(No Model.) 2 Sheets—Sheet 1.

G. A. EDDY.

BOILER FEEDING DEVICE.

No. 552,170. Patented Dec. 31, 1895.

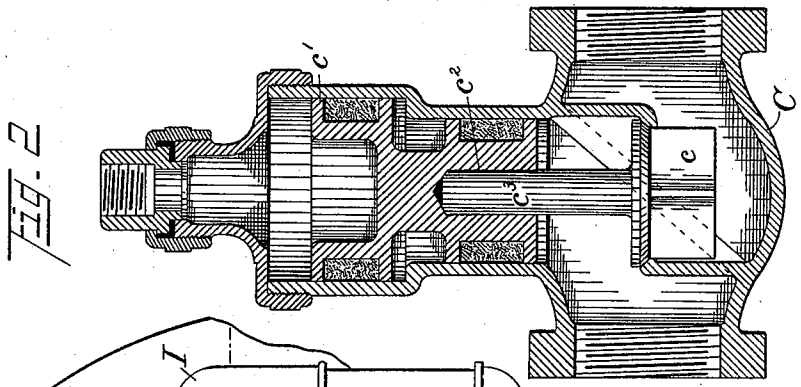

Fig. 2.

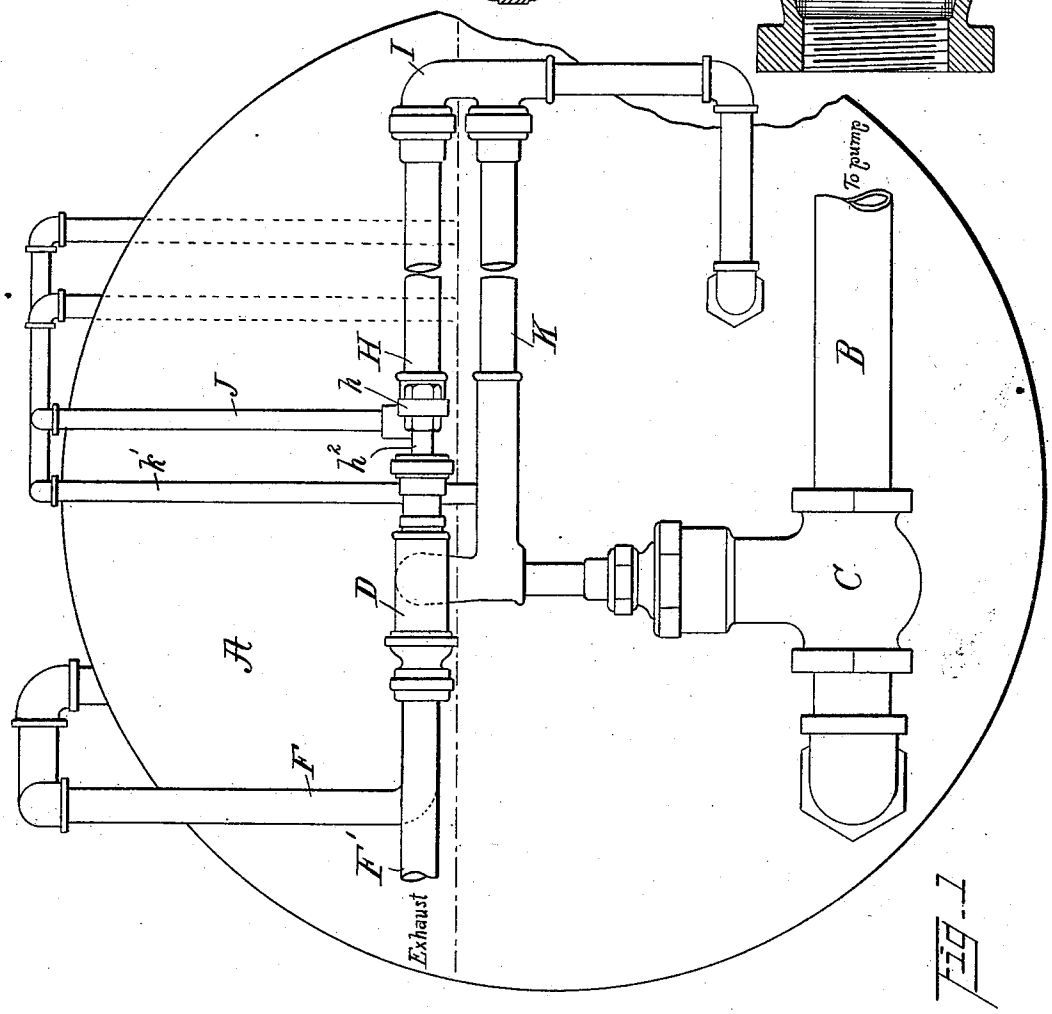

Fig. 1.

