No. 661,782. Patented Nov. 13, 1900.

T. J. WHITNEY.

BOILER FEEDER.

(Application filed Dec. 13, 1899.)

(No Model.) 4 Sheets—Sheet 1.

fig. 1.

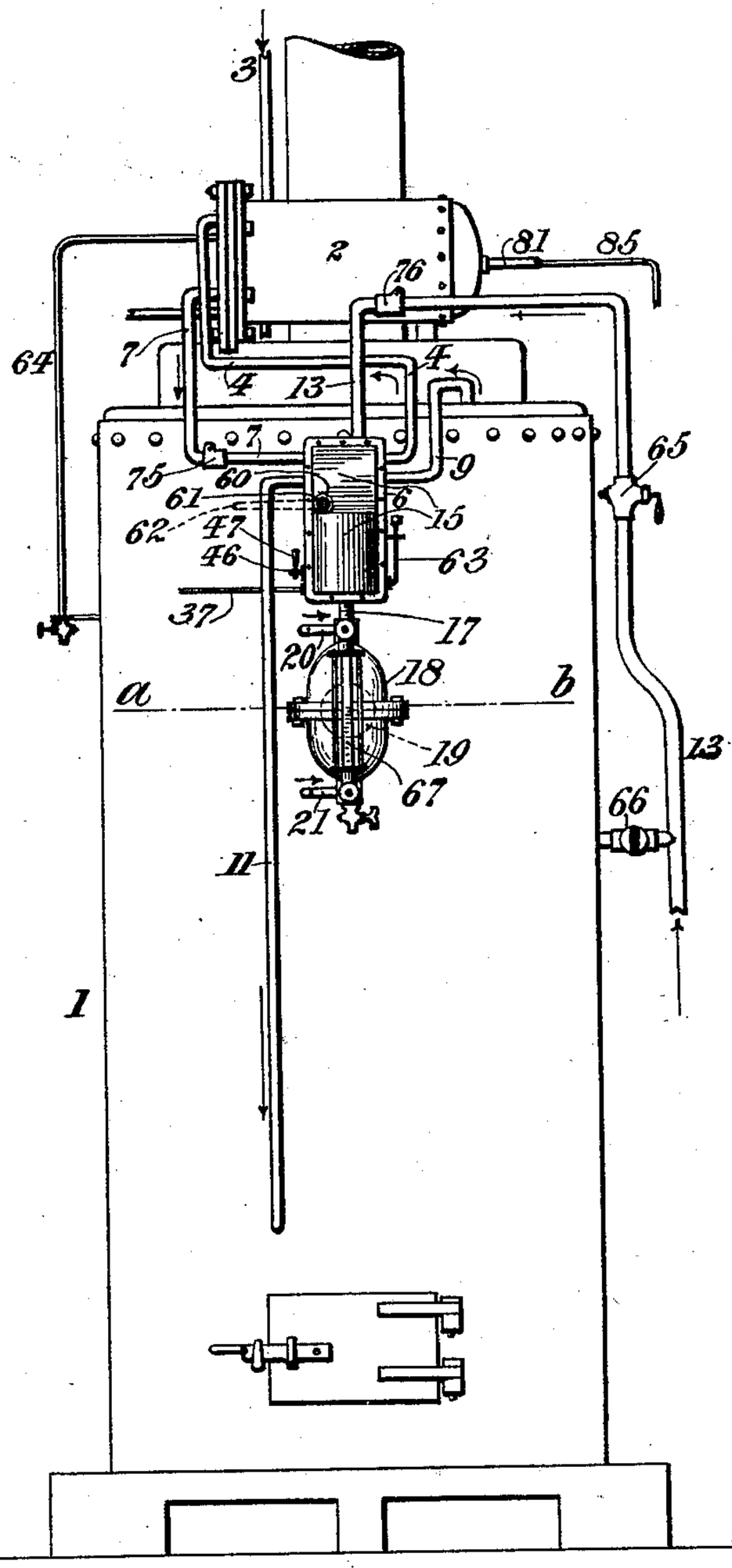
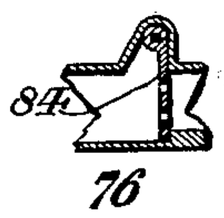


fig. 23.



Witnesses
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No. 661,782. Patented Nov. 13, 1900.

T. J. WHITNEY.

BOILER FEEDER.

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(No Model.) 4 Sheets—Sheet 2.

fig. 2.

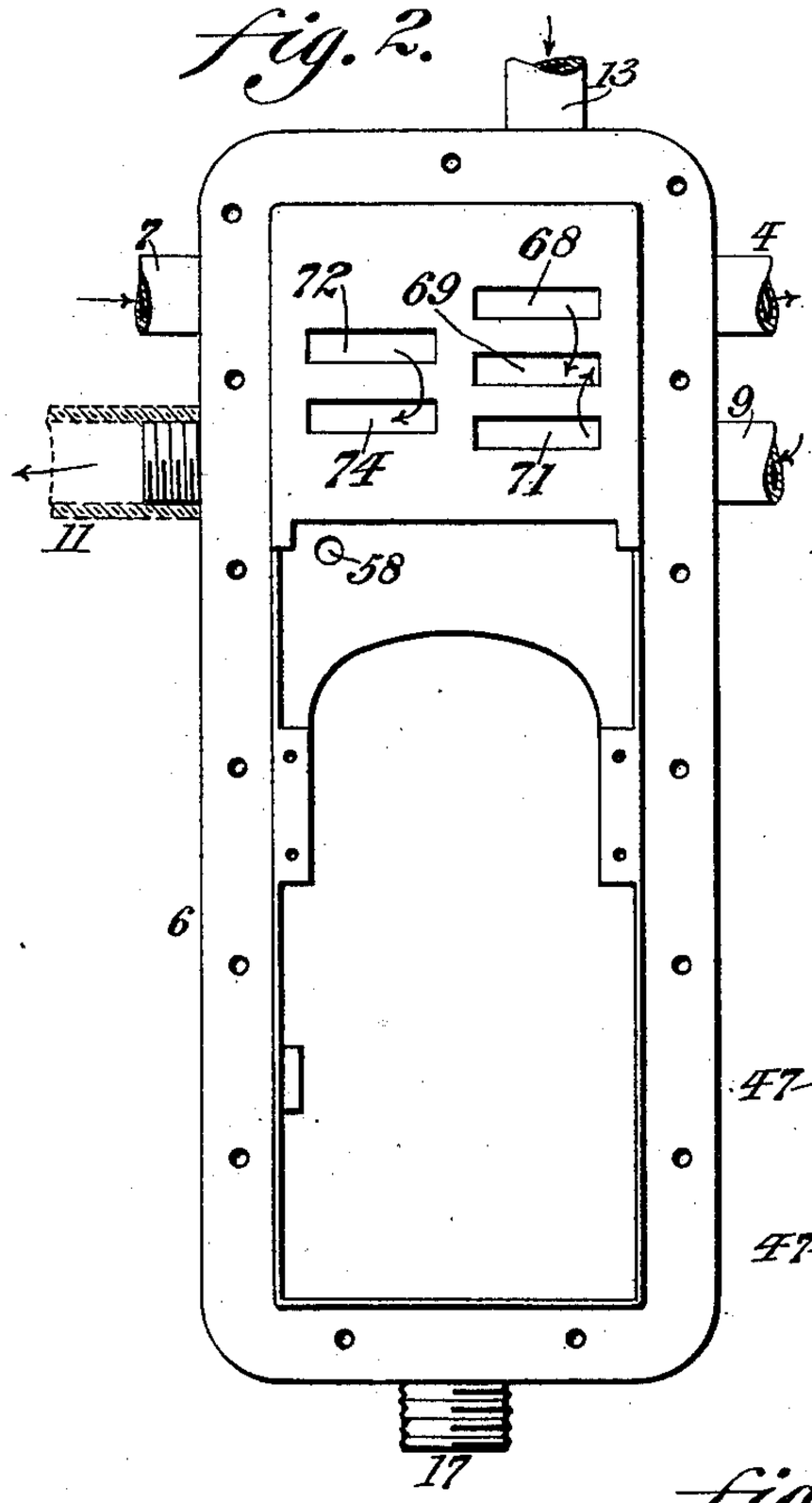

fig. 3.

