No. 684,893. Patented Oct. 22, 1901.

# M. L. WHITFIELD.

## ELECTRIC FEED REGULATOR FOR STEAM BOILERS.

(Application filed Apr. 13, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

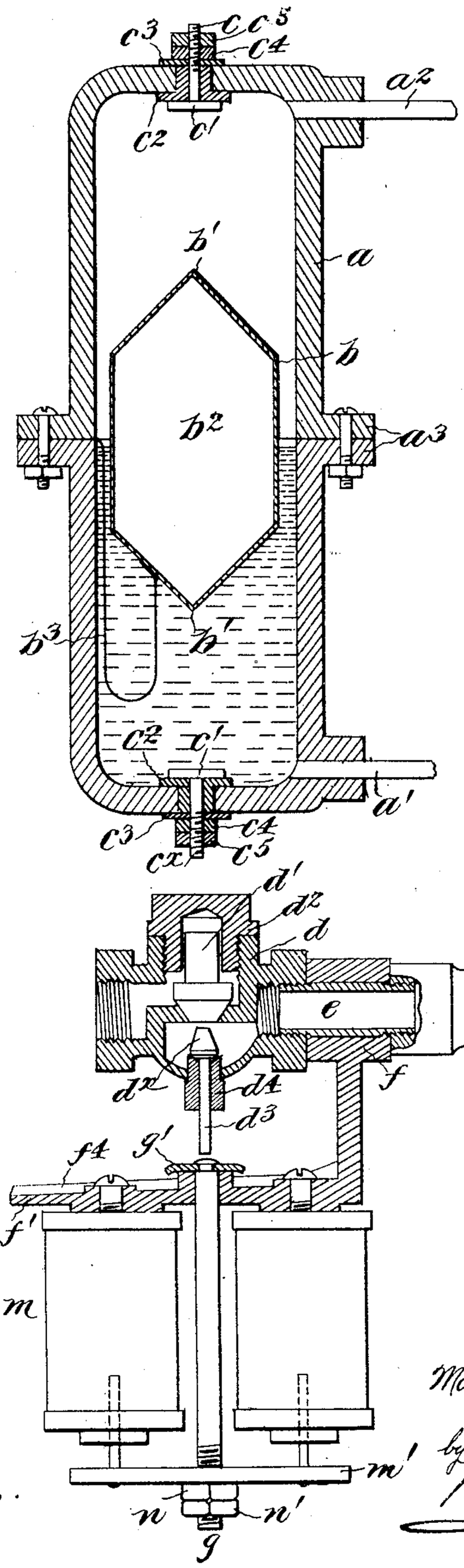


Fig. 2.

