(No Model.) 2 Sheets—Sheet 1.

J. BAINBRIDGE.

BOILER FEEDING AND WATER FORCING DEVICE.

No. 366,912. Patented July 19, 1887.

FIG. 1.

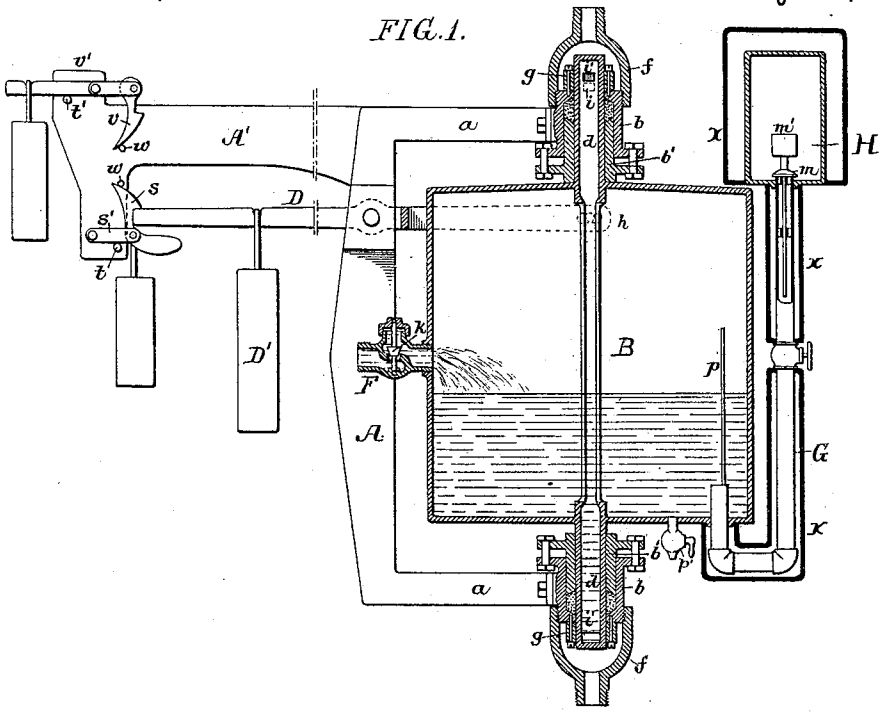
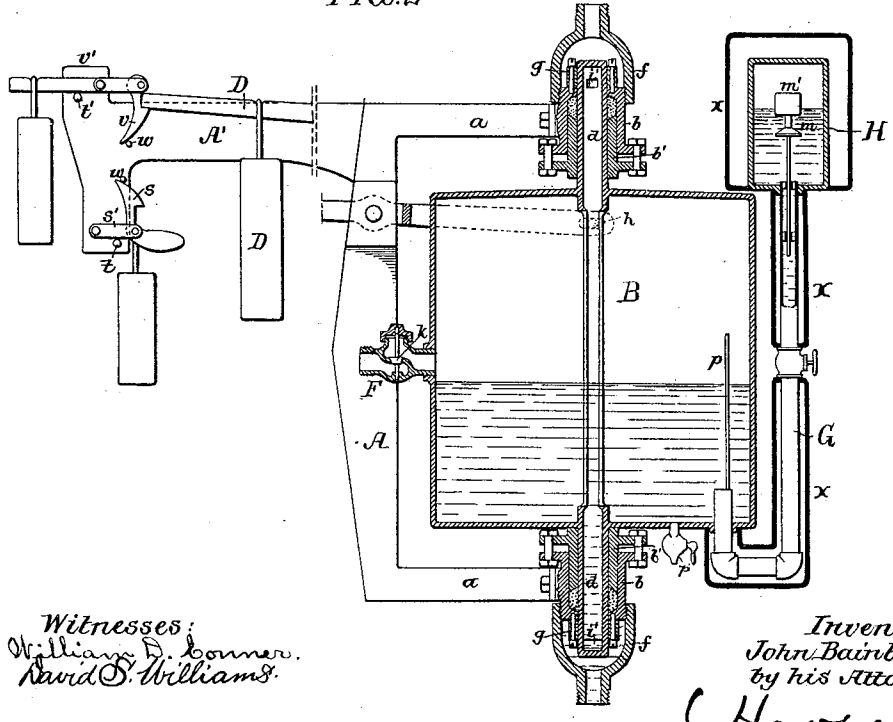


FIG. 2.



Witnesses:
William D. Conner.
David S. Williams.