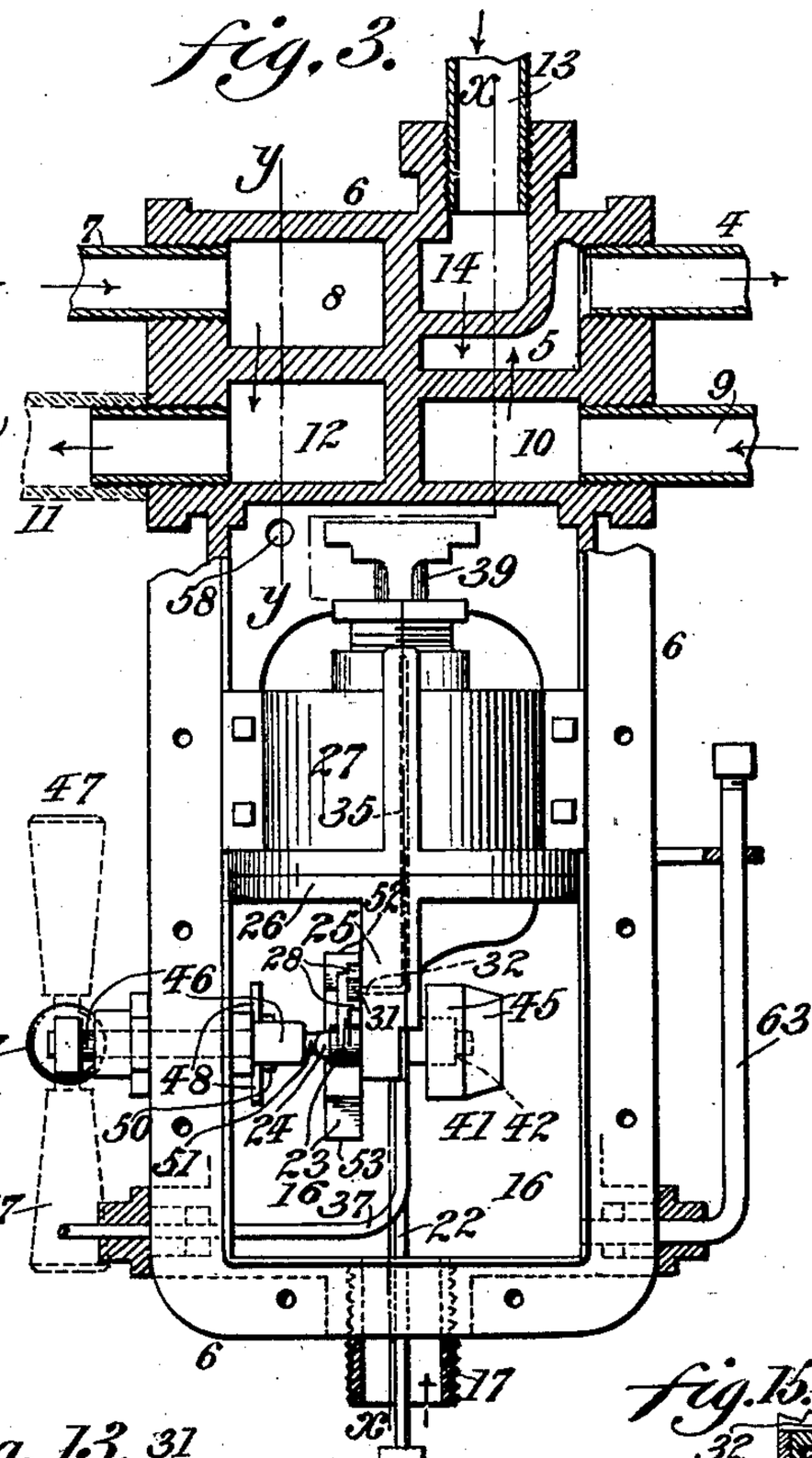

fig. 17.

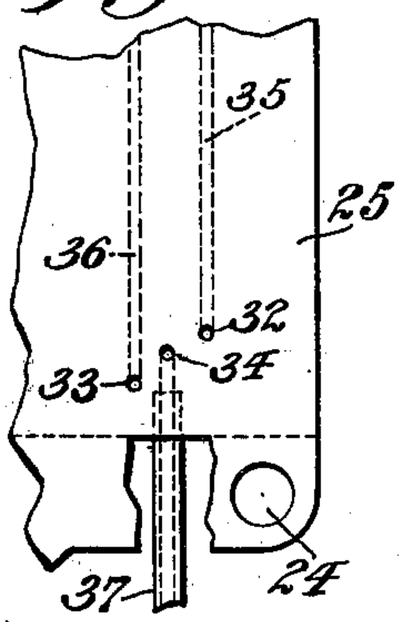

fig. 13.

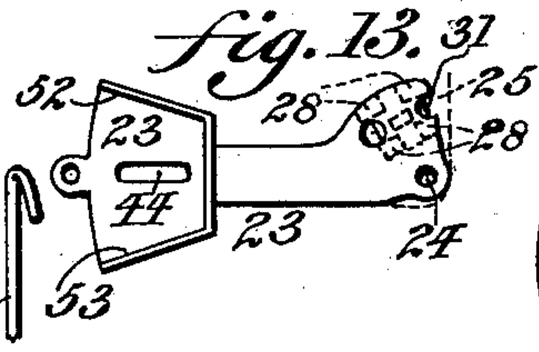

fig. 15.

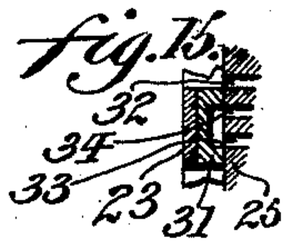

fig. 16.

fig. 14.

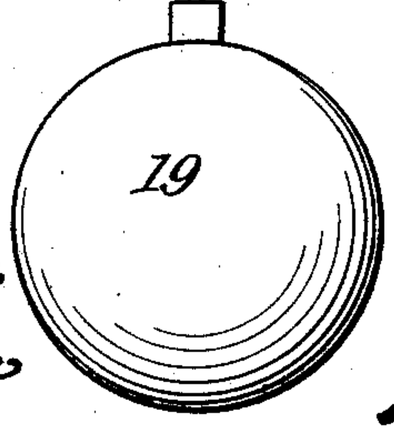

fig. 18.

