

No. 688,295.

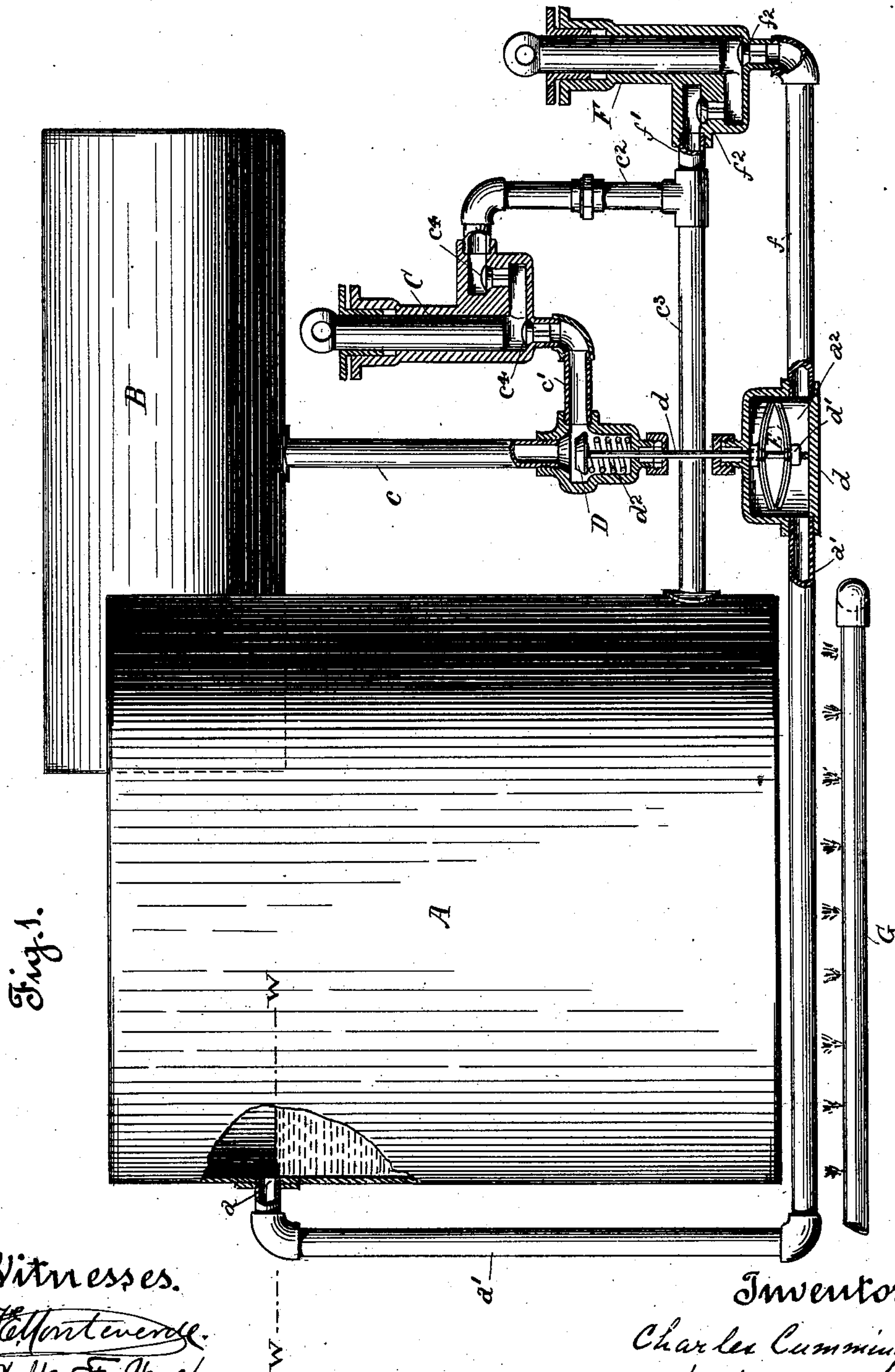
Patented Dec. 10, 1901.

C. CUMMINGS.  
AUTOMATIC BOILER FEEDER.

(Application filed Mar. 13, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses.  
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his Attorney.

