

E. J. WOOD.  
BOILER FEEDER.

(Application filed Aug. 2, 1901.)

(No Model.)

3 Sheets—Sheet 1.

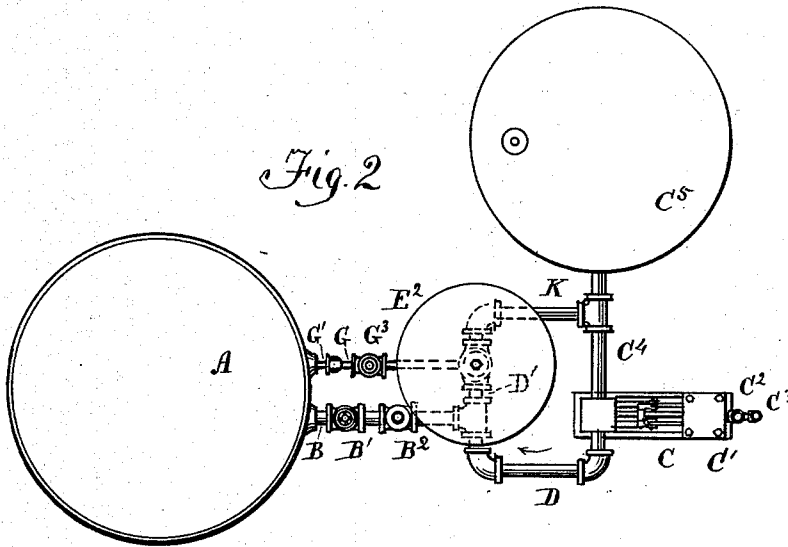


Fig. 2

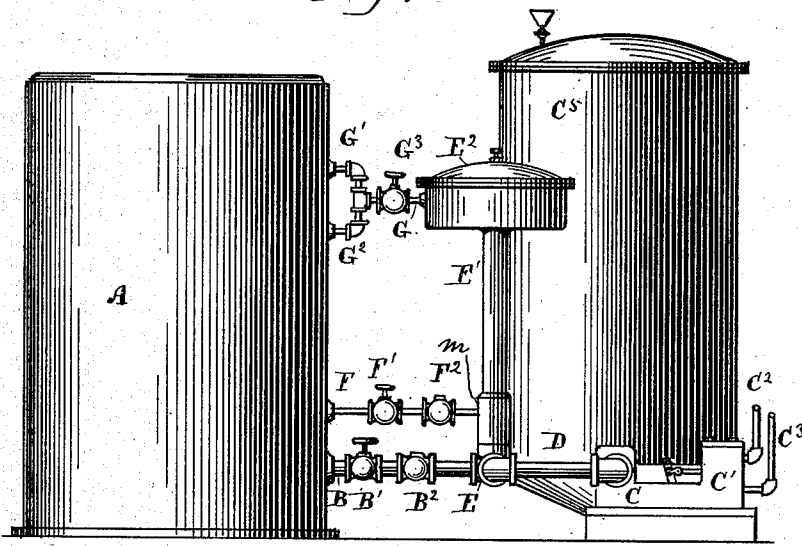


Fig. 1.

Fig. 3.

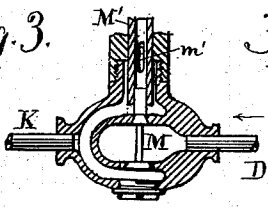
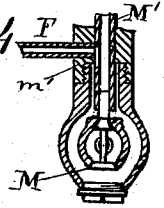


Fig. 4.



