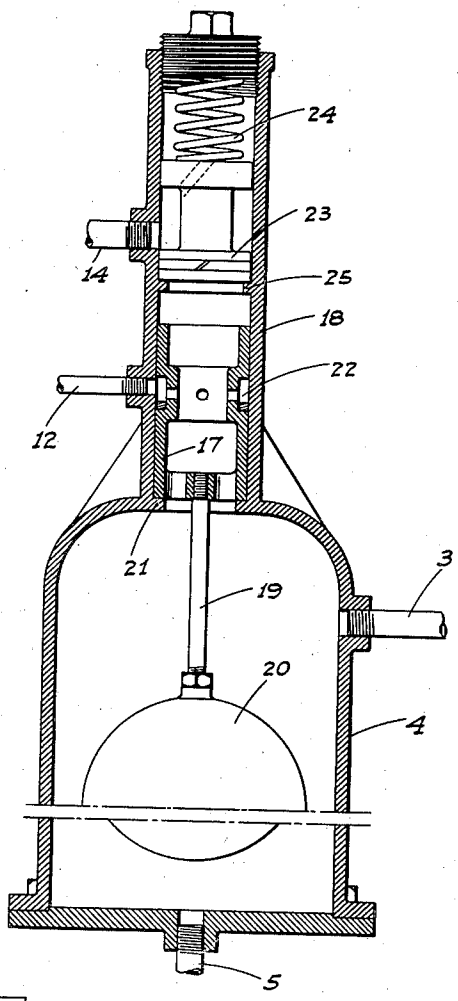
July 16, 1946. R. R. WATERMAN 2,404,114

WATER FEED SYSTEM FOR BOILERS

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Fig. 1



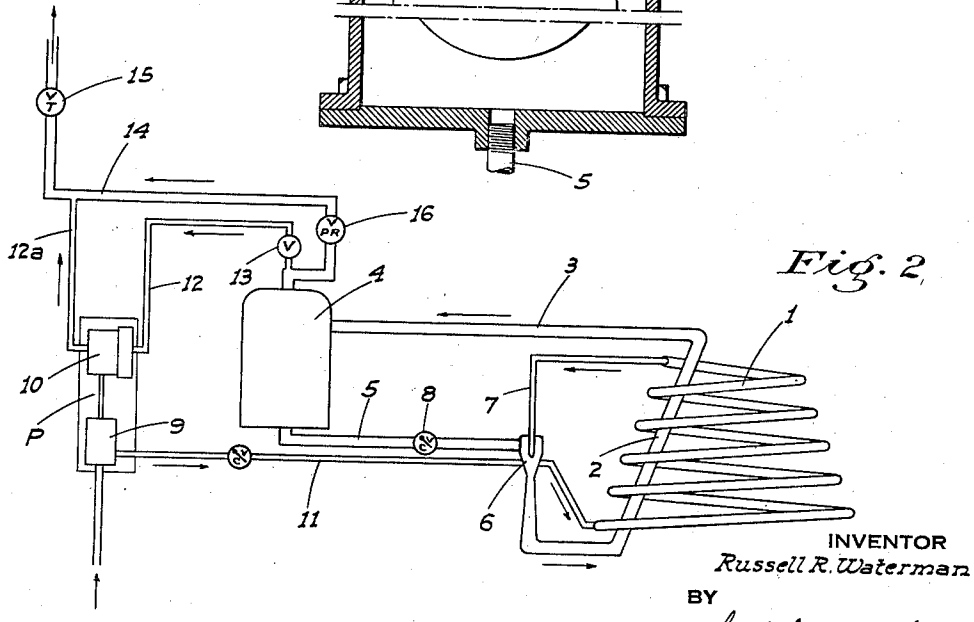


Fig. 2

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Fig. 3

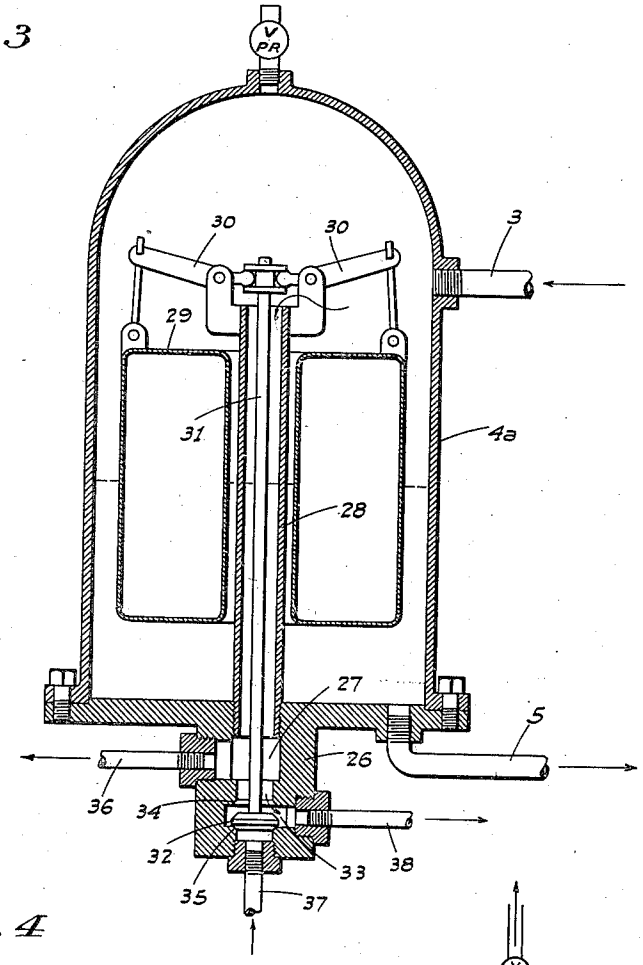
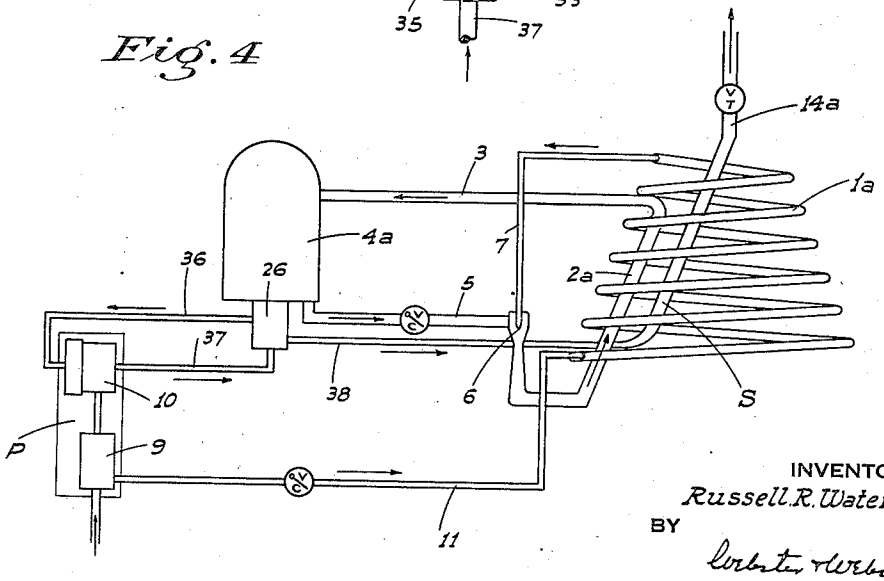


Fig. 4



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WATER FEED SYSTEM FOR BOILERS

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Application December 28, 1942, Serial No. 470,334

8 Claims. (Cl. 122—451)

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This invention relates to an automatic boiler feed system and apparatus, one object being to provide a water feed system for the purpose which includes a steam operated boiler feed pump arranged for float-controlled operation only according to water level conditions in the boiler, and only if steam is being withdrawn from the boiler, and which functions to maintain a substantially constant heat and water balance in the boiler. In other words, the pump does not necessarily operate whenever steam is withdrawn, but on the other hand withdrawal of steam is a prerequisite to pump operation.

A further object is to arrange the steam pump in the system in connection with a float actuated control valve unit mounted in a steam and water drum disposed exteriorly of but operatively connected to the boiler in flow circulating relationship therewith.

It is also an object of the invention to provide an improved apparatus which in one form causes a re-circulation of the water from the drum through an evaporator zone of the boiler when re-entering the drum, so that steam in a wet condition enters the drum, as is desirable with this system.

A further object of the invention is to provide a simple and inexpensive system, and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in th several views:

Figure 1 is a sectional elevation of one form of float control steam valve unit for operating the pump.

Figure 2 is a diagram of the system in which said unit is interposed.

Figure 3 is a sectional elevation of another form of float controlled valve unit.

Figure 4 is a diagram of the system in which the last-named unit is interposed.