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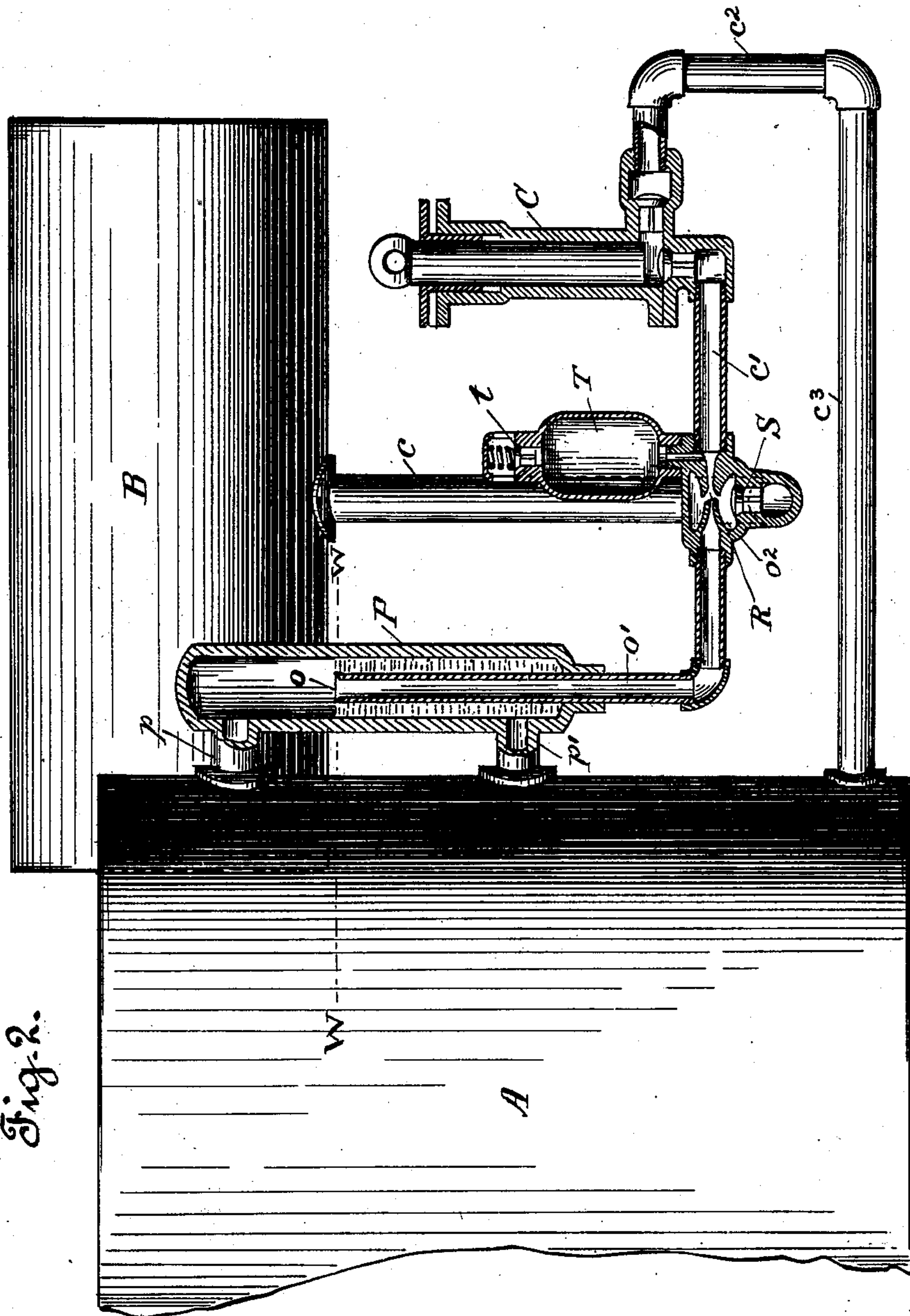
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(No Model.)

**2 Sheets—Sheet 2.**



Witnesses.

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# UNITED STATES PATENT OFFICE.

CHARLES CUMMINGS, OF OAKLAND, CALIFORNIA, ASSIGNOR TO AUTOMATIC BOILER FEED-WATER REGULATOR CO., OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

## AUTOMATIC BOILER-FEEDER.

SPECIFICATION forming part of Letters Patent No. 688,295, dated December 10, 1901.

Application filed March 13, 1901. Serial No. 50,941. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES CUMMINGS, a citizen of the United States, residing at Oakland, county of Alameda, State of California, have invented certain new and useful Improvements in Automatic Boiler-Feeders; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to the class of devices for automatically supplying water to boilers.

The object of my invention is to provide a boiler-feed the automatic operation of which is dependent upon a more positive principle than heretofore employed, resulting in greater sensitiveness and positiveness in operation and in durability of mechanism without tendency to deterioration by continued use.