Inventor
John Bainbridge
by his Attorneys
Howson and Sons

(No Model.) 2 Sheets—Sheet 2.

J. BAINBRIDGE.

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FIG. 4.

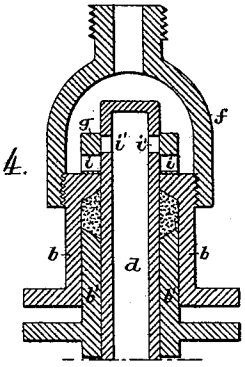


FIG. 8.

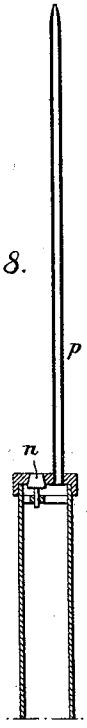


FIG. 6.

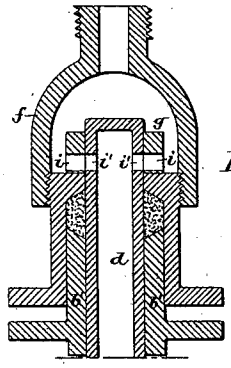


FIG. 5

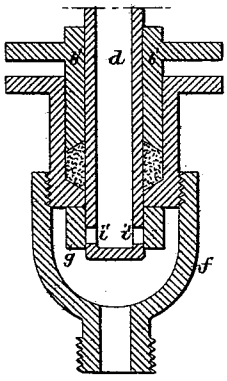


FIG. 7.

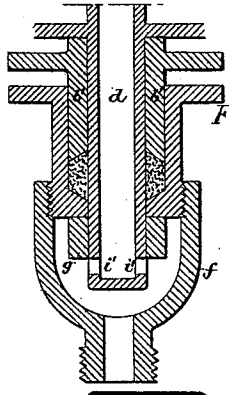
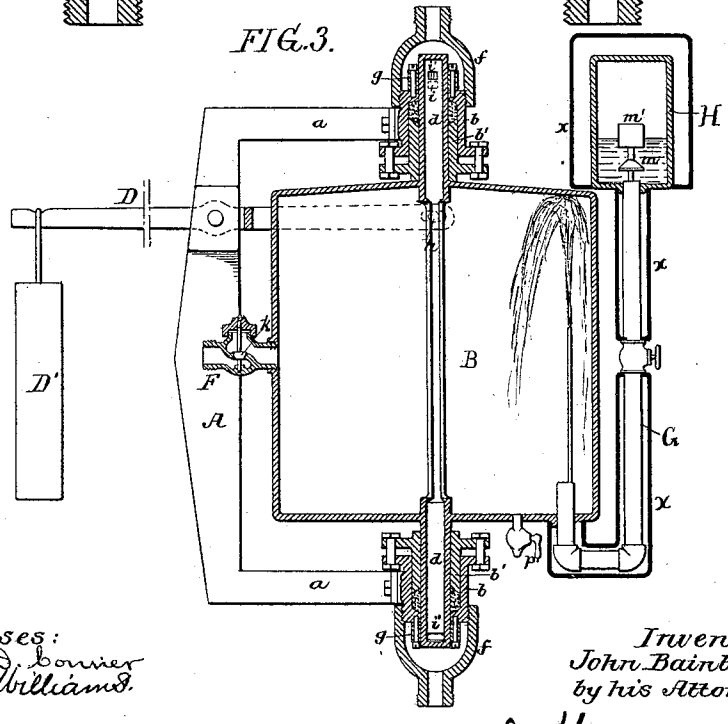


FIG. 3.



Witnesses:
William D. Bonnier
David S. Williams.

Inventor:
John Bainbridge
by his Attorneys
Howson and Sons

UNITED STATES PATENT OFFICE.

JOHN BAINBRIDGE, OF TRENTON, NEW JERSEY.

BOILER-FEEDING AND WATER-FORCING DEVICE.

SPECIFICATION forming part of Letters Patent No. 366,912, dated July 19, 1887.

Application filed March 5, 1887. Serial No. 229,769. (No model.)

To all whom it may concern:

Be it known that I, JOHN BAINBRIDGE, a citizen of the United States, residing in Trenton, Mercer county, New Jersey, have invented certain Improvements in Boiler-Feeding and Water-Forcing Devices, of which the following is a specification.