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Inventor.
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Fig. 3

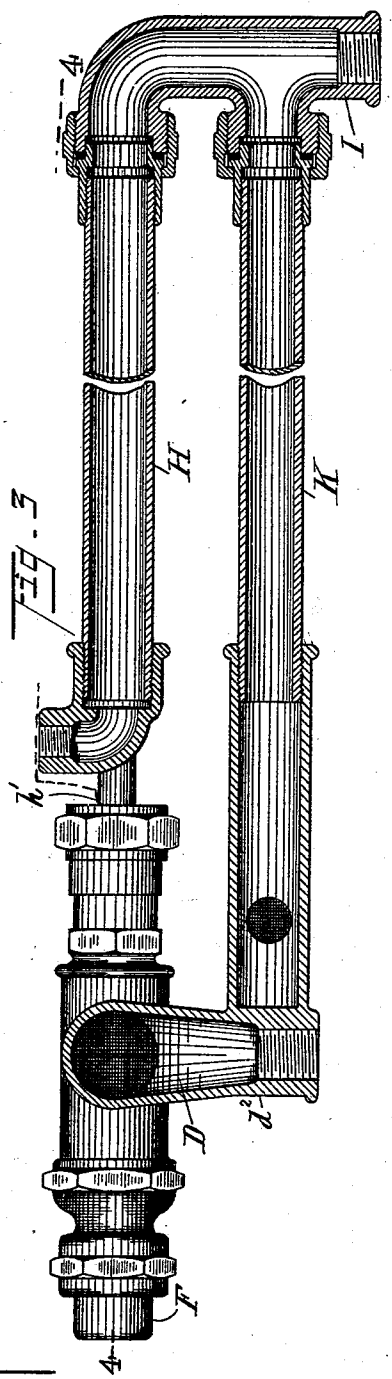
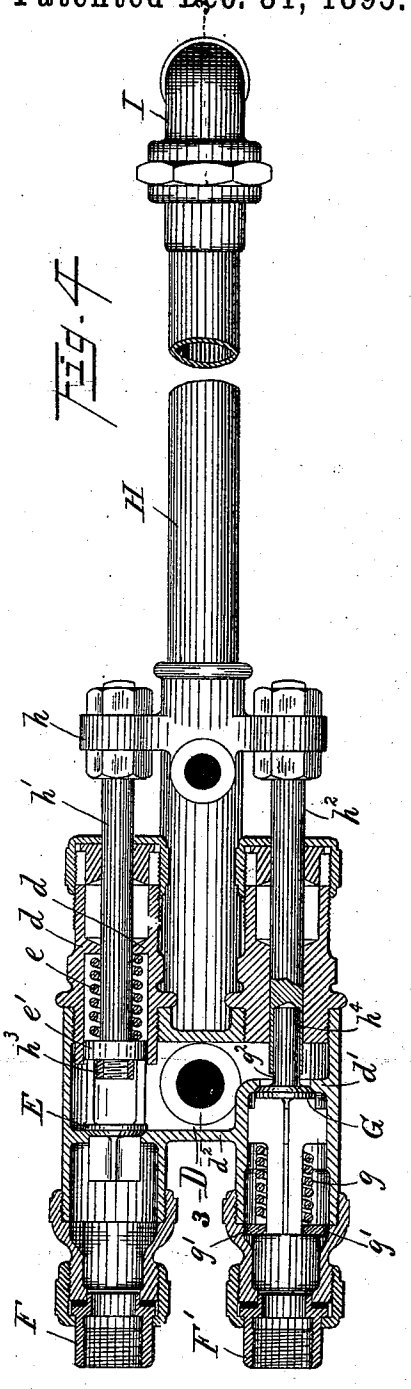


Fig. 4



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UNITED STATES PATENT OFFICE.

GEORGE A. EDDY, OF CLEVELAND, OHIO, ASSIGNOR TO THE AUTOMATIC TANK AND BOILER FEED COMPANY, OF SAME PLACE.

BOILER-FEEDING DEVICE.

SPECIFICATION forming part of Letters Patent No. 552,170, dated December 31, 1895.

Application filed March 5, 1895. Serial No. 540,672. (No model.)

To all whom it may concern:

Be it known that I, GEORGE A. EDDY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Boiler-Feeding Devices; 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.

My invention relates to automatic boiler-feeds.

One object of the invention is to provide a novel device by which the water in a steam-boiler shall be automatically maintained at the desired level.

Another object of the invention is to provide a novel device by which the water shall be automatically maintained at a predetermined level, whatever may be the pressure in the boiler.

To these ends the invention consists in the novel construction and combination of parts shown in the drawings and hereinafter described and claimed.