Referring now more particularly to the characters of reference on the drawings, and particularly at present to Figs. 1 and 2 the system includes, with a coil boiler 1, here shown as being of the so-called flash type, an evaporator unit indicated at 2 from which a steam line 3 leads to a pressure-tight vertical drum 4 disposed exteriorly of the boiler and in which steam and water separate, said line being connected with the drum near the top. A return water line 5 is

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here shown as leading from the bottom of the drum to the evaporator unit 2 at the bottom of the latter, with an ejector device 6 of suitable character interposed in said line 5 intermediate its ends and operated by steam supplied from the boiler through a line 7. A check valve 8 in the line 5 prevents back flow to the drum. By reason of this arrangement it will be seen that water forming in the separator drum from the steam supplied thereto from the line 3 is automatically returned to the evaporator unit 2 and re-circulated therethrough.

A steam pump P includes a pumping member 9 and an operating member 10, the pumping member drawing water from a suitable relatively inexhaustible source and delivering such water to the boiler through a line 11. Steam to operate the member 10 is fed thereto from a line 12 connected to the top of the drum, with a float operated valve 13 interposed therein; the main steam take-off line 14 being connected with the line 12 and bypassing the valve, and having a throttle valve 15 therein. The exhaust line 12a from the pump member 10 is connected to the line 14, the latter having a pressure relief valve 16 therein set according to the difference in pressure in the main line and exhaust line, this being the same arrangement and for the same purpose as described in my copending application for patent, Serial No. 463,886, filed October 26, 1942.

The preferred form of float controlled valve and pressure relief unit are shown in detail in Fig. 1. The valve comprises a tubular open-ended piston 17 slidable in an elongated cylinder 18 mounted on and here shown as upstanding from the top of the drum 4. A rod 19 is secured to and depends from the valve 17 and carries a float 20 disposed a predetermined distance below the level at which the steam line 3 connects with the drum. In its lowest position or when the level of the condensate in the drum is correspondingly lowered, the valve is supported on a shoulder 21 at the bottom of cylinder 18. An annular groove 22 in the periphery of the valve, and which communicates with the interior of the same, then registers with the steam pump line 12.

The pressure relief valve 16 is mounted in the cylinder above the piston valve and comprises a spool-like plunger 23, yieldably pressed down by an adjustable spring 24 and normally seated against a top shoulder 25 in the cylinder. The plunger when lifted a predetermined distance against the resistance of the spring by the steam pressure in the drum passing up through the pis-

ton valve 17, establishes communication between the drum and the steam outlet pipe 14, allowing steam to pass out if the throttle is open, without the necessity of causing the pump to operate, in the event that the float is lifted by a high condensate level and the piston valve closes the line 12.

It will thus be seen that steam may be withdrawn from the boiler without necessarily placing the pump in operation, as long as the water level in the drum, which corresponds to the water level in the boiler, is sufficiently high to lift the float and maintain the piston valve closed. At the same time the pump cannot operate unless steam is being withdrawn.

In the system shown in Figs. 3 and 4, the circulation of the condensate from the drum 4a through evaporator unit 2a of the boiler coil 1a and back to the drum is the same as in the first described system, but the main steam outlet line 14a takes off directly from a superheater unit S as shown in Fig. 4, and the float controlled valve for the steam pump is here shown as being of somewhat different form and arrangement than in the first described system.

In this case the drum is provided with a depending boss 26 having a passage 27 communicating with a tube 28 secured on and upstanding from the base of the drum and open at its upper end to the interior of the drum. A float 29 surrounds the tube and is connected, by conventional opposed levers 30 pivoted on the tube, with a valve stem 31 which extends into the tube from its upper end and projects into the passage 27. The stem on its lower end carries a double-ended valve 32 disposed in an enlarged portion 33 of the passage 27 and adapted to alternately engage seats 34 and 35 at the upper and lower ends respectively of said enlarged portion. The steam line 36 leading to the operating member 10 of the steam boiler feed pump communicates with the passage 27 above the seat 34; the exhaust line 37 from the member 10 communicates with said passage 27 below the seat 35; while the steam return line 38 leads from the enlarged passage portion 33 between the valve seats to the superheater unit S of the boiler near the lower end of said unit.

With the float and valve arrangement above described, the float when lifted by the water in the drum, lowers the valve and causes it to engage the seat 35. When the float drops by a lowering of the condensate level, the valve is lifted and engages the upper seat 34. In operation, therefore, when the water level in the drum is at or near normal, the steam in the drum, if the throttle is opened, cannot circulate through the pump but passes down through the tube 28 and then to the superheater unit S through line 38. When the water level in the boiler and drum is lowered by the use of steam, the line 38 is closed to the tube 28 by the valve 32 engaging seat 34, but is opened to the line 37, and steam then passes through said tube to the pump through line 36 and back to the superheater unit through lines 37 and 38.