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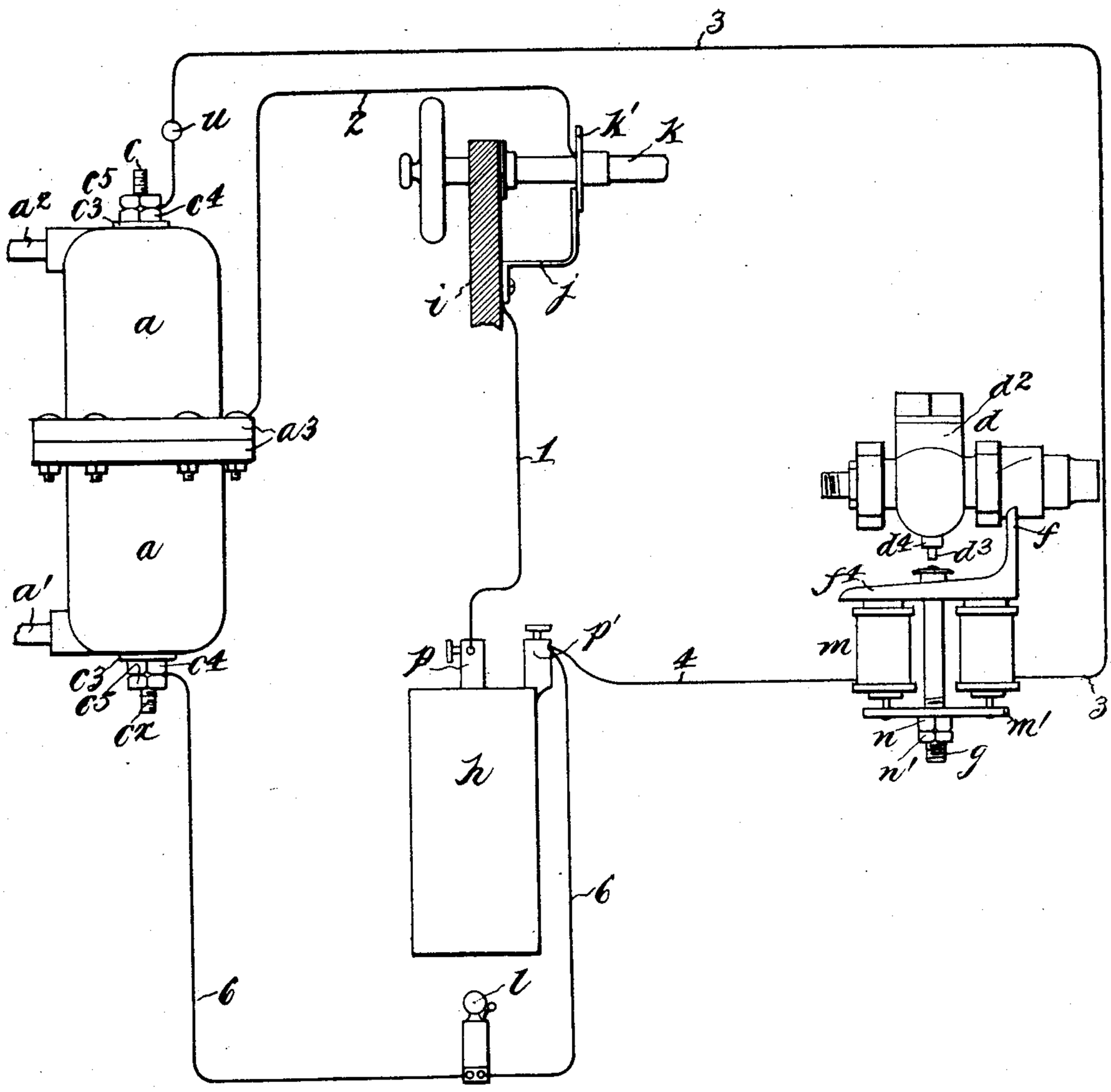
Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## ELECTRIC FEED-REGULATOR FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 684,893, dated October 22, 1901.

Application filed April 13, 1901. Serial No. 55,741. (No model.)

*To all whom it may concern:*

Be it known that I, MARCY L. WHITFIELD, a citizen of the United States, residing at Memphis, in the county of Shelby and State of Tennessee, have invented certain new and useful Improvements in Electric Feed-Regulators for Steam-Boilers; 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, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

This invention has relation to automatic feed-regulators for steam-boilers, and more particularly to that type in which the feeding of the boiler is controlled and regulated by electrically-operated appliances, the operation of which is controlled by variations of the level of the water in the boiler through the medium of a float. Generally speaking, the operation of feed-regulators for steam-boilers is dependent upon the movement of a float due to variations in the level of the boiler-water, such float operating suitable mechanical appliances that control the feed. When the float is made to control a valve, it is of necessity of such dimensions as to develop the power required to operate such valve and to overcome the friction of the connections and stuffing-box, so that these floats are of comparatively great diameter. Experience has shown that the mechanism operated by the float is liable to become inoperative by reason of an increase of the frictional resistance to the movements of the float, particularly the frictional resistance in the stuffing-boxes, and, on the other hand, owing to its comparatively great diameter the float is liable to collapse under the boiler-pressure. In electrically-controlled feed-regulators in which a float is used to open and close an electric circuit the function of the contacts is also more or less unreliable, this being also due to friction, while the electrically-operated power device—namely, the armature of the electromagnet, for instance—performs its function also under a variable friction, even when the weight of the valve operated thereby is reduced to a minimum, so that these electrically-controlled feed-regulating appliances are also more or less unreliable.

The object of this invention lies in the provision of means whereby the above-related disadvantages are entirely avoided, and this I attain, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical sectional view of the float-chamber. Fig. 2 is a sectional view of the electrically-controlled feed-valve, and Fig. 3 is a more or less schematic view of an electric boiler-feed regulator embodying my invention.