WITNESSES:

J. B. Blautice  
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INVENTOR

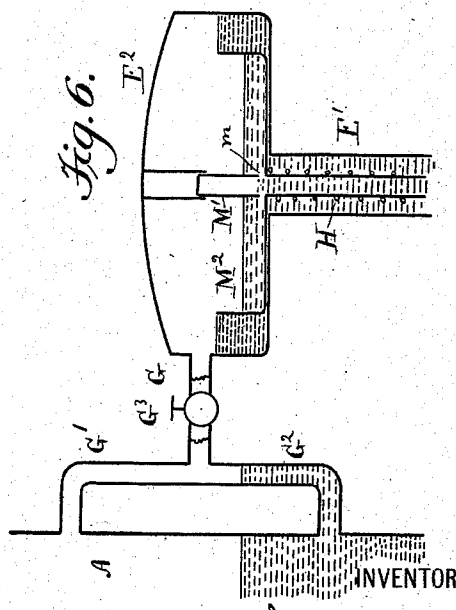
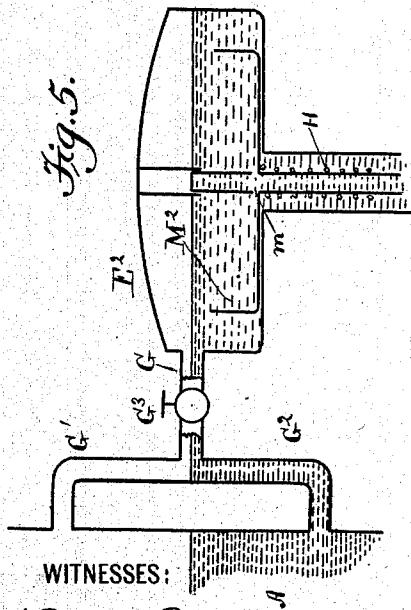
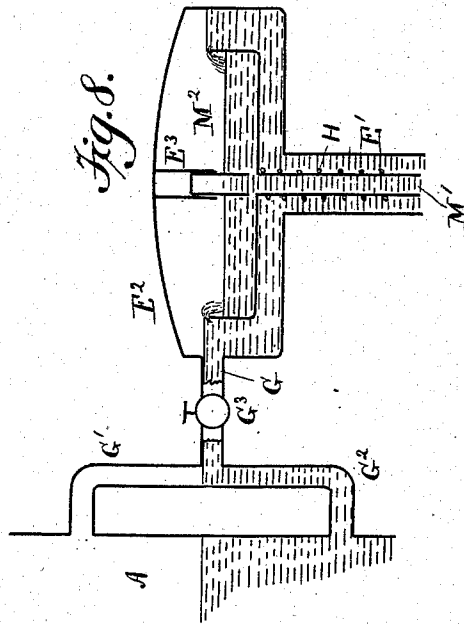
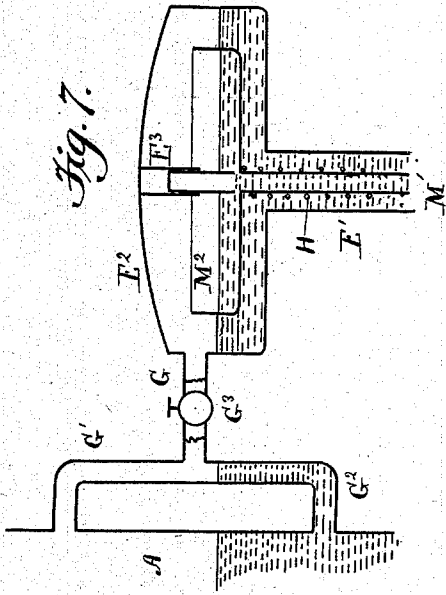
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E. J. WOOD.  
BOILER FEEDER.

(Application filed Aug. 2, 1901.)

(No Model.)

3 Sheets—Sheet 2.



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No. 714,549.

