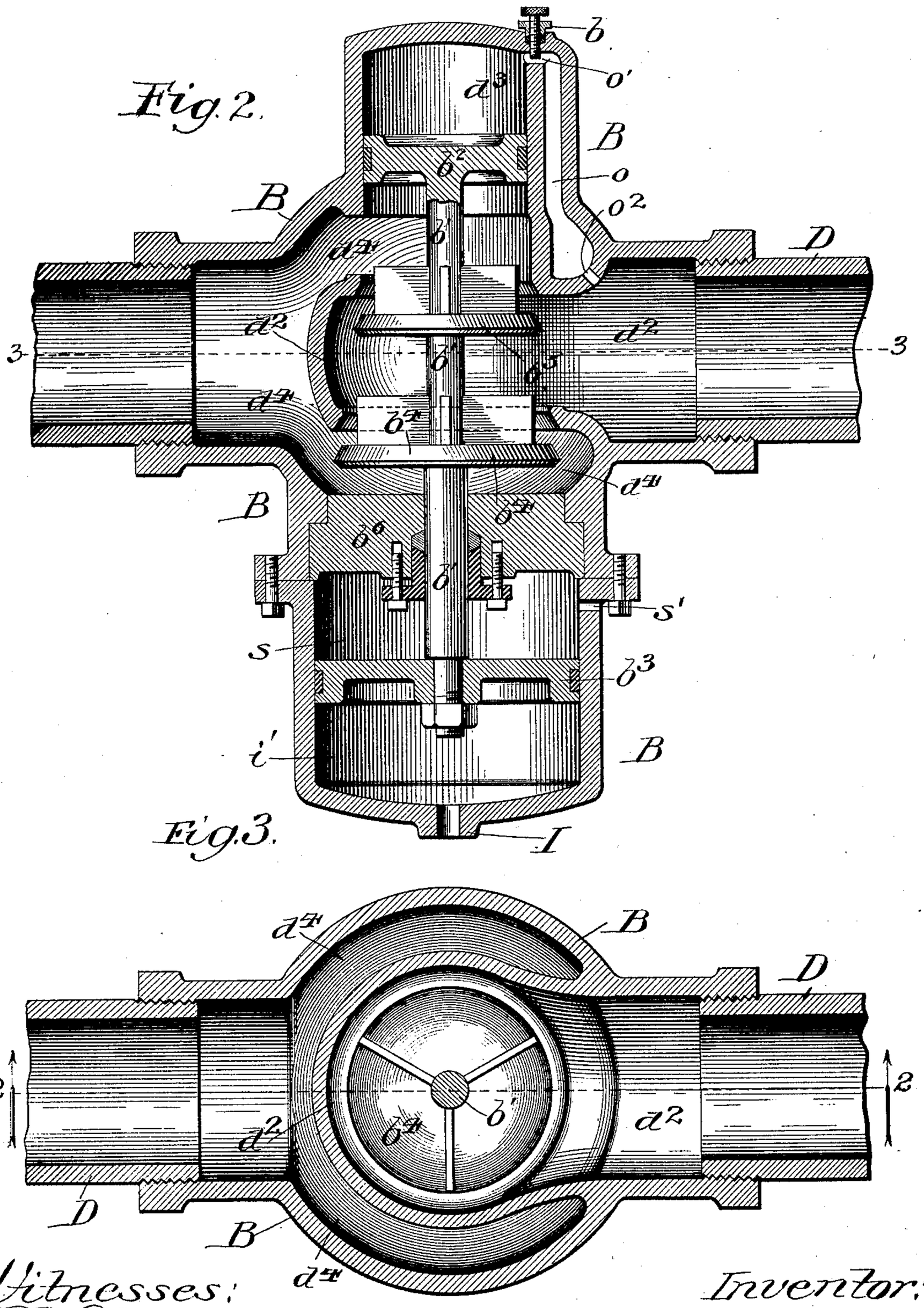

Fig. 3.