My invention consists in the novel combinations which I shall hereinafter fully describe and claim.

Referring to the accompanying drawings, Figure 1 is an elevation of one species of my automatic boiler-feed, parts being broken away and parts in section to show interior constructions. Fig. 2 is a similar view of another species of my invention.

In Fig. 1, A is a boiler, and B is a water-supply tank. C is a feed-pump supposed to have suitable connections, unnecessary herein to show, with the engine, whereby while the latter is running the pump is in motion in the usual manner. The pump is connected with the supply-tank by pipes  $c$  and  $c'$  and with the boiler by pipes  $c^2$  and  $c^3$ , and suitable pump-valves  $c^4$  are provided, as shown. A main controlling-valve D is also provided in the base of the tank-pipe  $c$  to cut off the water from or supply it to the pump. The desired water-level in the boiler is represented by the line W W. In the horizontal plane of this level is an outlet  $a$  from the boiler, and thence a pipe  $a'$  is conducted in such a course that heat may be applied to it for any suitable portion of its length. I have here shown it as passing under the boiler and above the furnace or heating-flames G, and thence to a chamber  $a^2$ , in which is located a thermostat E, of any suitable character, but here shown as of the elliptical form of the diverse metal

variety. The upper bow of this thermostat is fixed to the chamber  $a^2$ , while the lower bow plays freely over a rod  $d$ , having a foot-nut  $d'$ . This rod extends upwardly through chamber  $a^2$  and carries the valve D above. A spring  $d^2$  around the rod tends to close the valve D. F is a second pump, to be connected with the engine suitably. It communicates with the chamber  $a^2$  by a suction-pipe  $f$  and with the boiler-inlet  $c^3$  by a pipe  $f'$ , suitable valves  $f^2$  being provided.

The operation is as follows: As long as the water-level W W is not exceeded steam passes from the outlet  $a$  through pipe  $a'$ . In its passage the steam, being subjected to the heat of the furnace-flames G, has its temperature raised very much higher than when it left the boiler. In this superheated condition it reaches the chamber  $a^2$ . Here because of its temperature it expands the thermostat, causing its lower bow to press downwardly on the foot-nut  $d'$  of rod  $d$ , thereby pulling down said rod and opening and holding open the valve D. This opens the communication between the supply-tank B and the pump C, and water is fed to the boiler; but when the water in the boiler rises above level W W water will flow from outlet  $a$  through pipe  $a'$  into chamber  $a^2$ . The water, though subjected to the heat of the furnace-flames, does not have its temperature raised to that degree to which the steam was raised because of the well-known law of physics that pressure being constant the temperature of water cannot be raised above the degree at which the water is converted into steam, and being, therefore, at a lower temperature than the steam had been, it causes the thermostat to contract, so that its lower bow rises, thus relieving the foot-nut  $d'$  of rod  $d$  and permitting the spring  $d^2$  to lift the valve D to its seat, and thus to cut off the water-supply, so that the pump runs idle. The water in chamber  $a^2$  is forced back into the boiler by pump F. It will now be seen that in this operation I have used steam and water and have been enabled to do so by locating the outlet in the plane of the water-level. I have also made a difference between the steam and water, and al-



though I have thus far described an apparatus adapted to be controlled by one character of difference—namely, that of temperature—I wish it to be understood that I do not confine my invention to this character of difference nor to an apparatus or device adapted to be controlled by it, for my invention contemplates the utilization of any other differences in the physical properties of steam and water and the employment of apparatus capable of control by such other differences. The essential feature, therefore, of my invention is the utilization of both steam and water to differentially control suitable devices which in turn control the water-feed.