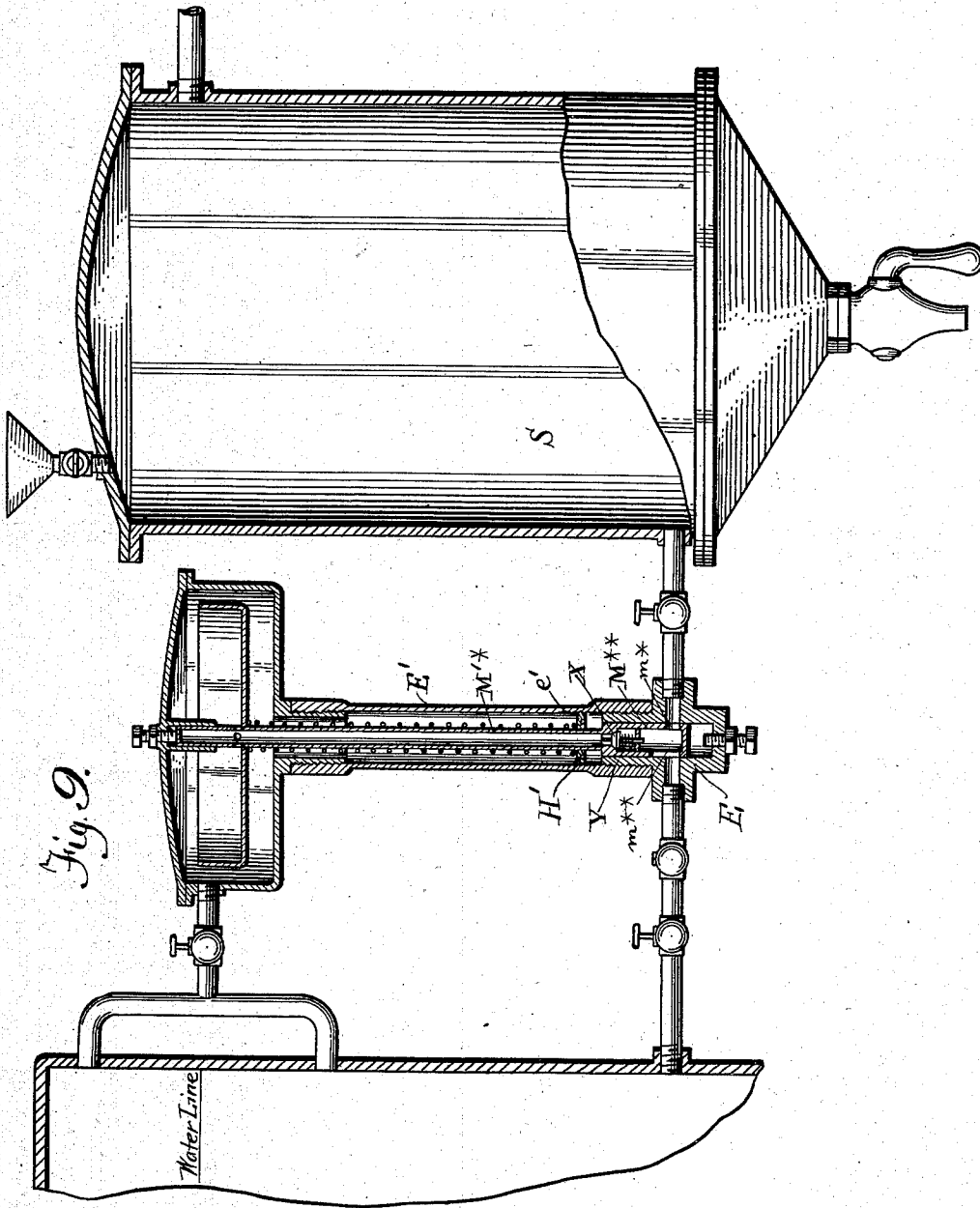
Patented Nov. 25, 1902.

E. J. WOOD.  
BOILER FEEDER.

(Application filed Aug. 2, 1901.)

(No Model.)

3 Sheets—Sheet 3.



WITNESSES

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# UNITED STATES PATENT OFFICE.

EDGAR JAMES WOOD, OF BROOKLYN, NEW YORK.

## BOILER-FEEDER.

SPECIFICATION forming part of Letters Patent No. 714,549, dated November 25, 1902.