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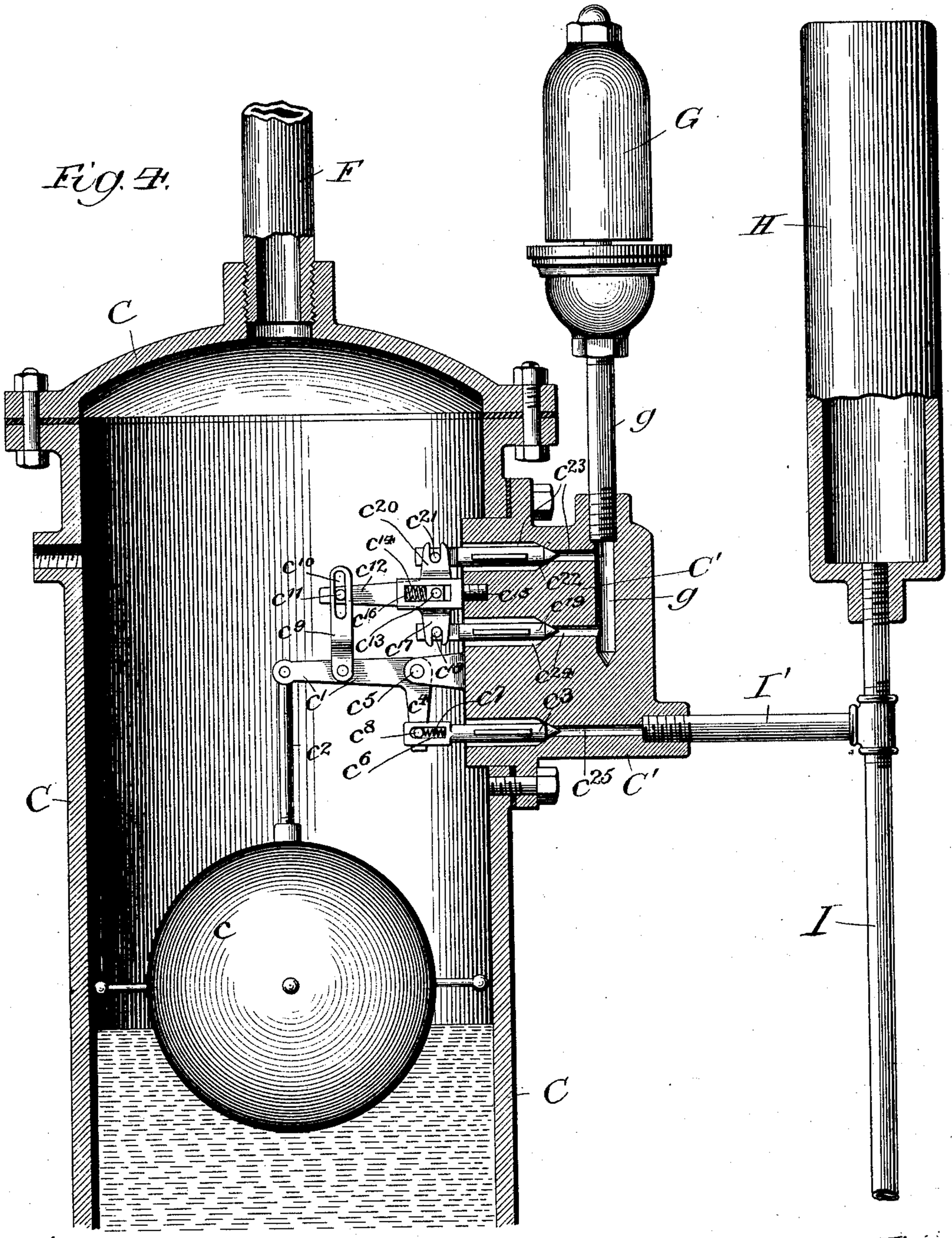
Fig. 4.



Witnesses:
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UNITED STATES PATENT OFFICE.

JUDSON A. BALDWIN, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO JAMES McCREA & CO., OF CHICAGO, ILLINOIS, A CORPORATION.

AUTOMATIC BOILER-FEED-CONTROLLING VALVE.

SPECIFICATION forming part of Letters Patent No. 716,982, dated December 30, 1902.

Application filed November 29, 1901. Serial No. 84,136. (No model.)

To all whom it may concern:

Be it known that I, JUDSON A. BALDWIN, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Automatic Boiler-Feed-Controlling Valves, of which the following is a specification.

My invention consists of an automatic controlling-valve to regulate the feed-water supply to the boiler and maintain a certain water-level in the boiler at all times. My valve is situate in the feed-water pipe to the boiler and is worked and controlled by a float in a water-column located without the boiler and on a level with it. This float is by mechanism more particularly described hereinafter enabled to operate certain needle-valves located in the steam-pipe, and thereby to control the supply of steam therein, and in consequence thereof to control the operation of the valve in the water-supply pipe and the amount of the water passing through the same in the manner more particularly set forth hereinafter.