The latter system is particularly designed for use in installations when dry steam only is desired, as for instance in cleaning and pressing establishments. However, this type of system is also suitable for power application when constructed for operating at relatively high pressures, and when superheated steam is desired.

From the foregoing description it will be readily seen that I have produced such a system as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the system, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

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

1. A boiler water-feed system including with a boiler, a pump to feed water to the boiler and including a steam operated unit, steam passage means leading to the unit from the boiler, means to allow of a flow of steam through said passage means only when steam is drawn from the boiler for use other than in the pump, and means controlled by water level conditions in the boiler to prevent such flow unless the water is at a predetermined low level.

2. In a boiler water-feed system, a steam and water drum connected in circulating relation with the boiler, a pump to feed water to the boiler and including a steam operated unit, a tubular extension on the drum communicating with the steam zone thereof, a steam line leading to the pump unit from said extension, a valve in the extension to control the flow of steam through said line, a water-engaging float connected to the valve to operate the same by change of level of the water in the drum, a main steam outlet line connected to the extension in bypassing relation to the valve and to which the exhaust line from the pump unit is connected, and a pressure relief valve in the extension and arranged in connection with the outlet line to control the flow of steam therethrough.

3. In a boiler water-feed system, a steam and water drum connected in circulating relation with the boiler, a pump to feed water to the boiler and including a steam operated unit, a tubular extension on the drum communicating with the steam zone thereof, a steam line leading to the pump unit from said extension on one side thereof, a tubular, open-ended piston valve slidable in the extension to open or close the line to the extension, a water-engaging float connected to the valve to move the same according to changes in level of the water in the drum, a main steam outlet line connected to the extension on the side and beyond the piston valve and to which the exhaust of the pump unit is connected and a pressure relief valve in the extension beyond the piston valve and including a spring advanced plunger slidable in the extension and when inactive closing the main line to the interior of the extension.

4. In a boiler water-feed system, a steam and water drum connected in circulating relation with the boiler, a pump to feed water to the boiler and including a steam operated unit, a member on and projecting from the drum and having a passage formed therein, a tubular element mounted on the drum and extending from said passage to maintain communication between said passage and the steam zone of the drum, a feed steam line leading to the pump unit from the steam zone of the drum, an exhaust steam line from the pump unit leading to the passage, a return line leading to the boiler from the passage, and a valve in the passage float-controlled by changes in level of the water in the drum to shut off the exhaust line from the tubular element and return line when the water level is

relatively high and to shut off the return line from the element and at the same time establish communication between the exhaust line and said return line when the water level is relatively low.

5. In a boiler water-feed system, a steam and water drum connected in circulating relation with the boiler, a pump to feed water to the boiler and including a steam operated unit, a member on and projecting from the drum and having a passage formed therein, a tubular element mounted in the drum and extending from said passage to maintain communication between said passage and the steam zone of the drum, a feed steam line leading to the pump unit from the steam zone of the drum, the passage having an enlarged portion intermediate its ends and formed at its opposite ends with opposed valve seats, a steam exhaust line from the pump unit leading to the passage beyond the seat furthest from the tubular element, a return line to the boiler from the enlarged portion of the passage between the seats, a double-ended valve between and alternately engageable with the seats, a water engaging float in the drum and means connecting the float and valve so that the latter engages the valve seat nearest the tubular element when the water level drops and engages the other seat when the water level rises.

6. A structure as in claim 5, in which said last named means comprises a stem connected to the valve and extending through the tubular element to its outer end, the float surrounding the latter and opposed levers pivoted intermediate

their ends on the element and operatively connected at one end to the stem and at the other end to the float.

7. A boiler water feed system including, with a boiler, a drum separate from but connected in circulating relation with the boiler and receiving water and steam therefrom, a steam driven pump adapted to pump feed water from a source of water supply to the boiler, a steam line leading from the drum to a point of use, a separate steam line leading from the drum to the steam driven pump for operating the same, a steam line leading from the pump to the first named steam line, and means responsive to the water level in the drum for controlling the flow of steam from the drum to the second named steam line for operating the pump.

8. A boiler water feed system including, with a boiler, a drum separate from but connected in circulating relation with the boiler and receiving water and steam therefrom, a steam operated pump to feed water to the boiler, a steam circulating pipe system between the boiler, pump, and point of ultimate steam use, such system being so arranged that the pump can only operate when steam is being drawn from the boiler for use other than in operating the pump, while allowing use of the steam independently of pump operation, and means responsive to the water level in the drum for controlling the operation of the pump.

RUSSELL R. WATERMAN.