Application filed August 2, 1901. Serial No. 70,600. (No model.)

*To all whom it may concern:*

Be it known that I, EDGAR JAMES WOOD, a citizen of the United States, residing in the borough of Brooklyn, in the city and State of New York, have invented a certain new and useful Improvement in Boiler-Feeders, of which the following is a specification.

The invention may serve with apparatus of whatever name in various chemical and other operations where liquid is forced into a space against pressure and requires to be maintained near a certain level; but it is intended more especially for feeding water into steam-boilers, and I will describe it as thus applied. The apparatus may serve with steam at any pressure. I will assume it to be about the same as is carried on locomotives—from a hundred to a hundred and fifty pounds per square inch. I supply water at a superior pressure, so that it will, when so conditioned by my device, flow into the boiler under any of the variations of pressure to which the latter may be subjected in practice.

It is permissible and is common in ordinary practice to have appreciable changes in the water-level of the boiler. I provide for feeding intermittently for short periods, so that the water-level in the boiler will alternate between the highest and lowest of two slightly-divided levels, and I have devised apparatus which causes the several changes of condition to be made with unusual force and certainty.

I provide a chamber connected with the boiler at what is to be the highest water-level and make the lower part of the chamber extending considerably below such connection, so as to form a bowl or reservoir in which the water may be held up after the level in the boiler has sunk below the connection, and mount in such chamber an open-top vessel adapted to float on the water. As this vessel and its attachments will ordinarily be of metal and too heavy without assistance, I provide an adjustable spring having a long range of motion which affords such support that it can float by such aid. Unlike ordinary floating devices, I provide for allowing such vessel to fill whenever the water in the boiler accumulates above the proper quantity, and when so filled it will sink. I provide a

pipe extending downward from such vessel, controlled by a valve opening practically downward, and I provide for the discharge of the water from the open-topped float by flowing through such valve and thence through a liberal passage into the boiler, so that the float is soon partially emptied. The connection between the boiler and the chamber through which the water is received when the water rises and through which it is discharged during the first part of the sinking of the water-level is at so high a point that the water is retained in the chamber during the last part of the sinking motion of the water. This condition induces a higher water-level in the chamber than in the boiler during the last part of each sinking motion of the water. My device acts in the opposite direction to an ordinary float, sinking when the water is too high and floating when the water is too low. This extraordinary condition is attained by virtue of the water being retained in the chamber higher than the water-level in the boiler. It can lift the float when the water within the float sinks with the water in the boiler. The rise of the float is limited. When the water in the boiler rises sufficiently to flow again through the main connection from the boiler and raises the level in the chamber, either immediately or after this condition has obtained, for a little period, according as it is adjusted, the water-level attains such a height in the chamber now connected with the boiler that it flows inward over the rim of the float and again loads the float so that it sinks. I can operate with some success by forcing the water directly from a pump, but prefer a capacious vessel, which I will term a "closed tank," in which a supply of water and compressed air is stored. This modifies the action in important respects, especially in supplying the water at a very uniform pressure, allowing it to be fed for a considerable period before the starting of the engine, if such shall in any case be required, in working by the action of the main engine. I will describe the invention as operated by a steam-pump, and when so worked that advantage is not material.

In one form of the invention I will show a pump worked by the main engine, with pro-

visions for automatically stopping it when the pressure in the supply vessel is too high and starting it again when needed.

It will now be understood that a pump however operated maintains the pressure of water in the supply vessel, and consequently in the supply-pipe, sufficiently above the pressure in the boiler to induce an active flow into the boiler when the controlling device so directs and that the controlling device is actuated by my peculiar floating and sinking vessel so that it induces the entrance of water only when the water-line has sunk a little below the desired level.

The following is a description of what I consider the best means of carrying out the invention:

The accompanying drawings form a part of this specification.