In the drawings accompanying and made a part of this specification like letters refer to like parts in the various figures.

Figure 1 is a diagrammatic view showing all the major parts in their relative positions. Fig. 2 is a perpendicular sectional view of my controlling-valve cut on line 2 of Fig. 3 as seen in the direction of the arrow-point. Fig. 3 is a transverse sectional view of my controlling-valve cut on line 3 of Fig. 2 as seen in the direction of the arrow-point. Fig. 4 is a sectional view of my water-column cut perpendicularly, showing in detail the working of the parts therein and thereto attached.

The major parts of my invention and parts essentially connected thereto are represented as follows:

A, Fig. 1, is a boiler or steam-generator.

B, Figs. 1, 2, and 3, represents my controlling-valve.

C, Figs. 1 and 4, is my water-column.

D, Figs. 1, 2, and 3, is the supply water-pipe to the boiler A.

E, Fig. 1, is a water-pipe leading from a point below the water-line in the boiler A to the lower end of my water-column C.

F, Figs. 1 and 4, is a steam-pipe leading from a point above the highest water-line in the boiler A to the top of the water-column C.

G, Figs. 1 and 4, is a steam alarm-whistle connected to and operated from the top of my water-column C by mechanism therein described hereinafter.

H is a steam-condensing chamber.

I, Figs. 1 and 4, is a steam-pipe connecting the bottom of the condensing-chamber H with the water-chamber *c* and the bottom of controlling-valve B.

J is a glass water-gage connected with my water-column C (or elsewhere to the boiler A) by means of valves *j j'*.

The minor parts of my device are represented as follows:

On the exterior of my controlling-valve B is located *b*, Figs. 1, 2, and 3, which is a regulating-screw and only necessary to properly regulate the workings thereof. In the interior of my controlling-valve B is a vertical stem *b'*. To the upper end of this stem *b'* is fixed a piston-head b^2 and to the lower end a piston-head b^3, both of which piston-heads are suitably provided with packing-boxes. To this stem *b'* is also fixed two interior valves b^4 and b^5 of unequal diameters, that of b^4 being greater than that of b^5. On the interior of my controlling-valve B, Fig. 2, is also a stationary head b^6, through which the vertical stem *b'* operates.

Within my controlling-valve B, Fig. 2, are three water-chambers d^2, d^3, and d^4, (d^2 being connected with d^3 by means of a duct *o* and orifices *o'* and o^2,) one steam-chamber *i'*, and an atmospheric chamber *s*, having an external opening *s'* from its upper extremity.

In the interior of my water-column C, Figs. 1 and 4, is placed a float *c* in such a manner as to allow a perpendicular movement and with a buoyancy sufficient to operate the mechanism thereto connected and now to be described.

c', now to be described, is an L-shaped lever connected with a stem c^2 of the float C and operated thereby.

c^3 is a needle-valve operated by the arm c^4 of the L-shaped lever *c'*, which moves about a fulcrum c^5 on the interior of the wall of my water-column C. The needle-valve c^3 is pro-

vided with a slot c^6, within which is placed a coil-spring c^7 and a holding-pin c^8, affixed in the arm c^4 of the L-shaped lever c' for the purpose hereinafter more particularly described. On the L-shaped lever c' is movably affixed a link-bar c^9, in the upper end of which is a slot c^{10}, operating loosely upon a pin c^{11} in a T-shaped lever c^{12}. This T-shaped lever c^{12} is provided with a pin c^{13}, which operates loosely in the slot c^{14} of the bifurcated slotted post c^{15}, firmly fixed to the interior wall of water-chamber C. Within the outer end of the slot c^{14} of the bifurcated slotted post c^{15} is a coil-spring c^{16}, which operates against the pin c^{13} of the T-shaped lever c^{12}. The lower arm c^{17} of the T-shaped lever c^{12} operates upon the pin c^{18} of the needle-valve c^{19} to pull the latter inward when the pin c^{11} and the T-shaped lever c^{12} are pushed upward, and the upper arm c^{20} of the same acts pivotally upon the pin c^{21} of the needle-valve c^{22} as a fulcrum. Likewise the upper arm c^{20} of the T-shaped lever c^{12} operates upon the pin c^{21} of the needle-valve c^{22} to pull the latter inward when the pin c^{11} and the T-shaped lever c^{12} are pushed downward, and the lower arm c^{17} of the same acts pivotally upon the pin c^{18} of the needle-valve c^{19} as a fulcrum, all for the purpose hereinafter stated.