In the drawings, Figure 1 is an elevation of a boiler with my improved device connected therewith. Fig. 2 is a vertical sectional view of the feed-water valve. Fig. 3 is a longitudinal section on line 3 3 of Fig. 4, and Fig. 4 is a vertical sectional view on line 4 4 of Fig. 3.

Referring to the parts by letter, A represents the boiler, and B the feed-water pipe which connects the pump with the boiler below the water-level.

C represents a valve-casing which is connected in the pipe B. In this casing is a check-valve c, which is lifted from its seat by the pressure of the water forced forward by the pump, when said movement of the valve is not prevented by the mechanism to be presently described. In the casing is a vertically-movable piston c', the lower end of which is always subject to the back-pressure from the boiler. The area of the upper end of the piston is greater than that of the lower end, wherefore said piston is moved downward whenever both ends are subjected to the boiler-pressure. In the lower end of the piston is a vertical socket c^2, into which the stem c^3 of the valve c projects. The socket is of such depth compared with the length of the valve-stem that when the piston is forced down it forces and holds the valve c down upon its seat; but when the piston is raised the socket serves as a guide for the valve-stem.

The upper end of the valve-chamber C is connected with a chamber D in the casing d^2, with which are likewise connected, first, a pipe F, which is in communication with the steam-space in the boiler, and, second, the exhaust-pipe F'. The entrance to chamber D of steam from the boiler through pipe F is prevented by the valve E, while the escape of steam from the chamber to the exhaust-pipe is prevented by the valve G. The valve E is forced and held against its seat by a coil-spring e, which thrusts against the end of the valve-stem e' and the fixed shoulders d d, and the valve G is forced and held against its seat by a similar spring g, which thrusts against the shoulders g' on the valve-stem and the fixed cross-bar d'.

Mechanism, which I will now proceed to explain, is provided for opening the valve G when the valve is closed, and vice versa.

H represents a tube made of copper or some other material which expands and contracts considerably as its temperature changes. This tube is secured at one end to a fixed pipe I, which is connected with the boiler below the water-level. The other end of the tube is connected with a more or less flexible or movable pipe J, which communicates with the boiler. The end of this pipe in the boiler must be so placed that when the water is below the desired level steam may enter it, and it may be so placed that it is open to the entrance of steam at all times. On the end of the tube H is fixed a head h, to which are attached two rods h' h^2, which enter the chamber D through stuffing-boxes and act upon the valves E and G in the manner hereinafter described. The inner end of the rod h' passes through a hole in the tubular stem e', and on its inner end is a head h^3, (which may be a nut,) which, as the rod is drawn backward, engages with the valve-stem and draws the valve from its seat. When the rod moves inward, it permits the spring to seat the valve,

and then, in a further movement of said rod, it slides through the hole in the valve-stem without moving said valve. The rod h^2 has in its inner end a socket h^4, into which the stem g^2 of the valve G enters. When the rod h^2 moves forward, it pushes the valve G from its seat, thereby connecting the chamber D with the exhaust-pipe F'. When the rod moves backward, the valve is closed by its spring, and the further backward movement of said rod does not affect the position of the valve. When the tube expands, (lengthens,) the rods h' h^2 are forced forward, with the result of opening the exhaust-valve G and permitting the valve E to close itself. When the tube contracts, (shortens,) it draws the rods h' h^2 backward, with the result of opening the valve E and permitting the valve G to close.

When the described apparatus is attached to a boiler, the parts thereof may be placed at any convenient point, except this, that the tube H must be horizontal and must lie wholly or partly above the level below which the water in the boiler is not intended to fall and must be outside of the boiler.

When the apparatus is connected in the described manner to the feed-pipe and boiler, the mode of operation is as follows: When the water has risen above the tube H, said tube is filled with water, which enters through the pipe I, expelling the steam from said tube. The water which thus enters the tube H is or very soon becomes cooler than the steam expelled. The tube consequently cools off and contracts, thereby, through the described mechanism, opening the steam-valve E and permitting the exhaust-valve G to be closed. Steam from the boiler passes into the chamber D and thence into the valve-casing C on top of the piston c' therein. This piston is moved down by the steam and carries down with it the check-valve c, which is held against its seat with sufficient force by said piston and by the back-pressure from the boiler to prevent the passage of water past it. When, by evaporation, the water-level is lowered, the water in the tube runs out and steam enters said tube, which steam, being hotter than the water it replaced, causes the elongation of the tube H. This, through the intermediate mechanism described, causes the exhaust-valve G to be opened and permits the valve E to be closed, whereupon the back-pressure from the boiler in the feed-water pipe raises the piston c' and permits the check-valve c to be raised by the water as it is forced along by the pump.

I prefer to have the end of pipe J in the boiler just below the lower side of the tube H, because the tube then remains full of water until the water in the boiler falls below the end of the pipe J, and then instantly the water is expelled by the steam. With this construction, the expansion of the tube is more rapid in its action and the device responds more quickly.