Figure 1 is a side elevation, and Fig. 2 a corresponding plan view. Fig. 3 is a vertical section of the regulating-valve detached. Fig. 4 is a corresponding section at right angles to that in Fig. 3. Figs. 5 to 8, inclusive, are outline diagrams illustrating the action of my peculiar float. All are central vertical sections. Fig. 5 shows the float sunk and remaining down, the water completely covering it, but gradually lessening its depth. Fig. 6 shows it in its sunk position about to rise, the water in its interior having moved by gravity into the boiler. Fig. 7 shows it floated and remaining up, the water around it gradually rising; and Fig. 8 shows it in its elevated position about to sink, the water around it being high and rising. Fig. 9 is a vertical section showing an important modification in the construction.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

Referring to Figs. 1 to 8, inclusive, A indicates an upright boiler; B, a feed-pipe; B', a stop-valve, and B<sup>2</sup> an ordinary check-valve. C is a steam-pump which may be actuated by the engine. In these figures I have shown it actuated by a separate steam-cylinder C', supplied with steam through a pipe C<sup>2</sup> and allowed to exhaust through a pipe C<sup>3</sup>. These parts may be of any ordinary or suitable construction.

D is the delivery-pipe of the pump, branched so that the water can be delivered either through the feed-pipe B into the boiler or through the continuation D' of the pipe D to my water-regulating device, which latter is inclosed with liberty to move freely up and down in a casing E E' E<sup>2</sup>, the lower portion E being a balance puppet-valve casing, E' a continuation upward therefrom, and E<sup>2</sup> a capacious chamber at the top.

M is a balance puppet-valve conditioned to open downward, receiving the water from the pump in the space between the two disks and to deliver such water from the space above the upper disk and below the lower disk. These

spaces communicate, through a pipe K, with the suction-pipe C<sup>4</sup> of the pump leading from the tank C<sup>5</sup>. A tube M' extends upward from the upper disk loosely inclosed in the passage E' and connecting to an open-topped vessel M<sup>2</sup>, which performs important functions and which I will sometimes for brevity term a "sinking float." This float can rise and sink in the chamber E<sup>2</sup>. The tube M' opens into the interior of this sinking float M<sup>2</sup> by the aid of liberal apertures *m*, but is continued upward farther to engage with a steadiment E<sup>3</sup>, which projects down from above.

H is a helical spring loosely surrounding the tube M' and exerting a lifting force on the regulating device, its lower end abutting on an adjustable cross-piece H', which is engaged with screw-threads *e'* in the interior of the casing E. By reaching axially into the passage E' this cross-piece H' when the parts are separated can be turned in one direction or the other to adjust the tension of this spring, so that my regulating device comprising the balance puppet-valve M and its several attachments will reliably sink when the sinking float M<sup>2</sup> is filled by the rise of the water in the boiler, and consequently in the chamber E<sup>2</sup>, and will reliably rise when the water becomes partially emptied from M<sup>2</sup>.

F is a pipe which connects a well-finished portion of the interior of the upright casing E' with the interior of the boiler. It has a stop-valve F' and a light check-valve F<sup>2</sup>. When the sinking float is in its lowest position, an aperture *m* in the side of the tube M' coincides with this pipe F, and during each such period the water can flow gently downward from the interior of the sinking float and through the orifice *m* into the pipe F and passing the light check-valve F<sup>2</sup> can flow into the boiler. I provide for emptying this sinking float M<sup>2</sup> as follows: The water flows freely inward through the apertures *m* and descends through the interior of the tube M' and flows freely through an aperture *m'* and a coinciding pipe F into the boiler A. So long as no feed-water is required to flow into the boiler my regulating device is held up, the sinking float M<sup>2</sup> being supported by such water in the manner which I describe as "floating." Although being too heavy to float naturally, it is aided by the carefully-adjusted spring H. Under these conditions the water-level in the interior of the sinking float M<sup>2</sup> will be a half-inch more or less below that of the surrounding water in the chamber E<sup>2</sup>, Figs. 6 and 8; but the water in the boiler will be prevented by the valve F<sup>2</sup>, Figs. 1 and 10, from flowing upward through the interior of M' to increase the supply within M<sup>2</sup>. When this depression of the water-level within my sinking float M<sup>2</sup> has reached a sufficient degree to overcome the slight resistance, my device floats. This induces an immediate and decided change in the conditions. My balance-valve M (see Fig. 3) is tightly closed by the upward move-