In a thickened portion C′ of the wall of my water-column C are apertures c^{23} and c^{24}, communicating with the stem g of the alarm-whistle G, and an aperture c^{25}, communicating with the joint I′ of the steam-pipe I, all for the purpose hereinafter set forth.

In Fig. 1 certain stop-valves are represented at d, d', e, f, and h which are not essential to the working of my device, but are necessarily to be used in case of removal and replacement of the same.

The purpose and operation of my automatic controlling-valve are as follows: When there is a greater pressure of water than steam in the pipes, acting together with the air-pressure in the air-chamber I, my controlling-valve B will be open, as will be seen in Fig. 2. If more water continues to flow to the boiler A, Fig. 1, it will flow through the pipe D, Figs. 1, 2, and 3, passing into the water-chamber d^2, through the two interior valves b^4 and b^5 into the water-chamber d^4, and thus on into the boiler A, at the same time filling the water-chamber d^3 of my controlling-valve B. When the water in the boiler A reaches the maximum height, as indicated in the water-gage J, Fig. 1, and to which the interior mechanism of my water-column C has been adjusted to be controlled by a change of the water-level and the action of the float c, the parts will be in the position seen in Fig. 4. Should the inflow of water be greater than the evaporation, the water-level will rise. This action will push the float c upward, and its operation through the L-shaped lever c' and its arm c^4 will open the needle-valve c^3, admitting steam into the joint I′ of the steam-pipe I and through it upward into the condensing-chamber H and downward into the steam-chamber i', Fig. 2, in the lower part of the controlling-valve B and against the piston-head b^3, Fig. 2. This pressure of steam beneath the piston-head b^3 (action being permitted because of the atmospheric chamber s having an exterior opening s') will cause the perpendicular stem b' and its attendant valves b^4 and b^5 to rise and close the communication between the water-chambers d^2 and d^4, thereby stopping the flow of water through the pipe D into the boiler A. The water-supply being cut off in the manner last above shown, the evaporation in the boiler A will lower the water-level therein and in the water-column C, causing the float c to fall in consequence thereof. By the downward movement of the float c the L-shaped lever c', Fig. 4, will be depressed and, moving upon the fulcrum c^5, the arm c^4 by its pin c^8, acting upon the coil-spring c^7 in the slot c^6 in the needle-valve c^3, will drive it into the aperture c^{25}, and will thereby cut off the flow of steam from the joint I′ of the steam-pipe I. The condensation of steam within the condensing-chamber H, Figs. 1 and 4, acting through the steam-pipe I and steam-chamber i' of my regulating-valve B, will relieve the pressure beneath the piston-head b^3 therein. The pressure of the water within the water-chambers d^2 and d^3, acting upon the piston-head b^2 and interior valve b^4, together with the weight of the parts and regardless of the less pressure of water beneath the interior valve b^5, will drive the stem b' and its attendant parts downward, again opening communication between the water-chamber d^2 and d^4, thereby permitting a flow of water through the water-pipe D into the boiler A, as before.

A steady action of my controlling-valve when influenced by the pulsation of the pump is insured by the water in the water-chamber d^3 in the upper part of my controlling-valve B when acted upon by the movement of the piston-head b^2 having to make ingress and egress through the orifices o' and o^2 of the duct o in its communication with the water in the water-chamber d^2, the freedom or restriction of which ingress and egress is regulated by the screw b. Such is the normal action of my automatic boiler-feed-controlling valve.

Safety in the event of abnormal action of any of the above-described parts of my invention or of any of the parts of the mechanism necessarily connected therewith and operating thereupon I have insured by the following-described parts and their operation. By reference to Fig. 4 it will be seen that slot c^{10} in the link c^9, attached to the lever c', permits of much movement of the float c without disturbing the T-shaped lever c^{12} or its attendant parts. This freedom of movement is limited to the positions of the float c at the desired maximum and minimum levels of the water in the boiler A and water-column C. If the water rises above the maximum level,