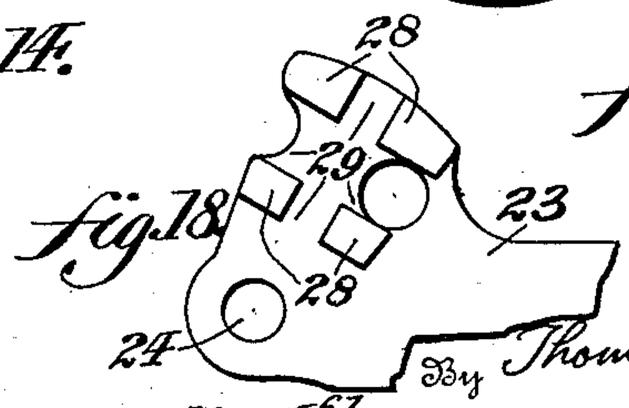

fig. 19.

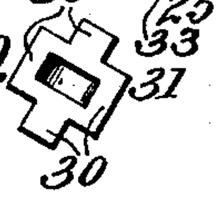

fig. 20.

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No. 661,782. Patented Nov. 13, 1900.

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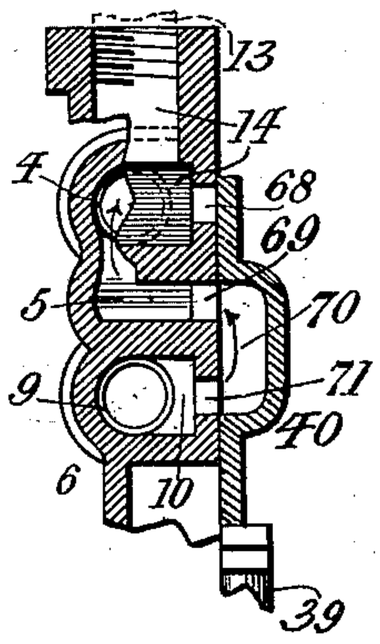
BOILER FEEDER.

(Application filed Dec. 13, 1899.)

(No Model.) 4 Sheets—Sheet 3.

fig. 5.



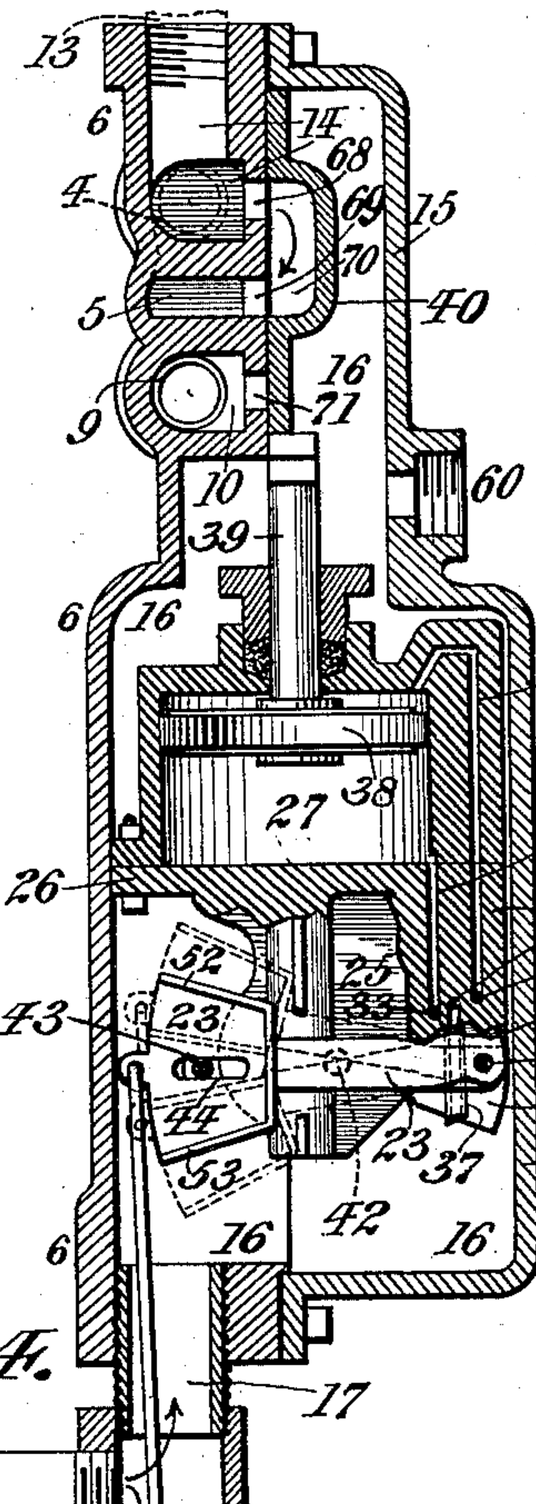


fig. 6.

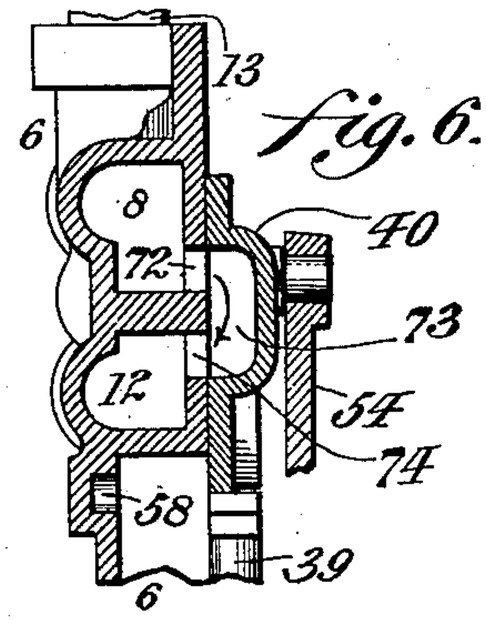


fig. 8.

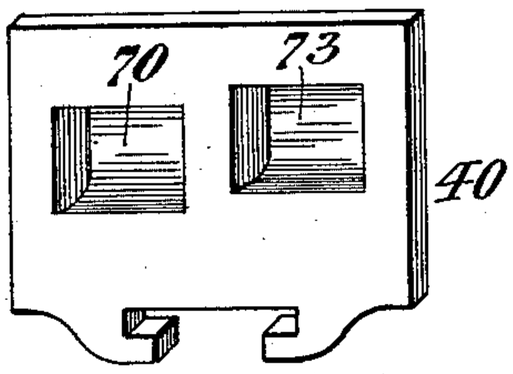


fig. 10.

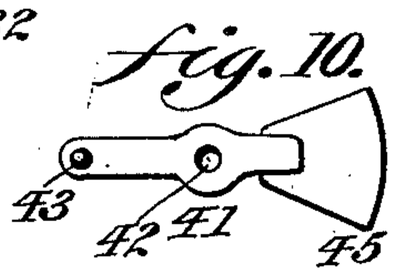


fig. 7.

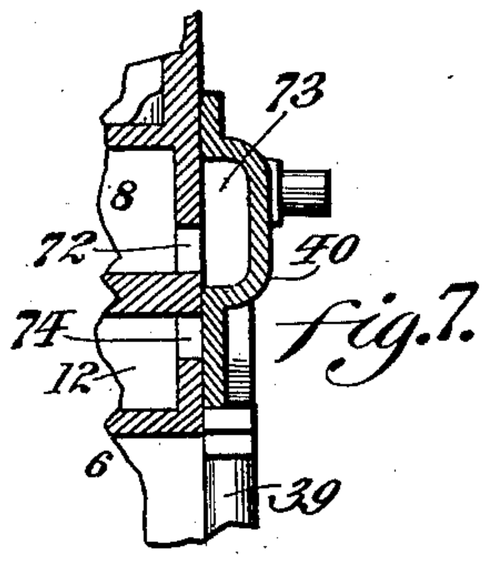


fig. 9.