ment, and as the water can no longer pass idly around it lifts the check-valve  $B^2$  and flows into the boiler, and the water-level in the boiler commences to rise. A sufficient rising causes the water to flow outward through the level-pipe  $G$  and raise the water in the chamber  $E^2$ , and as the sinking float is held firmly against rising higher the water soon flows over the edge inward and fills it. When this condition is attained, my device sinks and again opens the balance-valve  $M$ . This change of condition allows the water from the pump to again pass idly through the valve  $M$ , and the feeding of the boiler is thus again completely stopped. Thus the conditions of actively jumping up and resting in the high position and sinking down and resting in the low position alternate at periods, which vary according as the consumption of the steam requires. While this valve  $M$  remains open, no more water is forced into the boiler. The water will continue to be acted on by the pump; but finding my balance-valve open it flows freely through the by-pass  $K$  back into the suction-pipe  $C^4$  of the pump and passes around again and again, thus causing the pump to work idly.

During a certain period, which may be longer or shorter, according to the conditions, the evaporation of the water and the consumption of steam from the boiler continuing, the water-line in the boiler sinks. The water-line in the chamber  $E^2$  sinks with it at first by some of the water in the chamber flowing through the level-pipe  $G$  and its branch  $G^2$  into the boiler; but after the water-line has sunk below the pipe  $G$  the chamber  $E^2$  retains all the water then remaining in it. As soon as the water-level in the boiler has sunk appreciably below that in the chamber  $E^2$  a new state of things obtains. The water commences to flow inward through the orifices  $m$  and to descend through the tube  $M'$  and to pass into the boiler through the pipe  $F$ , the valve  $F'$ , which is a light check-valve, opening readily and allowing such motion. In other words, the water impelled by gravity flows down through the tube  $M'$  and laterally through the passage  $m$ , which in this position of the parts coincides with the horizontal pipe  $F$  and flows through such pipe and mingles with the water in the boiler. The water-level soon sinks below the rim of the open-topped sinking float  $M^2$ . Now a further change is inaugurated. The water-level within the sinking float  $M^2$  sinks below such rim, leaving the remainder of the chamber  $E^2$  filled to the same high level as before. This continues until the water-level has sunk in the boiler, and consequently in the sinking float, so as to lighten the float enough to make it rise, and the prompt rising of the float and consequent closing of the valve  $M$  stops the by-pass again and compels the water worked by the pump to be forced into the boiler and raises the level again, as before. Now the conditions are again becoming as at first.

The tendency of the rising water in the boiler to return through the pipe  $F$  and to flow upward through the pipe  $M'$  and fill the sinking float being resisted by the light check-valve  $F'$ , the sinking float remains floating until the water-level in the boiler rises sufficiently to induce a flowing through the branch  $G^2$  and pipe  $G$  into the chamber  $E^2$ , where it raises the level again. My invention does not require extremely accurate adjustment. It is preferable that in the elevated position of the sinking float its rim be near, but not above, the interior of the pipe  $G$ . Wherever it is, if it shall be something above the level of the pipe  $G$ , the rising of the water-level after this pipe  $G$  is filled with water will be hastened by the condensation of the steam in the upper part of the chamber  $E^2$ , and the water is certain to soon flow inward over the rim into the sinking float and again cause its descent, with the repetition of the several steps.