My invention relates to that class of boiler-feeding or water-forcing apparatus in which is employed a movable tank communicating with the supply-pipe and with the boiler or other vessel into which the water is to be forced, the falling movement of the tank opening valves to permit the discharge of the water from the tank and the inlet of steam to the tank to force the water therefrom, and the rising of the tank closing these valves, so as to permit the entrance of a fresh supply of water, which is induced to enter the tank by reason of the partial vacuum produced therein by the condensation of the steam.

My improvements comprise a simple construction of tank and valves, means for facilitating the condensation of the steam left in the tank when the valves are closed, and means for holding the tank in its extreme positions until such time as it may have become filled or emptied.

In the accompanying drawings, Figure 1 is a view, partly in section and partly in elevation, of a boiler-feeder or water-forcing device constructed in accordance with my invention; Fig. 2, a similar view with the parts in different positions; Fig. 3, a view similar to Figs. 1 and 2, but illustrating another stage of the operation and omitting the tank-retaining devices; Figs. 4 to 7, enlarged views of the valve structures of the apparatus, and Fig. 8 an enlarged view of part of the condensing mechanism of the apparatus.

In Figs. 1, 2, and 3, A represents a frame, which, if the device is to be used as a boiler-feeder, is erected in any convenient place adjacent to the boiler, and on the same level as the desired water-level of the boiler, this frame having at top and bottom projecting arms *a*, terminating in tubular bosses *b*, which are provided with suitable followers, *b'*, and form stuffing-boxes for the upper and lower tubular stems, *d*, of the tank B, these stems forming the opposite projecting ends of a tube, *d'*, which passes through the tank and is slotted for the passage of steam and water. To the upper stuffing-box, *b*, is secured a chest, *f*, which should communicate through a suitable pipe with the steam-space of the boiler, and to the lower stuffing-box, *b*, is secured a similar chest, which should communicate with the water-space of the boiler. In each chest *f* is a valve-ring, *g*, secured to the stuffing-box *b*, and fitting snugly to the tubular stem *d* of the tank, ports *i* in said valve-ring acting in conjunction with ports *i'* in the stem, as described hereinafter, so that the ports *i'* in the stems of the tank are simultaneously opened and closed as said tank falls and rises.

The tank B has pins *h*, adapted to slots in the forked arm of a lever, D, which is pivoted to the frame A, so that said tank is free to rise and fall under the circumstances described hereinafter. At one side of the tank is a branch, F, provided with a check-valve, *k*, which will permit the flow of liquid into the tank, but will close against back-pressure, and this branch should be in communication, through a suitable flexible pipe, with a supply of water, which may or may not be under pressure. Carried by the tank is a pipe, G, which has at the upper end a closed vessel, H, the upper end of this pipe within the vessel forming a seat for a valve, *m*, which is connected to a float, *m'*. The lower end of the pipe G projects into the tank B, and is provided with a valve, *n*, and pipe *p*, the valve opening into the pipe, but outward from the tank, and the pipe *p* having a contracted orifice or mouth at its upper end. The tank is also provided with a suitable blow-off cock, *p*, to permit the expulsion of air from the tank in starting the apparatus.

The lever D is provided with a counterbalance-weight, D', the effect of which is to exert upon the tank B a lifting force somewhat greater than the weight of said tank and its attachments. The outer end of the lever D, when the tank is at the limit of its upward movement, engages with and is retained by a weighted catch, *s*, hung to an arm, *s'*, pivoted to a bracket, A', on the frame A, a suitable stop-pin, *t*, limiting the descent of this arm, and

when the tank is at the limit of its downward movement the outer end of the lever D engages with and is retained by a catch, *v*, which is hung to a weighted lever, *v'*, pivoted to the bracket A', and retained by a stop-pin, *t'*. Both catches have beveled faces, which bear against pins or projections *w* on the bracket.