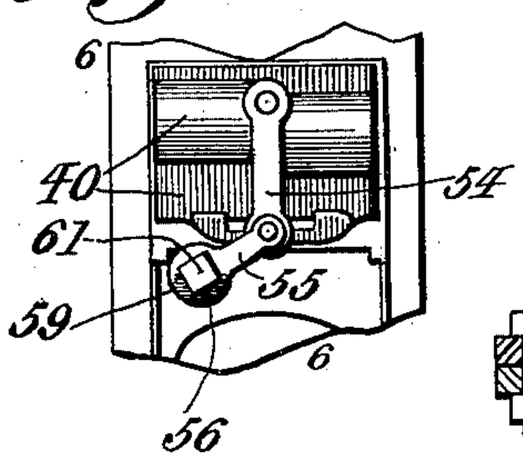


fig. 11.

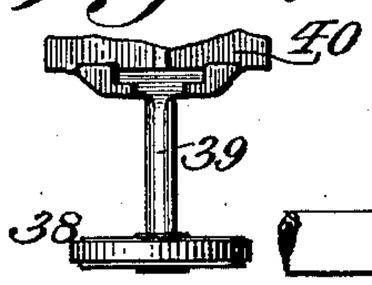
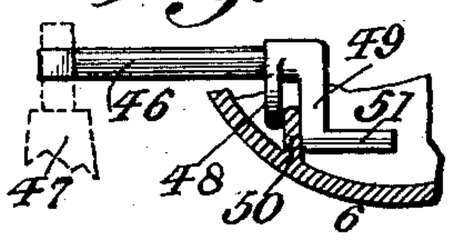


fig. 12.



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No. 661,782. Patented Nov. 13, 1900.

T. J. WHITNEY.

BOILER FEEDER.

(Application filed Dec. 13, 1899.)

(No Model.) 4 Sheets—Sheet 4.

fig. 21.

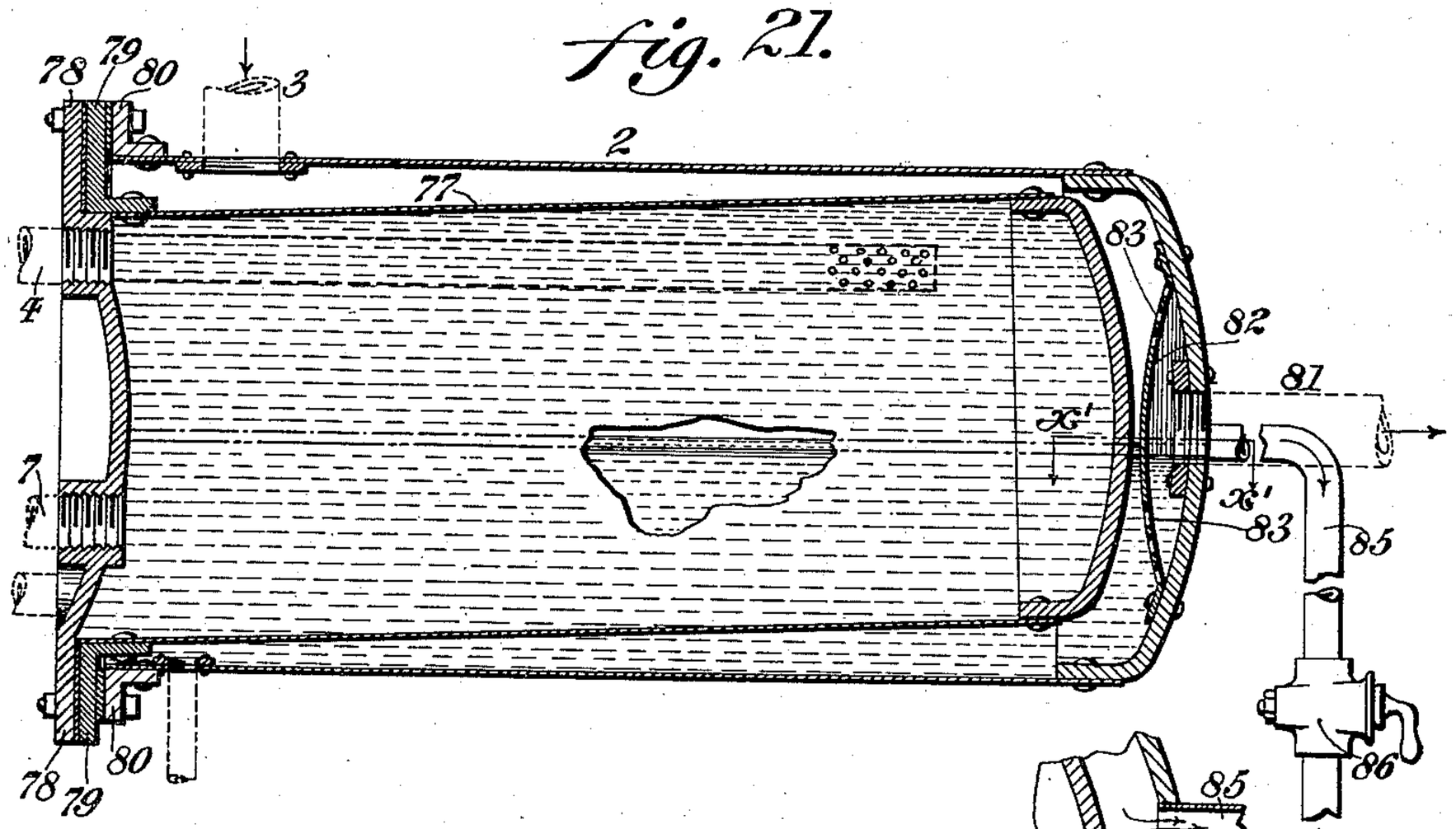

fig. 22.