In order to better illustrate the scope of my invention, I will now proceed by reference to Fig. 2 to describe another species. In this figure, A is the boiler, and B is the water-supply tank. C is the pump, having connections  $c$  and  $c'$  with the water-tank and connections  $c^2$  and  $c^3$  with the boiler, all substantially as hereinbefore described. W W is the water-level. In the plane of this level is the outlet  $o$ , which, though it might be made directly through the boiler side, as in the first case, I have here shown it as outside the boiler in order to lessen any liability of clogging from scale. I form the necessary steam and water boiler connections with this outlet  $o$  by means of the column P and the upper and lower connections  $p$  and  $p'$ , so that the water-level is the same in the column as in the boiler. From the outlet  $o$  (which in this case is the entrance to a pipe) a pipe  $o'$  extends in a suitable course to a chamber  $o^2$ , in which is a steam-ejector R, composed of the opposing nozzles, as shown. With this ejector-chamber  $o^2$  the feed-tank pipe  $c$  communicates, said communication being controlled by the valve S. The pump-pipe  $c'$  also communicates with the chamber  $o^2$ . The operation of this form of my invention is as follows: As long as the water-level is not exceeded steam passes down through outlet  $o$  and pipe  $o'$ , and acting through the ejector R creates a vacuum in chamber  $o^2$  and opens valve S and allows the water from the tank B to pass to the pump, which feeds it to the boiler; but when the water-level is exceeded water passes down through outlet  $o$  and pipe  $o'$ , and, merely using the ejector as a passage without force enough to open valve S, passes to the pump and is fed back into the boiler. In this form of the device it may be necessary to use the relief-chamber T, which communicates with the pipe  $c'$  beyond the ejector, and has a spring-controlled relief-valve  $t$  in its top. After water has been passing through there may be a little remaining in pipe  $c'$ , which being converted into steam may increase the pressure in said pipe to such an extent as to render the ejector inoperative under the pressure of steam from the boiler; but by properly regulating the valve  $t$  this pressure in pipe  $c'$  may be relieved. It will be seen that in this second form of my invention I have

again utilized the steam and water by locating the outlet at the predetermined water-level and have taken advantage of the difference in velocities between the two.

I do not confine myself in either of the forms described nor in other species of the invention to the particular construction or form or connection of the devices or apparatus capable of control by whatever differences between the physical properties of steam and the water it may be the intention to take advantage of, and therefore for the form of thermostat here described may be substituted other forms or other heat-regulators, and likewise for the ejector other means of taking advantage of the difference in velocities of the water and steam may be substituted.

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

1. In an automatic boiler-feed, the combination of a continuously-driven pump, having a communication with the water-supply tank and with the boiler, a valve adapted to cut off, and to open said communication, an outlet from the boiler in the horizontal plane of the predetermined water-level therein, said outlet having a passage, to convey water or steam from the boiler, according to whether said predetermined water-level is exceeded or not, and a device differentially affected by the differences in the physical properties of said water or steam, and adapted to control the valve of the pump communication, whereby the latter is closed or opened.

2. In an automatic boiler-feed, the combination of a continuously-driven pump, having communication with the water-supply tank and with the boiler, a valve adapted to cut off and to open said communication, an outlet from the boiler in the horizontal plane of the predetermined water-level therein, said outlet having a passage to convey water or steam from the boiler, according to whether said predetermined water-level is exceeded or not, means for applying heat to said water or steam in said passage, to differentiate their temperatures, and a device differentially affected by the difference in temperature between the water and steam, and adapted to control the valve of the pump communication, whereby the latter is closed or opened.

3. In an automatic boiler-feed, the combination of a continuously-driven pump, having communication with the water-supply tank and with the boiler, a valve adapted to cut off and to open said communication, an outlet from the boiler, in the horizontal plane of the predetermined water-level therein, said outlet having a passage to convey water or steam from the boiler, according to whether said predetermined water-level is exceeded or not, means for applying heat to said water or steam in said passage, to differentiate their temperatures, a thermostat exposed to said water or steam, whereby it is differentially



affected, and a rod controlled by said thermostat, and connected with the valve of the pump communication, whereby the latter is closed or opened.

5 4. In an automatic boiler-feed, the combination of controllable means for supplying water to the boiler, an outlet from the boiler in the horizontal plane of the predetermined water-level therein, said outlet having a passage to convey water or steam from the boiler according to whether said predetermined water-level is exceeded or not, a device differentially affected by the differences in the physical properties of said water or steam; and  
10 adapted to control the water-supply means, to throw it out of or into action, and means for returning the overflowed water to the boiler.

20 5. In an automatic boiler-feed, the combination of a continuously-driven pump, having communication with the water-supply tank and with the boiler, a valve adapted to cut

off and to open said communication, an outlet from the boiler in the horizontal plane of the predetermined water-level therein, said outlet having a passage to convey water or steam from the boiler according to whether said predetermined water-level is exceeded or not, means for applying heat to said water or steam in said passage, to differentiate their temperatures, a thermostat exposed to said water or steam, whereby it is differentially affected, a rod controlled by said thermostat and connected with the valve of the pump communication, whereby the latter is closed or opened, and a second pump, to return the overflowed water.

In witness whereof I have hereunto set my hand.

CHARLES CUMMINGS.

Witnesses:

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D. B. RICHARDS.