The operation of the apparatus is as follows: The valve in the feed-pipe leading from the lower chest, *f*, to the boiler being closed, the tank is depressed, so as to permit steam to enter the same and drive out the air through the cock *p'*. This cock being then closed, the valve in the feed-pipe is opened, and as a partial vacuum in the tank B is formed by the condensation of the steam therein, water enters the tank through the branch F. As soon as water has accumulated in the tank to such an extent that its weight overcomes the restraining influence of the counterbalance-weight D' and the weighted catch *s*, the tank falls to the position shown in Fig. 2, the catch *s* being tripped by the pin *w* as the outer end of the lever D rises. When the tank reaches its lowest position, the outer end of the lever D is caught and retained by the upper catch, *v*, and when the tank is in this position the ports *i'* of the upper and lower stems are open, so that steam can enter the tank through the upper stem and force the water therefrom through the lower stem, the pressure closing the check-valve *k* in the branch F, so that there can be no backflow through the latter. The pressure upon the water in the tank causes the opening of the valve *m* in the pipe G, and permits a flow of water through said pipe and up into the vessel H at the top of the same, the valve *m* being lifted by its float *m'*, and the air in the vessel H being compressed in the upper portion of the same. When the tank has been emptied, the weight upon the lever D preponderates that on the lever *v'* of the upper retaining-catch; hence the lever D falls, and said upper catch is tripped by the pin *w*, so as to release the outer end of the lever, the latter continuing to descend until it is caught and retained by the lower catch, *s*, and the tank is restored to its elevated position. As soon as the lever is released from the control of the catch *v*, the full force of the weight D' is exerted upon said lever, which therefore descends rapidly, so as to insure a quick movement of the tank and a sharp cut-off of the steam and water. The tank is now filled with steam, and as soon as there is such a slight condensation of the latter as will reduce its pressure the pressure of air confined in the upper portion of the vessel H drives the water therefrom through the pipe G and nozzle *p*, the water thus issuing from the nozzle in the form of a jet, as shown in Fig. 3, so as to rapidly condense the steam remaining in the tank and form a partial vacuum therein, which induces a fresh flow of water into the tank through the branch F. This flow continues until the tank receives its proper amount of water, whereupon the above operations are repeated.

When the apparatus is intended for forcing or feeding hot water, the vessel H, and by preference, also, the pipe G, are provided with casings *x*, so as to form chambers for the circulation of cold air or water in contact with said pipe and vessel, whereby the temperature of the water admitted to the latter will be so far reduced that it will properly perform its condensing duty when it is admitted to the tank on the escape of the water therefrom.

Springs may be used for counterbalancing the tank in place of the weighted lever D; but the latter is preferred.

I claim as my invention—

1. The combination of the tank having upper and lower tubular ported stems, a frame having steam inlet and water-discharge chambers and upper and lower bearings for the stems, and a valved water-inlet for the tank separate from the tubular ported stems of the same, all substantially as specified.

2. The combination of the tank having water-inlet and upper and lower tubular ported stems, the frame having bearings for said stems, the inlet and discharge chests, and valve-rings embracing the projecting ends of the stems, and acting in conjunction with the ports of the latter to cut off or open communication between the chests and the interior of the tank as the latter rises and falls, all substantially as specified.

3. The combination of the tank having water-supply pipe, steam-inlet and water-discharge pipe, valves for opening and closing communication between said steam-inlet and water-discharge pipe and the interior of the tank as the latter rises and falls, a lever carrying the tank, and a weighted catch for retaining said lever when the tank is at the limit of its downward movement, all substantially as specified.

4. The combination of the tank having water-supply pipe, steam-inlet and water-discharge pipe, valves for opening and closing communication between said steam-inlet and water-discharge pipe and the interior of the tank as the latter rises and falls, a lever carrying the tank, and a weighted catch for retaining said lever when the tank is at the limit of its upward movement, all substantially as specified.

5. The combination of the tank having water-supply pipe, steam-inlet and water-discharge pipe, valves for opening and closing communication between said steam-inlet and water-discharge pipe and the interior of the tank as the latter rises and falls, a lever carrying the tank, a weighted catch for retaining the lever when the tank is at the limit of its downward movement, and a similar weighted catch for retaining the lever when the tank is at the limit of its upward movement, all substantially as specified.

6. The combination of the tank having water-supply pipe, steam-inlet and water-discharge pipe, valves governing the communi-

cation between the tank and said steam-inlet and water-discharge pipe, and a closed vessel communicating with the lower portion of the tank and receiving a supply of condensing-water therefrom, all substantially as specified.

7. The combination of the tank, its water-supply pipe, steam-inlet and water-discharge pipe, the valve mechanism, the closed condensing-vessel, the pipe providing a communication between said vessel and the tank, and a float-valve contained in the vessel for closing the upper end of the pipe, all substantially as specified.

8. The combination of the tank, its water-supply pipe, steam-inlet and water-discharge pipe, the valve mechanism, the closed condensing-vessel, and the pipe forming a communication between said vessel and the lower portion of the tank, and having a check-valve and jet-nozzle, all substantially as specified.

9. The combination of the tank, its water-supply pipe, steam-inlet and water-discharge pipe, the valve mechanism, and the condensing-vessel having a cooling-jacket, all substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN BAINBRIDGE.

Witnesses:

STEPHEN O. LANNING,

HENRY D. PHILLIPS.