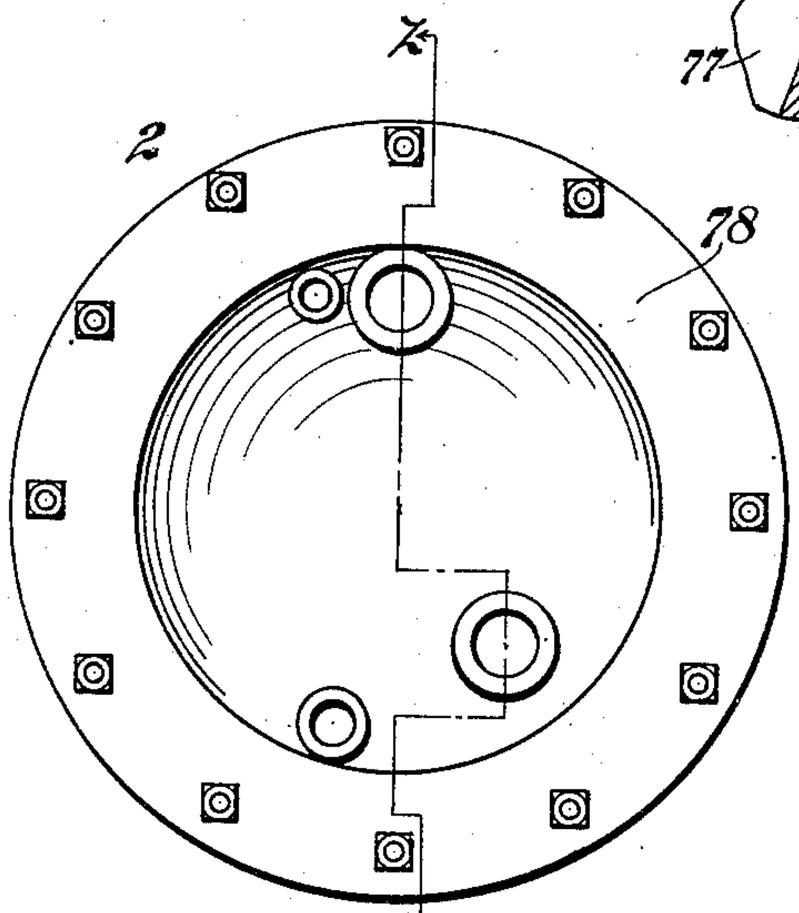

fig. 24.

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UNITED STATES PATENT OFFICE.

THOMAS J. WHITNEY, OF PHILADELPHIA, PENNSYLVANIA.

BOILER-FEEDER.

SPECIFICATION forming part of Letters Patent No. 661,782, dated November 13, 1900.

Application filed December 13, 1899. Serial No. 740,229. (No model.)

To all whom it may concern:

Be it known that I, THOMAS J. WHITNEY, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Boiler-Feeders, which improvement is fully set forth in the following specification and accompanying drawings.

My invention relates to improvements in steam-boiler feeders; and it consists of novel means whereby water from a street-main or other source of supply may be directed to the water-heater and from thence in a heated condition and by gravity to the steam-boiler.

It also consists of means whereby the device may be operated either by hand or automatically, according to requirements, provision being made by means of pipes and valves for regulating the circulation between the main boiler and the water-heater.

It further consists of novel details of construction, all as will be hereinafter fully set forth, and particularly pointed out in the claims.

Figure 1 represents a front elevation of a steam-boiler having connected therewith a steam-boiler feeder and its adjuncts embodying my invention. Fig. 2 represents, on an enlarged scale, an elevation of a portion of the casing of the feeder. Fig. 3 represents an elevation, partly in section, of the portion of the casing seen in Fig. 2 with certain portions of the mechanism for operating the several valves in position therein. Fig. 4 represents a vertical section on line *x x* in Fig. 3, with the addition of a chamber for a float secured thereto. Fig. 5 represents a vertical section of certain of the parts seen in Fig. 4, the valve being in a different position from that seen in Fig. 4. Fig. 6 represents a vertical section on line *y y* in Fig. 3. Fig. 7 represents a vertical section of the parts seen in Fig. 6, the valve, however, being in a different position from that seen in said Fig. 6. Fig. 8 represents a perspective view of a valve employed. Fig. 9 represents, on a reduced scale, a plan view of the valve seen in Fig. 8 and certain mechanism connected therewith, so that said valve may be operated by hand. Fig. 10 represents a side elevation of a counterbalance employed. Fig. 11 represents a plan view of a portion of the valve seen in Fig. 9 and illustrates the manner of connecting the same with a piston employed to impart a sliding motion to said valve. Fig. 12 represents a partial side elevation and partial vertical section of certain detached portions of the device. Fig. 13 represents a side elevation of a lever employed for operating the valve of a steam-cylinder located within the casing seen in Fig. 3. Fig. 14 represents an elevation of a float and rod for operating the lever seen in Fig. 13. Figs. 15 and 16 represent sectional views of certain detached portions of the device. Fig. 17 represents a side elevation of a portion of the device. Fig. 18 represents, on an enlarged scale, a portion of the lever seen in Fig. 13. Fig. 19 represents a plan view of a valve employed in connection with the lever seen in Fig. 13. Fig. 20 represents a perspective view of a lever employed in connection with my invention. Fig. 21 represents a longitudinal sectional view on line *z z*, Fig. 22. Fig. 22 represents an end view of Fig. 21. Fig. 23 represents, on an enlarged scale, a sectional view of the check-valve seen in Fig. 1. Fig. 24 represents a horizontal section on line *x' x'* in Fig. 21.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates a steam-boiler, above which is placed a feed-water heater 2, the latter being provided with a pipe 3, which conducts the exhaust-steam from an engine into the upper portion of the outside casing of said heater, said exhaust-steam serving to heat the water within said heater before the same is fed to the boiler 1.

4 designates a pipe one end of which is connected with the upper portion of the inner casing of heater 2, its opposite end being connected with the chamber 5 in the casing 6, as best seen in Figs. 1, 3, 4, and 5.

7 designates a pipe one end of which is connected with the heater 2, its opposite end being connected with the chamber 8 in the casing 6 and as best seen in Figs. 1, 3, 6, and 7.

9 designates a pipe one end of which is connected with the upper portion of the boiler 1, its opposite end being connected with the chamber 10, as best seen in Figs. 1, 3, 4, and 5.

11 designates a pipe one end of which is connected with the chamber 12, its opposite end being connected with the lower portion of the boiler 1. (See Figs. 1, 3, 6, and 7.)

13 designates a pipe which leads from the street-main or other source of water-supply and discharges into the chamber 14. (See Figs. 1, 3, 4, and 5.)

The casing 6 is provided with a lid 15, which may be bolted or otherwise secured thereto, as best seen in Fig. 4, it being noted that when said casing 6 and lid 15 are placed together, as seen in Fig. 4, a chamber 16 will be formed.

17 designates a pipe one end of which is connected with the casing 6, its other end being connected with a shell or casing 18, within which is placed a float 19, it being noted that said pipe 17 establishes a communication between the interior of the shell or casing 18 and the chamber 16, as best seen in Fig. 4. The shell or casing 18 has connected with its upper portion one end of a pipe 20, which leads from the steam-space in the boiler 1.

21 designates a pipe which leads from the boiler 1 to the lower portion of the shell or casing 18, so as to permit a portion of the water in the boiler 1 to pass through said pipe 21 and enter the shell 18 in order to operate the float 19, located therewithin, for a purpose to be hereinafter described. The float 19 has secured thereto a rod 22, which follows the rising and falling motions of the float 19, due to the varying levels of water within the shell or casing 18. The upper extremity of the rod 22 is connected with one end of a lever 23, which is pivoted, as at 24, to an extension 25 of the head 26 of the steam-cylinder 27, the latter being located within the space 16 formed by the casing 6 and lid 15, it being understood that said cylinder 27 may be held firmly in position within the space 16 by any suitable means. The inner face of the lever 23 is provided with raised portions 28 adjacent its pivotal point 24, as best seen in Figs. 13 and 18. The spaces 29 between the raised portions or lugs 28 are adapted to receive the projecting members 30 of the valve 31, (see Fig. 19,) so as to cause said valve 31 when placed in position relative to the lever 23 to move in unison therewith.