In the drawings I have shown my improved feed-regulator as organized for use with locomobile-boilers, but do not desire to limit myself to such use, as the regulator can be used with any other type of steam-boiler.

One of the features of my invention lies in the fact that the controlling-float is not contained in the boiler, but in a box or chamber separate therefrom and suitably connected with the water and steam spaces thereof, whereby I am enabled to use a comparatively small chamber and a correspondingly small float, the only function of which is that of circuit-closer, thus avoiding the use of a stuffing-box for the float-rod, which is necessary when the float is contained in the boiler.

Referring to Fig. 1, the float box or chamber $a$, preferably of cylindrical form, is made of an electrically conductive material, preferably metal and preferably in approximately two equal parts, having bolt-flanges $a^3$ $h^3$. In the top and bottom of the chamber $a$ and axially thereof is arranged an electric contact in the form of a metal bolt $c$ and $c^\times$, respectively, having an enlarged contact-head $c'$ and passing through a bushing $c^2$, made of a suitable insulating material, and through a washer $c^3$, also made of a suitable insulating material and secured in place by a metal nut $c^4$ and a lock-nut $c^5$. The lower end of the chamber $a$ is connected by pipe $a'$ with the water-space of the column or boiler, and the upper end of said chamber is connected by a pipe $a^2$ with the steam space of said column or boiler. The chamber $a$ contains a float $b$, made of an elec-

trically conductive metal, preferably copper, consisting of a cylindrical body $b^2$, having conical heads forming contact-points $b'$, adapted to contact with the heads $c'$ of contacts $c$ $c^\times$. The cylindrical body $b^2$ of the float $b$ may be of such diameter as to be at all times in frictional (hence electric) contact with the inner surface of its chamber $a$. This, however, has a disadvantage in that the proper contact between the float and its chamber may be interrupted either by the formation on the chamber-walls of a coating of oxid or by incrustation with deposits from the boiler-water, and although this could in a measure be obviated by providing the float $b$ with longitudinal knife-edge contacts, which, however, would materially increase the cost of construction, I prefer a float of somewhat less diameter than that of its chamber and connect it therewith by means of a wire $b^3$, as shown. The upper and lower contacts $c$ $c^\times$ of float-chamber $a$, the said chamber, and the electromagnets $m$ are included in suitable electric circuits, as hereinafter described, the said electromagnet $m$ controlling the feed to the boiler.

Referring now to Fig. 2, $d$ is the check-valve casing of the general construction of the well-known globe-valve casing, interposed in the pipe leading from the water-supply tank of the locomobile to the suction-port of the feed-pump, whose forcing-port is connected with the boiler. $d'$ is a gravity-valve that controls the port or passage in said valve-casing, the chamber for said valve being closed by a screw-plug $d^2$. The branch on the supply side of the valve-casing has secured thereto a pipe $e$, on which is journaled the support or hanger $f$ for the electromagnet $m$, and to the outer end of said pipe $e$, is screwed the pipe connected with the aforesaid water-supply tank and whereby the hanger $f$ is firmly clamped to said valve-casing, said hanger being made of iron or the like. The horizontal arm $f'$ of hanger $f$, to which the electromagnet $m$ is secured, has its upper face inclosed and provided with flanges $f^4$ on opposite sides, so as to shed water and prevent it from reaching the electromagnet. The armature $m'$ of the electromagnet $m$ is adjustably secured by means of a nut and lock-nut $n$ and $n'$, respectively, to a stem $g$, whose upper end is guided in a bearing in the arm $f'$ of the hanger $f$, from which said stem is supported by means of a somewhat dished plate $g'$, seating on a boss or projection of said arm $f'$ and secured to the upper attenuated head of stem $g$, which is in line with the vertical axis of the gravity-valve $d^\times$ and its seat. In the receiving-chamber of the valve-casing $d$ is formed an opening, into which is fitted a guide-plug $d^4$, in which slides a valve-supporting pin $d^3$ in line with the armature-stem and the check-valve $d'$.