The apparatus above described is one which is admirably suited to use with boilers which are operated at all times at approximately the same pressure, and it can be arranged and adjusted so as to perform its functions perfectly with any pressure in the boiler, provided said pressure is approximately maintained; but since the tube expands and contracts within the useful limits at certain temperatures, and since the temperature of the water as well as the steam is greater as the pressure is greater, it is obvious that said apparatus, as hereinbefore described, has this defect in common with other boiler-feeding devices employing expanding thermostatic tubes to operate any of their parts, viz: When the normal pressure is greatly increased, the water in the tube will be much longer in cooling to the temperature which will permit such an amount of contraction in said tube as will open the valve E and close the valve G, thereby closing the check-valve c. In order to remedy this defect and to adapt the device for use with boilers in which the pressure varies greatly at times I employ a second expansion-tube K, arranged parallel and below the tube H. This tube is connected at one end with the fixed pipe I, so that it is also filled with water from the boiler. The other end of said tube is fastened to some rigid part of the casing d^2, which contains the chamber D. When both tubes contain water, the said water will be approximately of the same temperature, and therefore both tubes (being of substantially the same length) will expand to substantially the same degree. The expansion of the tube K pushes back the casing to which it is secured, and which contains the valves G and E, a distance equal to the elongation of the tube H, wherefore said valves are not moved within the casing. It is only when water is expelled from the tube H and live steam takes its place therein that the tube H becomes hotter than tube K, whereupon the said tube expands more than the tube K, and consequently the said valves are operated as described. The tube K is connected with the steam-space in the boiler by the pipe k', which preferably enters the water therein.

The valves E and G are auxiliary valves, the purpose of which is to control the admission of steam from the boiler to the interior of the valve-casing C above the valve-closing piston c', and the escape of said steam from said part of said casing to the exhaust, whereby, first, the piston c' is moved in one direction by the steam-pressure to close the valve c, or, second, permitted to be moved in the other direction by the back-pressure from the boiler, so that said valve c may open.

One great advantage secured by the described construction over any other automatic boiler-feeds is this—viz., the valve in the feed-pipe is either tightly closed, so that no water can pass through it, or it is susceptible of being opened wide by the pressure from the pump. The pump, therefore, acts freely and easily, or not all.

Having described my invention, I claim—

1. In a boiler feeding device, in combination, a valve casing adapted to be connected in the feed water pipe, a valve therein, a piston therein adapted to close said valve, an auxiliary valve casing, a port or pipe connecting the two casings, said auxiliary valve casing having an outlet port and an inlet port, a pipe for connecting the latter with the steam space in the boiler, two valves movable in opposite directions to open said inlet and outlet ports, an expansible tube fixed at one end, pipes connecting said tube with the boiler at two points—one above and one below the water level in the boiler, two rods, connected with the movable end of said expansible tube, which enter the auxiliary valve casing and engage with said valves respectively, substantially as and for the purpose specified.

2. An auxiliary valve for a boiler-feeding device consisting of a chambered casing having an exhaust port and an inlet port and an orifice with which the main feed water valve casing may be connected, two valves for closing said inlet and outlet ports, an expansible tube fixed at one end, pipes for connecting said tube with the boiler above and below the water level therein, two rods secured to the movable end of said tube, which rods enter the chambered casing, and suitable connections between said rods and valves, substantially as and for the purpose specified.

3. In an auxiliary valve for a boiler feeding device, a chambered valve casing having inlet and outlet ports, valves for closing said ports, springs for moving said valves to their seats, an expansible tube fixed at one end, pipes for connecting said tube with the boiler at two points—one above and one below the water level therein, two rods secured to the movable end of said expansible tube and entering said chambered casing and having a telescoping connection with the stems of said valves, and shoulders on said rods and stems, whereby the said valves are opened by said rods, substantially as and for the purpose specified.

4. In a boiler feeding device, two expansible tubes both fixed at one end, pipes for connecting both tubes with the boiler at two points, a valve casing fixed to one expansible tube, a valve therein, and mechanism intermediate of said valve and the movable end of the other expansible tube, substantially as and for the purpose specified.

5. In a boiler feeding device, a chambered valve casing, having inlet and outlet ports, and another opening with which the feed water valve casing is connected, valves for closing said inlet and outlet ports, an expansible tube connected at one end to said chambered valve casing and rigidly fixed at the other end, pipes connecting said tube with the boiler at two points, a second expansible tube above that first named fixed at one end, and connected with the boiler at two points—one above and one below the water level, two rods connected with the movable end of the expansible tube last named, and entering the valve casing, and suitable mechanism connecting said rods and valves, substantially as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

GEO. A. EDDY.

Witnesses:
E. L. THURSTON,
L. F. GRISWOLD.