The extension 25 in the head 26 of the cylinder 27 is provided with ports 32, 33, and 34, which open into the space 16, (see Figs. 3, 4, 15, 16, and 17,) and it is to be noted that the valve 31 is adapted to be moved over said ports by the rocking motions of the lever 23, due to the raising and lowering of the float 19, occasioned by the varying levels of the water in the shell 18. The port 32 leads into a passage 35, which communicates with the upper portion of the interior of the cylinder 27, as best seen in Fig. 4. The port 33 leads into a passage 36, which communicates with the lower portion of the interior of the cylinder 27, as seen in Fig. 4. The port 34 leads into a pipe 37, which directs the exhaust-steam from the cylinder 27 to any desired point.

38 designates a piston located within the cylinder 27 and adapted to reciprocate therein, it being noted that the rod 39 of said piston is connected to the valve 40, as best seen in Fig. 11.

41 designates a counterbalance pivoted, as at 42, to the extension 25 of the cylinder-head 26, one end of said counterbalance being provided with a stud 43, which engages a slot 44 in the lever 23, the opposite end of said counterbalance being provided with a weight 45, the object of the latter being to cause the float 19 to be immersed normally one-half in the water, as seen in Figs. 1 and 4.

When the water-level, as at *a b* in Figs. 1 and 4, in the boiler 1 and shell 18 lowers, the float 19 will not immediately lower with the varying water-level, but will remain stationary, due to the friction of the valve 31 against the wall of the extension 25 of the cylinder-head 26, owing to steam-pressure against said valve. When, however, the water-level has lowered sufficiently, the weight of the float 19 and also that portion of the lever 23 to the left of its pivotal point 24 will exceed that of the weight 45, due to the displacement of water in the shell 18, and thus cause the float 19 to rapidly drop, and consequently turn the lever 23, containing valve 31, on its pivot 24 and open the port 32, whereupon a communication will be established between the chamber 16 and the upper portion of the cylinder 27, and steam from said chamber will enter the upper portion of the cylinder and force the piston 38 downwardly, thereby causing the valve 40 to move from the position seen in Fig. 4 to that seen in Fig. 6.

When the water-level in the boiler 1 and shell 18 increases in height, the float 19 will not immediately rise with the varying water-level, but will remain stationary until the water-level reaches a point at which its pressure upon the float 19 exceeds that of the friction of the valve 31 against the extension 25 of the cylinder-head 26, whereupon said float will rise rapidly, thereby opening the port 33 and closing the port 32 to the chamber 16, whereupon steam will pass from the chamber 16 to the under side of the piston 38 and force the same upwardly, while the steam in the cylinder 27 and above the piston 38 will escape through the ports 32 and 34 and exhaust through the pipe 37. The steam-pressure on the under side of the piston 38 will cause the latter to rise, and thus move the valve 40 from the position seen in Fig. 6 to that seen in Fig. 4.

46 designates a bell-crank lever journaled in the casing 6 and provided with a handle 47, so that said lever 46 may be operated from the outside of the casing 6 when desired.

The lever 46 has a projecting member 51, adapted to be brought in contact with the walls 52 and 53 of the lever 23 in order to rotate said lever, and thus actuate the valve 31. (See Fig. 13.)

The valve 40 has pivoted thereto one end of a link 54, (see Figs. 6 and 9,) the other end of said link being pivoted to the outer extremity of the arm 55 of a lever 56, (see Figs. 9 and 20,) whose lower portion 57 is journaled in a socket 58 in the casing 6, the portion 59 of said lever passing through a stuffing-box 60 in the lid 15. The squared portion 61 of the lever 56 projects outside the lid 15, so as to receive a handle 62 (seen in dotted lines in Fig. 1) to permit said lever 56 to be operated from the exterior of the lid when desired, and for a purpose to be hereinafter described.

63 designates a pipe which leads into the chamber 16, said pipe being supplied with a suitable lubricant, which flows from the same and enters said chamber, where it commingles with the steam within said chamber, and thus causes the lubricant to reach all the portions of the device within said chamber which require to be lubricated.

64 designates a vent-pipe connected with the upper portion of the inner casing of heater 2 to permit the air and impurities within said heater to escape from the latter therethrough.

The operation is as follows: In order to primarily supply the boiler 1 with water, the cock 65 (seen in Fig. 1) is closed and the cock 66 opened, whereupon water from the street-main or other source of supply will flow through said cock 66 and enter the boiler 1, gradually filling the same, and when the desired water-level within the boiler has been attained the cock 66 is closed and the cock 65 opened, whereupon the water from the street-main or other source of supply will be directed by the pipe 13 into the chamber 14. It is to be noted that the water-level within the boiler 1 coincides with that within the shell or chamber 18 and that the water-level within said shell 18 is indicated by the gage 67. Assuming that the water-level within the boiler 1 and interiorly of the shell 18 is at the height indicated at *a b* in Figs. 1 and 4 and that the piston 38 and valve 40 are in the positions seen in Figs. 4 and 7, it will be apparent that the water directed to the chamber 14 by the feed-pipe 13 will escape from said chamber 14 through the port 68 and enter the chamber 5 through the port 69 after passing through the passage 70 in the valve 40 and will then flow from the chamber 5 through the pipe 4 into the inner casing of heater 2 and from the latter through the pipe 7 into the chamber 8, where it is confined by the valve 40 when in the position seen in Figs. 4 and 7, and thus prevented from entering the chamber 12. During this time the ports 32 and 33 are closed by the valve 31 and no steam can enter the cylinder 27. The water within the boiler 1 will, owing to its being converted into steam and consumed, decrease in volume and its level will consequently become lower, as also that of the water within the shell 18, and the float 19 will, as is evident, likewise lower and in so doing will cause the lever 23 to turn on its pivotal point, as at 24, and carry with it the valve 31, so as to cause the latter to occupy the position seen in Fig. 15, and thus permit a portion of the steam within the space 16 to enter the port 32 and passage 35 and be directed by the latter into the upper portion of the interior of the cylinder 27, the pressure of steam against the piston 38 causing the same to lower and carry with it the valve 40, so that the latter will be brought into the position seen in Figs. 5 and 6, it being noted that the port 68 is now closed by said valve and the communication between the chambers 14 and 5 no longer exists. Consequently no water from the heater 2 can now enter the chamber 5; but steam from the boiler 1 will be directed by the pipe 9 into the chamber 10 and from the latter through the port 71 into the passage 70 of the valve 40 and from said passage into the port 69 and then into the chamber 5 and from the latter through the pipe 4 into the upper portion of the inner casing of heater 2, so as to exert a pressure upon the water within said heater, thus causing said water to flow by gravity from the same through the pipe 7 and into the chamber 8, from which it escapes through the port 72 and enters the passage 73 in the valve 40 and from said passage through the port 74 into the chamber 12, as best seen in Fig. 6, and from said chamber 12 through the pipe 11 and from the latter into the lower portion of the boiler 1. It is to be noted that the steam-pressure within the heater 2 counterbalances the steam-pressure within the boiler 1 and that both pressures act in opposite directions, whereby the water in the heater 2, being at a higher level than that in the boiler 1, must, as is evident, flow by gravity from said heater into said boiler, and consequently the water will gradually rise therein, as also in the shell 18, and cause the float 19 to rise and impart a partial rotation to the lever 23, thereby causing the valve 31 to again close the port 32 and cut off the supply of steam to the upper portion of the interior of the cylinder 27. The water within the shell 18 in rising will cause the float to likewise rise and at a certain time will cause the latter to carry the valve 31 into the position seen in Fig. 16, it being noted that the port 33 is now in communication with the space 16 and that a portion of the steam within said space enters the port 33 and passage 36 and is directed by the latter into the lower portion of the interior of the cylinder 27, while the steam in the upper portion of the same is escaping from said cylinder through the passage 35, port 32, valve 31, port 34, and finally through the pipe 37 to any desired point. The steam-pressure against the under side of the piston 38 will cause the same to move upwardly and return the valve 40 to the position seen in Figs. 4 and 7, whereupon the heater 2 will again be supplied with water, as hereinbefore described.