Referring now to Fig. 3, $h$ indicates an electric battery of any suitable type, to one pole $p'$ of which is connected the lower float-chamber contact $c^\times$ by wire 6, in which is included an alarm-bell $l$. The upper float-chamber contact $c$ is connected by wire 3 to one terminal of the electromagnet $m$, and in said wire is included an incandescent lamp $u$. The other terminal of the electromagnet $m$ is connected by wire 4 with the aforesaid pole $p'$ of battery $h$. Finally the float-chamber $a$ is connected by wire 2 with a switch and the latter by wire 1 with the opposite pole of battery $h$. This switch is shown as controlled by the stem of the lock-valve of the locomobile, $k$ indicating said stem, and $k'$ a contact-plate, to which wire 2 is connected. $i$ indicates a suitable support for a contact-spring $j$, to which battery-wire 1 is connected.

The operation of the electric boiler feed-regulator is as follows, it being assumed that the lock-valve has been opened for starting, thereby electrically connecting wires 1 and 2. Let it be further assumed that the water glass or column and the float-chamber $a$ are about half-full of water. Under these conditions when the locomobile is started the valve $d^2$ is seated and free to move from and to its seat. The pump will therefore begin to feed the boiler under full capacity. As the water rises in the boiler or column and float-chamber $a$ the float $b$ also rises until it contacts with the upper contact $c$, thereby closing the circuit, current flowing from pole $p$ of battery $h$, wire 1, switch $j$ $k$, wire 2, float-chamber $a$, contact $c$, wire 3, electromagnet $m$, wire 4, to opposite pole $p'$ of said battery, thereby lighting lamp $u$ and energizing electromagnet $m$, whose armature $m'$ will be attracted, its stem $g$ lifting the valve-supporting pin $d^3$, which latter follows the valve as it moves off its seat at suction-stroke of the pump and so holds it until contact between the float $b$ and upper contact $c$ is again broken—that is to say, until the water-level in the float-chamber sinks sufficiently to move the float out of contact with said upper contact $c$. When contact between $b$ and $c$ is broken, the electromagnet is demagnetized, the armature $m$ drops, and the supporting-pin and check-valve $d^2$ drop back into their normal positions, so that the pump can again force water into the column or boiler.

It will readily be seen that with the arrangement described the pump need not be stopped when the valve $d^2$ is held off its seat, the operation of the pump causing the feed-water to simply flow from the tank to the pump, and vice versa.

Should the water-level fall from any cause so low as to cause the float to contact with the lower float-chamber contact $c^\times$, the alarm-circuit will be closed, current flowing from pole $p$ of battery $h$, wire 1, switch $j$ $k$, wire 2, float-chamber $a$, wire $b^3$, float $b$, lower contact $c^\times$, wire 6, back to opposite pole $p'$ and battery $h$, setting the bell in operation, thus advising the driver that something is wrong with the feeding appliances.

In practice the supporting-pin $d^3$ is not fitted to slide fluid-tight in its plug $d^4$, the upper face of which is concave, so as to allow sufficient water to pass through the plug to keep the pin lubricated, and in order to prevent such water from reaching the electromagnet $m$ I provide the channeled support $f'$ and the dished supporting-disk $g'$ for the armature-stem $g$.

Inasmuch as there is but little pressure at any time in the receiving-chamber of the check-valve casing $d$, and if the stem of the pin $d^3$ is so fitted in its bearing and guide-plug $d^4$ as to form a capillary passage, but a trifling quantity of water will escape from said plug.

It will readily be seen that there is little or no liability of the check-valve $d^2$ sticking to its seat, while the only work the armature $m'$ has to perform is to hold said valve off its seat as long as the feed-controlling circuit is closed, while there is as little liability of the supporting-pin $d^3$ sticking in its bearing $d^4$ for reasons above stated, said pin being a gravity-pin having a sufficiently heavy head.

By controlling the switch by means of the lock-valve stem of a locomobile the closure of the lock-valve will also break connection between wires 1 and 2, thus preventing accidental closure of the electric circuits and the running down of the battery when the locomobile is not in use or when the boiler is being blown off or drained.