the action will be as follows: The link c^9 at the lower limitation of the slot c^{10} will act against the pin c^{11}, producing an upward movement of the T-shaped lever c^{12}, and by its arm c^{20} acting upon the pin c^{21} of the needle-valve c^{22} as a fulcrum will move the arm c^{17} inward, such movement being permitted by the loose action of the pin c^{13} (of said T-shaped lever) within the slot c^{14} of the fulcrum c^{15} and against the coil-spring c^{16} therein. This inward movement of the arm c^{17} will be communicated to the needle-valve c^{19} by means of its pin c^{18}, thereby withdrawing it from the aperture c^{24} in the thickened walls C′ of the water-column C, admitting of a flow of steam through the stem g of the alarm-whistle G, thereby giving warning to the man in attendance, who by an inspection of the water-gage J (shown in Fig. 1) can determine whether it is because of too much or too little water in the boiler. If the water falls below the minimum level in the boiler A and water-column C, an exact reverse movement of the T-shaped lever c^{12} will be caused, producing a like movement of the arm c^{20} as that described of the arm c^{17} and by the operation of its attendant parts will admit a flow of steam to the alarm-whistle G in like manner.

Having thus described my device, what I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. A boiler-feed-controlling valve to be applied to a feed-water pipe to steam-boilers, consisting essentially of three water-chambers, two of which communicate directly with the feed-water pipe, and one of which is exterior to a water-piston; a steam-chamber communicating by means of a pipe with the steam-space in a boiler; a stem carrying two pistons of unequal areas and two valves of unequal areas, the larger of which pistons is located on one extreme of said stem and within the steam-chamber, and the smaller of which pistons is located on the other extreme of the stem and separates the water-chamber nearest the pump from the exterior water-chamber, the valves on such stem being placed at points between its extremities; suitable valve-openings between the two water-chambers, which communicate directly with the feed-water pipe; a stationary head between the steam-chamber and the adjacent water-chamber, through an orifice in which head the stem extends and is free to move, the same being packed to prevent the escape of water; an adjustable opening between the water-chamber exterior to the water-piston and the one of the other two water-chambers which is nearest the pump; and an exterior opening from that part of the steam-chamber which is on the opposite side of the steam-piston from the part into which the steam is admitted, all substantially as and for the purpose set forth.

2. In combination with a steam-boiler, a water-pump and a feed-water pipe, which connects the pump and boiler; a boiler-feed-controlling valve in the water-supply pipe consisting of three water-chambers, two of which communicate directly with the feed-water pipe and with each other by two valve-openings having unequal areas, and the third of which is separated from the one of the other two which is nearest the pump by a water-piston and communicates with it through an adjustable opening; a steam-chamber fitted with a piston, on one side of which piston such steam-chamber receives steam from the boiler, and on the other side of which piston such steam-chamber is provided with an exterior orifice; a stem carrying at one extremity a piston located in the steam-chamber, and at the other extremity a smaller piston separating the water-chamber exterior thereto from the one of the other two which is nearest the pump, and carrying also two valves of unequal areas adjusted to the two valve-openings between the two water-chambers connecting directly with the water-supply pipe; a stationary head separating the steam-chamber from the adjacent water-chamber, through which pipe the flow of steam is regulated by suitable mechanism, all substantially as and for the purpose set forth.

3. In combination with a steam-boiler, a water-pump and a feed-water pipe, which connects the pump and boiler; a boiler-feed-controlling valve in the water-supply pipe consisting of three water-chambers, two of which communicate directly with the feed-water pipe and with each other by two valve-openings having unequal areas, and the third of which is separated from the one of the other two which is nearest the pump by a water-piston and communicates with it through an adjustable opening; a steam-chamber fitted with a piston, on one side of which piston such steam-chamber receives steam from the boiler, and on the other side of which piston such steam-chamber is provided with an exterior orifice; a stem carrying at one extremity a piston located in the steam-chamber, and at the other extremity, a smaller piston separating the water-chamber exterior thereto from the one of the other two which is nearest the pump, and carrying also two valves of unequal areas adjusted to the two valve-openings between the two water-chambers connecting directly with the water-supply pipe; a stationary head separating the steam-chamber from the adjacent water-chamber, through which pipe the flow of steam is regulated by mechanism, consisting of a water-column containing a float, a needle-valve, an L-shaped lever and a fulcrum on the interior wall of such water-chamber, which float, by its lifting power, actuates the needle-valve to open, and by its weight to close the steam-pipe by means of the L-shaped lever acting on the fulcrum, to which and to the float and needle-valve it is suitably at-

tached, all substantially as and for the purpose set forth.