Should the water from the street-main or other source of supply be shut off for a considerable length of time, it will be evident that the water-level within the boiler 1 and shell 18 will gradually lower, owing to the fact that the water within the boiler 1 is being converted into steam for driving an engine or other purposes, and if such level should reach á point below the pipe 21 (seen in Figs. 1 and 4) it will be apparent that the shell 18 will no longer contain water and that the float 19 therein will remain stationary in the lower portion of said shell 18, and thus produce no effect upon the valve 40. In order then to restore the water-level within the boiler 1 and shell 18 to its normal height when the supply from the street-main or other source is again turned on, it may be necessary to operate the valve 40 from the outside of the casing 6, in which case the handle 62 (seen in Fig. 1) is manipulated so as to cause said valve 40 to occupy either the position seen in Fig. 4 or else that seen in Fig. 5, and for the purpose hereinbefore described. If desired, the handle 47 may be manipulated instead of the handle 62, in which case the valve 40 will be operated by the action of the piston 38 and will be caused to occupy either the position seen in Fig. 4 or else that seen in Fig. 5, according to requirements, it being noted that when the handle 47 is manipulated it will operate the lever 23, and, as hereinbefore stated, the latter will cause the valve 31 to slide over the ports 32, 33, and 34 and occupy either the position seen in Fig. 15 or else that seen in Fig. 16, for the purpose hereinbefore described. Should the pressure of steam either above or below the piston 38 prevent the handle 62 from being manipulated, this pressure may be removed by imparting a partial rotation to the handle 47, so as to cause the same to operate the lever 23, which latter will then so locate the valve 31 that one or the other of the ports 32 or 33 will be made to communicate with the exhaust-port 34, and thus permit the steam within the cylinder 27, which exerts its pressure against the piston 38, to escape through siad exhaust-port, and the piston 38 no longer meeting with resistance of steam-pressure will not interfere with the manipulating of said handle 62. The pipe 7 is provided with a check-valve 75, which is closed by the pressure of water from the boiler 1 when a vacuum exists in the inner casing of heater 2, and thereby prevents water from said boiler from flowing into the inner casing of heater 2, it being apparent that such would be the case were it not for the check-valve 75. When a vacuum does not exist in the inner casing of heater 2, the steam-pressure against the water therein is equal to that against the water in the boiler 1, whereupon since the pressure on the water in the inner casing of heater 2 is in an opposite direction to the pressure against the water in the boiler 1 and both pressures being equal the water in the inner casing of heater 2 must flow by gravity from said heater into the boiler 1, it being apparent that the check-valve 75 will not, owing to these conditions, obstruct the flow of water, since the pressure on both sides of said valve are equal, it being understood that as the water in the inner casing of heater 2 is at a higher level than the water in the boiler 1 the weight of the water in the pipe 7 and above the valve 75 will easily open the same when passing from the inner casing of heater 2 into the water-feeder, from which latter it is directed by the pipe 11 into the lower portion of the boiler 1.

In Figs. 21 and 22 I have shown a sectional view of the preferred form of heater, it being noted that the inner shell 77 is inclined at an angle with respect to the head 78, with which latter the pipes 4 and 7 engage, said inner shell 77 being secured to the flanged ring 79, which latter has secured thereto the outer flanged ring 80, to which is riveted or otherwise secured the outer shell of the heater 2, it being of course understood that said head 78 and the flanged rings 79 and 80 are provided with suitable gaskets and fastening devices, as are familiar to those skilled in this art.

As has been already explained, the exhaust-steam entering the pipe 3 can leave the heater through the pipe or any suitable conduit, as the pipe 81, provision being made, however, by the employment of the plate 82, having the perforations 83 therein, for freeing the water of condensation from oil and other impurities, which escape through the pipe 81 to the desired point.

I also desire to call attention to the location and function of the check-valve 76, (seen in Figs. 1 and 23,) said check-valve being located in the supply-feed-water pipe, preferably on the horizontal branch thereof and as near to the automatic device as possible, so that the pressure from the heater will tend to close the valve proper, 84, as will be understood from Fig. 23, said valve being provided with a plurality of holes, which are in practice about one-sixteenth of an inch in diameter, wherefrom it will be apparent that the expansion of steam against and in contact with the supply-water will not create a noise, but act as a muffler.

It is a well-known fact that lime, magnesium held in solution, and other elements contained in water if allowed to enter a steam-boiler under pressure with a high degree of heat are precipitated, and, coming in contact with the heated surfaces of a steam-boiler, are converted into what is generally known as "scale." The other impurities in water held in suspension are, by a high degree of heat, forced to the surface of said water, and the air contained therein is eliminated and ascends to the top of the steam-boiler.

In my improved heater, the pressure being equal and the heat the same as in the steam-boiler, the precipitation of scaly matter takes

place in the heater, where it remains in a granulated form and is easily blown out with other sediments, as are also the impurities held in suspension together with the accumulation of oxygen of the air in the heater. By thus supplying non-aerated water free from impurities held in solution and suspension the liability of explosion is reduced to a minimum and the durability of a steam-boiler is greatly increased.

85 designates a pipe leading from the outer casing of the heater 2 for withdrawing the oil obtained from the condensed steam and which floats upon the water in said outer casing, it being noted that said pipe 85 is provided with a cock 86, which when opened permits the oil to escape from said outer casing, so as to be collected for future use, it being evident that when the cock 86 is closed no oil can escape from the outer casing of the heater 2.

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

1. In a boiler-feeder, a steam-valve, a float for actuating the latter, a lever from which said float is supported, lugs on said lever, members on said valve engaging said lugs, ports controlled by said valve, a piston actuated by steam passing through said ports, a heater, a valve for controlling ports through which the water flows from said heater to the boiler and actuated by said piston, and pipes intermediate said heater, valves and boiler.

2. In a boiler-feeder, a heater, a casing containing a float, said casing communicating with the water and steam space of the boiler, a valve-chamber, steam-ports in said chamber, a steam-valve controlling said ports, a lever carrying said float, and located in said chamber, interlocking devices common to said lever and steam-valve, a piston actuated by steam passing through said ports, and a valve for controlling ports through which the water flows from said heater to the boiler actuated by said piston.

3. In a boiler-feeder, a casing containing a slide-valve, water-holding chambers controlled by said slide-valve, means for introducing water into one of said chambers, a heater, connections common to said heater, water-chambers and boiler, a piston connected to said slide-valve, steam-ports for actuating said piston in either direction, a valve controlling said steam-ports and a float for actuating said valve, in combination with a lever supporting said float, walls located on opposite portions of said lever, a second lever fulcrumed in said casing, and a projecting member on said lever adapted to contact with said walls.