My invention has the effect to induce the changes with promptness and firmness, permitting a small amount of fluctuation in the water-level, but forbidding such fluctuation to extend beyond a certain moderate degree. My regulating device may be made to move so easily that it will rise with a depression of the water-level in the interior of the sinking float only a fraction of an inch below that of the surrounding water, which latter, it will be understood, is held up at a stationary level in the chamber  $E^2$ . I esteem such sudden rising and lowering of the sinking float usually desirable, as it insures promptness of action, well defined though variable periods, and sharp and decisive changes.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. The forks  $G' G^2$  at the junction of the level-pipe  $G$  with the boiler may be omitted and the level-pipe continued directly into the boiler at the high-water line; but I prefer the forking, as it prevents the possibility of scum or any floating objects on the surface of the water in the boiler getting into the chamber or in any way encumbering the action. It will be understood that in this modification water or air is pumped either constantly or at intervals into the closed tank  $R$  through the pipe  $R'$  to maintain a high pressure therein. When there is no pressure, water may be supplied to the tank  $R$  through an ordinary funnel  $R^2$ , controlled by a stop-cock  $R^3$ . When it is desired to empty the tank, this may be effected by operating a stop-cock  $R^4$  at the bottom.

With either or any arrangement I create and maintain air-pressure on the water to induce it to move into the boiler controlled by my device.

Fig. 9 shows an arrangement partly corresponding to the modification shown in Fig. 3. In this form of the invention the balance-valve is materially changed. What corresponds somewhat thereto in function is a tube  $M^{**}$ , which is an enlargement of the tube  $M'^*$ ,

having an aperture  $m^*$  on the receiving side and  $m^{**}$  on the delivery side. When the sinking float sinks, it moves the aperture  $m^*$  out of coincidence with the adjacent aperture, through which the water is received from the closed tank S at a higher pressure than the boiler and the feeding stops. When the sinking float rises, it lifts this aperture again into line with the receiving-aperture, and the water comes in under the strong pressure and flows onward through the feeding-pipe into the boiler. The aperture  $m^{**}$  is high enough to keep the passage constantly open from the interior of the short tube  $M^*$  to the feed-pipe and thence to the boiler, and the emptying of the sinking float is effected through a small puppet-valve X, properly guided and opening downward in this pipe. This valve X is light and is held up by a gentle helical spring Y, so that it tends to stand closed. The downward pressure of the water, due to the small elevation of the water-level in the sinking float above that in the boiler, will cause it to depress the spring and open downward sufficiently to deliver the water from the interior of the sinking float downward, and thus through the aperture  $m^{**}$  and feed-pipe into the boiler. A corresponding spring may be arranged under the light check-valve  $F'$  in the form first described. That valve has but little load under any conditions. The design is to make it move into the tight-shut or sufficiently wide-open conditions under very slight forces.

35 Having now fully described the invention and some of the modes in which I propose to carry it out in practice as applied for feeding boilers and analogous uses, what I claim is—

1. The sinking float  $M^2$  having an open top,

in combination with a self-acting valve  $F^2$  arranged to discharge outward from the lower portion of such float, and with a chamber inclosing such float with liberty for the latter to rise and sink therein, adapted to be connected to a boiler so as to serve substantially as herein specified. 40 45

2. The sinking float  $M^2$  having an open top in combination with a self-acting valve  $F^2$  arranged to discharge outward from the lower portion of such float, and with a chamber inclosing such float with liberty for the latter to rise and sink therein adapted to be connected to a boiler and with an easily-operated valve M moved by such float, so arranged that the descent of the sinking float arrests and the rising of such float recommences the supply to the boiler, all substantially as herein specified. 50 55

3. The sinking float  $M^2$  having an open top, in combination with a self-acting valve  $F^2$  arranged to discharge outward from the lower portion of such float and with a chamber inclosing such float with liberty for the latter to rise and sink therein adapted to be connected to a boiler and with an easily-operated valve M moved by such float arranged to control a by-pass so that the water may be allowed to return idly to the forcing means when the boiler is sufficiently fed, all substantially as herein specified. 60 65 70

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

EDGAR JAMES WOOD.

Witnesses:

M. F. BOYLE,  
J. B. CLAUTICE.