4. In combination with a steam-boiler, a water-pump and a feed-water pipe, which connects the pump and boiler; a boiler-feed-controlling valve in the water-supply pipe consisting of three water-chambers, two of which communicate directly with the feed-water pipe and with each other by two valve-openings having unequal areas, and the third of which is separated from the one of the other two which is nearest the pump by a water-piston, and communicates with it through an adjustable opening; a steam-chamber fitted with a piston, on one side of which piston such steam-chamber receives steam from the boiler, and on the other side of which piston such steam-chamber is provided with an exterior orifice; a stem carrying at one extremity a piston located in the steam-chamber, and at the other extremity a smaller piston separating the water-chamber exterior thereto from the one of the other two which is nearest the pump, and carrying also two valves of unequal areas adjusted to the two valve-openings between the two water-chambers connecting directly with the water-supply pipe; a stationary head separating the steam-chamber from the adjacent water-chamber, through a packed opening in which head the stem is made to work; and a steam-pipe connecting the steam-chamber with the steam-space in the boiler, through which pipe the flow of steam is automatically regulated by mechanism consisting of a water-column having its lower portion connected with water in the boiler by means of a water-pipe, and its upper portion connected with the steam in the boiler by means of a steam-pipe, a float, an L-shaped lever, a needle-valve containing a slot with coil-spring therein, and a fulcrum, geared together loosely by pins, and acting together to open the steam-pipe connecting with the steam-chamber of my boiler-feed-controlling valve by means of the lifting power of the float, and to close such steam-pipe by the weight of the float; a slotted link-bar, a T-shaped lever, two needle-valves controlling openings into a steam-pipe leading to an alarm-whistle, a bifurcated slotted post, having a coil-spring in the slot thereof, pins gearing these parts together and to the L-shaped lever actuated by the float; and a steam-condensing chamber opening from the steam-pipe communication between the water-column and the steam-chamber of my boiler-feed-controlling valves, all substantially as and for the purpose set forth.

5. In a boiler-feed-controlling valve, automatic control of steam-supply and alarm-whistle, consisting essentially of a water-column, a water-pipe connecting the bottom of the same with the water in a boiler, a steam-pipe connecting the top of the same with the steam in a boiler, a steam-pipe connecting the same to the steam-chamber of the boiler-feed-controlling valve, a float, an L-shaped lever, a needle-valve containing a slot with coil-spring therein, and fulcrum, geared together loosely by pins and acting together by the lifting power of the float to open, and by its weight to close the steam-pipe connecting the water-column with the steam-chamber of the boiler-feed-controlling valve; a slotted link-bar, a T-shaped lever, two needle-valves controlling openings into a steam-pipe leading to an alarm-whistle, a bifurcated slotted post having a coil-spring in the slot thereof, pins gearing these parts together and to the L-shaped lever actuated by the float; and a steam-condensing chamber opening from the steam-pipe communicating between the water-column and the steam-chamber of the boiler-feed-controlling valve, all substantially as and for the purpose set forth.

6. An automatic controlling-valve having interior chambers separated by valve-surfaces of unequal areas and interior pistons of unequal areas operated upon by unequal pressures of fluids and atmosphere to produce a balance of pressure between the fluid-supply and the generated fluid-pressure and consequent inactivity of the valves and enabling an increased or decreased pressure of either fluid when acting together with the pressure of the atmosphere to cause an action of the valve to open or close automatically, when controlled by a float in a liquid column, to increase, diminish, or cut off the fluid-supply passing through such valve, all substantially as and for the purpose set forth.

7. An automatic boiler-feed-controlling valve to be located in the water-supply pipe leading to a boiler or steam-generator; which controlling-valve is provided with interior water-chambers, a steam-chamber, an atmospheric chamber having an exterior opening, and an interior movable stem to which are fixed piston-heads and valve-surfaces of unequal areas, and which stem moves through a stationary head; the steam-supply to the steam-chamber of which controlling-valve is automatically regulated by a float on the surface of a water-column connected with the water in the boiler, which float by a suitable mechanism thereto attached operates suitable levers (on the interior of the wall of the water-column) connected with a steam-valve in a pipe leading to the aforesaid steam-chamber of said controlling-valve, all substantially as and for the purpose set forth.

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In presence of—
ROSWELL SHINN,
H. S. DERBY.