4. In a boiler-feeder, a casing containing a valve, water-holding chambers controlled by said valve, means for introducing water into one of said chambers, a heater, connections common to said heater, water-chambers and boiler, a piston connected to said valve, steam-ports for actuating said piston in either direction, a valve controlling said steam-ports, and a float for actuating said valve, in combination with a lever supporting said float, walls located on opposite portions of said lever, a second lever fulcrumed in said casing, and a projecting member on said lever adapted to contact with said walls.

5. In a boiler-feeder, the combination of a boiler, a casing connected with the steam-space thereof, a steam-piston therein, ports for operating said piston in either direction through which steam passes from the boiler, a steam-valve controlling said ports, a lever upon which said valve is mounted, interlocking devices common to said lever and valve, a float, connections from said lever to said float, the latter being actuated by variations of water-level in the boiler, a heater, and a valve actuated by said piston to control ports through which the water passes from the heater to the boiler.

6. In a boiler-feeder, a boiler, a heater, a casing containing a steam-actuated piston, a water-controlling valve operated thereby, ports and passages controlled by said valve and through which the water passes from the heater to the boiler, a series of steam-ports for operating said piston in either direction, a steam-valve controlling said ports and adapted to permit the exhaust of steam at proper intervals, a float contained in said casing and having connections to the steam and water space of the boiler, a lever on which said steam-valve is supported, and connections from said float to said lever.

7. In a steam-boiler feeder, a boiler, a casing having a steam-actuated piston therein, ports and passages for conveying and exhausting steam to and from said piston, a valve for controlling said ports, a lever suitably fulcrumed on which said valve is supported, a float, connections from said float to said lever, means for actuating said lever from the exterior of the casing, a heater, and a valve actuated by said piston to control ports through which the water passes from the heater to the boiler.

8. In a boiler-feeder, a casing containing a water-inlet, a passage 14 and other water-passages 8, 12, 5 and 10, a feed-water heater, connections leading from said heater to certain of said passages, a steam-boiler, connections leading from the upper portion of the latter to certain of said passages, a pipe leading from certain of the latter to the lower portion of said boiler, a slide-valve controlling the flow of water through said passages, a steam-actuated piston connected to said slide-valve, ports leading to said slide-valve, ports leading to either side of said piston, a steam-valve controlling said latter ports, means for actuating said valve by a float and means for mechanically operating said valve from the exterior of the feeder.

9. In a steam-boiler feeder, a steam-boiler, a casing containing a float and having connections to the steam and water space of

said boiler, a water-heater located above the latter and connections from said float to a lever suitably fulcrumed, a valve actuated by said lever and adapted to control a series of ports, counterbalancing devices for said lever, steam-passages leading from said ports to a steam-cylinder, a piston in said cylinder, a piston-rod leading therefrom and engaging a valve, the latter being provided with passages for controlling ports through which the water flows from said heater to said boiler.

10. In a steam-boiler feeder, a steam-boiler, a casing containing a float and having connections to the steam and water space of said boiler, a water-heater located above the latter and connections from said float to a lever suitably fulcrumed, a valve actuated by said lever and adapted to control a series of ports, steam-passages leading from said ports to a steam-cylinder, a piston in said cylinder, and a piston-rod leading therefrom and engaging a water-controlling valve, the latter being provided with passages for controlling the flow of water from said heater to said boiler, in combination with means for operating said lever and said water-valve from the exterior of the casing.

11. In a steam-boiler feeder, the combination of a boiler, a feed-water heater, pipes 4 and 7 connected with said feed-water heater, a water-controlling valve having a casing, a pipe 9 leading from the top of said boiler to a passage 10 in said casing, a passage 5 in said casing in communication with said pipe 4, a passage 8 in said casing for communicating with said pipe 7, a pipe 13 for conveying water into a passage 14 of said casing, a valved connection 66 common to said pipe 13 and to said boiler, a pipe 11 leading from a passage 12 in said casing to the lower portion of said boiler, a water-valve 40 for controlling said passages, a steam-cylinder having a piston therein, a connection from said piston to said water-valve, ports and passages for admitting and exhausting steam from either side of said piston, a valve controlling said ports, a counterbalanced lever on which said latter valve is mounted, a float contained in a chamber having communication with the water and steam space of said boiler and connections from said float to the lever carrying said latter valve.

12. In a boiler-feeder, a casing containing water-passages therein, a feed-water heater, a boiler, connections common to said casing, boiler and heater, a pipe for conveying water into said casing, a water-valve for controlling the passages in said casing, a steam-actuated piston having a piston-rod provided with a head and engaging a recess in said water-valve, ports and passages for controlling the admission and exhaust of steam to and from said piston, a valve for controlling said ports, a lever suitably fulcrumed and adapted to carry said valve, a counterbalance for said lever, a float contained in a casing having connections to the water and steam space of said boiler and connections from said float to said lever.

13. In a boiler-feeder, a casing containing water-passages therein, a feed-water heater, a boiler, connections common to said casing, boiler and heater, a pipe for conveying water into said casing, a water-valve for controlling the passages in said casing, a steam-actuated piston having a piston-rod provided with a head and engaging a recess in said water-valve, ports and passages for permitting the admission and exhaust of steam to and from said piston, a valve for controlling said ports, a lever suitably fulcrumed and adapted to carry said valve, a counterbalance for said lever, a float contained in a casing having connections to the water and steam space of said boiler and connections from said float to said lever, in combination with means for operating the water-valve from the exterior of the casing and means for operating the lever carrying said steam-valve.

14. In a steam-boiler feeder, the combination of a steam-boiler, a feed-water heater, a casing, a valved inlet-pipe leading to said casing and having a valved branch leading to said boiler, connections common to said heater, boiler, and casing, a valve controlling the water-passages in said casing, a steam-actuated piston controlling said valve, a steam-valve for controlling said piston and a float actuated by the variations of water-level for controlling the movements of said steam-valve.

15. In a steam-boiler feeder, the combination of a steam-boiler, a feed-water heater, a casing, a valved inlet-pipe leading to said casing and having a valved branch leading to said boiler, connections common to said heater, boiler, and casing, a valve controlling the water-passages in said casing, a steam-actuated piston, a steam-valve for controlling said piston, and a float actuated by the variations of water-level for controlling the movements of said steam-valve, in combination with means for operating said water-valve and steam-valve from the exterior of said casing according to requirements.

16. In a boiler-feeder, a steam-valve, a lever, on which the latter is mounted, means for mechanically actuating said lever and valve from the exterior, ports controlled by said valve, a piston actuated by steam passing through said ports, a water-controlling valve actuated by the movements of said piston, a casing inclosing said valves, and means for actuating said water-valve from the exterior of said casing.

17. In a boiler-feeder, a casing, a steam-valve, a float for actuating the latter, ports controlled by said valve, a heater, means actuated by said steam-valve for controlling a valve through which the water flows from said heater to said boiler-pipes intermediate said heater, and boiler, and means for actuating

said steam and water valves from the exterior of said casing.

18. In a steam-boiler feeder, the combination of a steam-boiler, a feed-water heater, a casing, a valved inlet-pipe leading to said casing, a valved branch leading from said inlet-pipe to said boiler, connections common to said heater, boiler and casing, a valve controlling the water-passages in said casing, means for actuating said valve, and a check-valve located in said valved inlet-pipe, said check-valve being provided with a plurality of perforations therein.

THOMAS J. WHITNEY.

Witnesses:
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