When the locomobile is in use, the feeding of the boiler is interrupted but for a few moments occasionally, and in order that the driver may know that the feeding appliances are working properly I include the lamp $u$ in the magnet-circuit, said lamp performing the function of indicator, the feed being interrupted so long as the lamp is lighted, thus enabling the driver to determine whether the feeding of the boiler proceeds regularly and is not interrupted for too long a period of time or in case the alarm should fail from any cause. Thus, for instance, if the supply of water to the pump were interrupted by an obstruction in the connections with the tank the water-level in the float-chamber would of course drop, and should the alarm fail the driver would still be advised that the feeding is interrupted by the length of time the lamp $u$ remains unlighted.

Of course it will be obvious that the automatic feed-regulating appliances may be used for feeding liquids to holders other than boilers.

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

1. A feed-regulator comprising an electric feed-controlling circuit, a float-chamber constructed of a magnetic material and constituting one of the circuit-terminals, a contact in and insulated from the head of said chamber constituting the other circuit-terminal, a float of conductive material in said chamber and having a conical head adapted to contact with the circuit-terminal in the head of the float-chamber and a flexible conductor connecting the float with its chamber, for the purpose set forth.

2. A feed-regulator comprising electric feed-controlling and alarm circuits, a float-chamber of magnetic material constituting one of the terminals of each of said circuits, electric contacts in and insulated from the opposite heads of said chamber, said contacts constituting the second terminals of said circuits, a float of conductive material having conical heads adapted to coöperate with the last-named contacts, and a flexible conductor connecting the float with its chamber, for the purpose set forth.

3. A feed-regulator comprising a gravity check-valve in the feed-pipe between the source of supply and the feed-pump, an electric feed-controlling circuit, an electrically-operated device in said circuit adapted to engage and hold the valve off its seat when said circuit is closed, and means for closing and opening said circuit by the rise and fall of the level of the liquid in the receiver to be fed, for the purpose set forth.

4. A feed-regulator comprising a gravity check-valve in the feed-pipe between the source of supply and the pump, an electric feed-controlling circuit, an electromagnet, its armature, a gravity-pin moved thereby and adapted to engage and hold the valve off its seat when the electromagnet is energized, and means for closing and opening said circuit by the rise and fall of the level of the liquid in the receiver to be fed, for the purpose set forth.

5. A feed-regulator comprising a valve-casing in the feed-pipe between the source of supply and feed-pump, having receiving and delivery chambers and a port in communication therewith, a gravity check-valve in the delivery-chamber controlling said port, and a vertically-movable gravity-pin in and projecting from the receiving-chamber and in line with the valve; in combination with a feed-controlling circuit, an electromagnet therein, its armature, and a stem secured thereto in line with the aforesaid pin and adapted to engage and lift the same when the electromagnet is energized and thereby hold the valve off its seat and means for closing and opening said circuit by the rise and fall of the level of the liquid in the receiver to be fed, for the purpose set forth.

6. A feed-regulator comprising a valve-casing in the feed-pipe between the source of supply and feed-pump, having receiving and delivery chambers and a port in communication therewith, a gravity check-valve in the delivery-chamber controlling said port, and a vertically-movable gravity-pin in and projecting from the receiving-chamber and in line with the valve; in combination with a feed-controlling circuit, an electromagnet therein, its armature, and a stem secured

thereto in line with the aforesaid pin and adapted to engage and lift the same when the electromagnet is energized and thereby hold the valve off its seat, means for closing and opening said circuit by the rise and fall of the level of the liquid in the receiver to be fed and means for preventing liquid leaking out of the receiving-chamber of the valve along the pin from reaching the electromagnet, for the purpose set forth.

7. A feed-regulator for automobile-boilers, comprising an electric feed-controlling circuit, a float-chamber suitably connected with the column or boiler, suitable circuit-terminals, and a float in said chamber adapted to coöperate with said terminals to close and open the circuit by the rise and fall of the float; in combination with the lock-valve stem for the engine, and a cut-out in said circuit operated by said stem, for the purpose set forth.

8. A feed-regulator for locomobile-boilers comprising electric feed-controlling and alarm circuits, a float-chamber suitably connected with the column or boiler, suitable circuit-terminals and a float in said chamber adapted to coöperate with said terminals to open and close the controlling and alarm circuits by the rising and falling movements of the float due to variations in the level of the water in the column or boiler; in combination with the stem of the engine lock-valve and a cut-out operated by said stem, for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

MARCY L. WHITFIELD.

Witnesses:
PHILIP F. LARNER,
HENRY ORTH, Jr.