

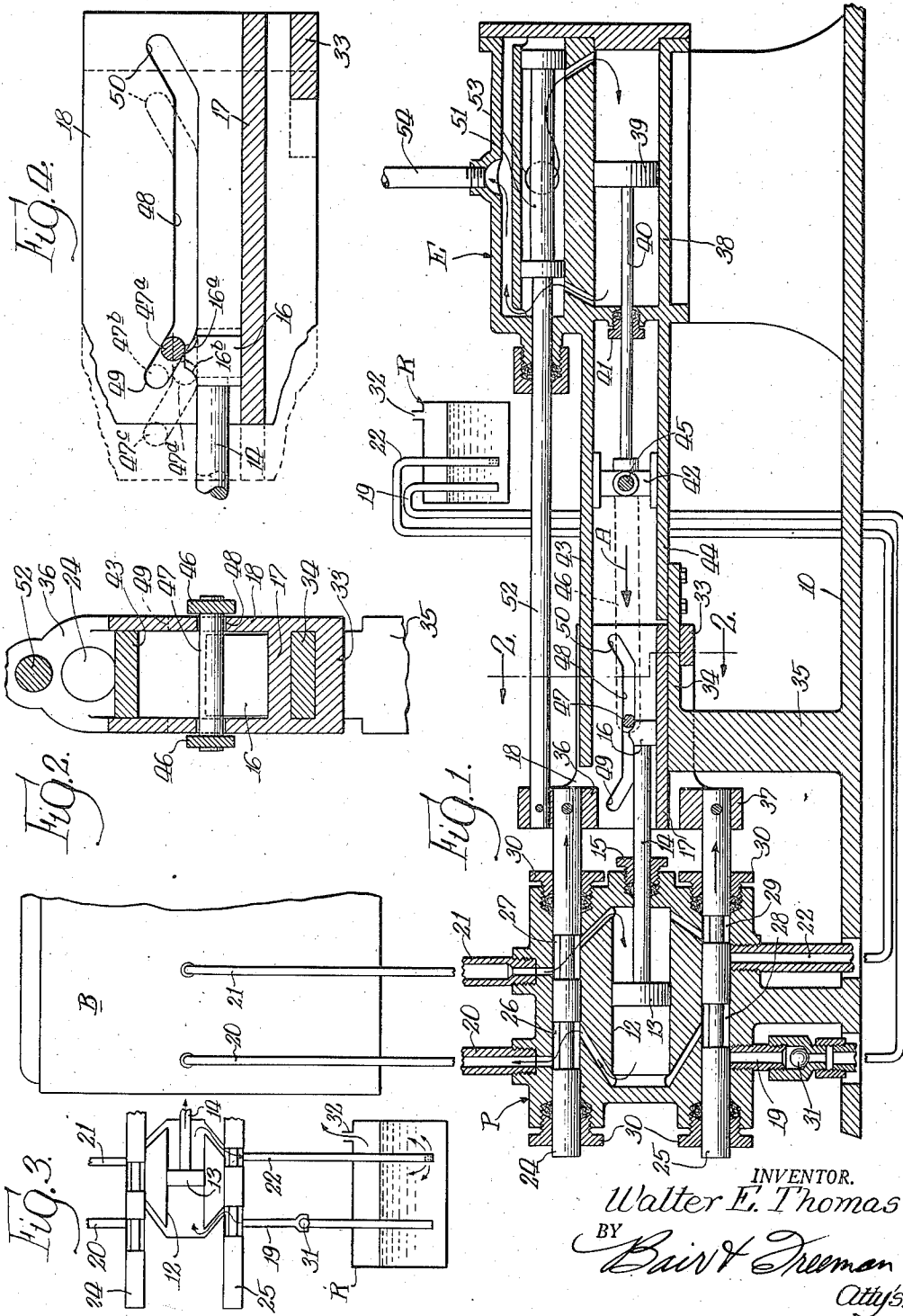
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BOILER FEED PUMP

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## UNITED STATES PATENT OFFICE

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## BOILER FEED PUMP

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My invention relates to a boiler feed pump which is simple and inexpensive to manufacture.

One object of the invention is to provide a boiler feed pump which does not have to operate against boiler pressure for forcing water into the boiler, thereby effecting an economy of operation due to less power required for its operation.

Another object is to provide a feed water pump of the reciprocating type wherein steam is introduced on one side of the pump piston when the other side is open to the boiler during the feed stroke of the piston, thereby permitting the use of a relatively small power steam engine or the like for operating the feed pump.

A further object is to provide a novel connection between the power means for the feed water pump and the water pumping piston as well as the water and steam control valves of the pump, whereby the water pumping piston travels its full stroke before the valves are shifted, the valves thereupon being shifted for reversing the stroke, and during the reverse movement, the pump piston being picked up by the power means for effecting the reverse stroke of the piston itself.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawing, wherein:

Figure 1 is a vertical sectional view through a boiler feed pump embodying my invention and showing a steam cylinder and piston type of power means for operating the same, connections to the boiler and to a water reservoir being shown diagrammatically.

Figure 2 is an enlarged sectional view on the line 2—2 of Figure 1 to illustrate details of construction.

Figure 3 is a diagrammatic view similar to Figure 1 showing the parts in a different position; and

Figure 4 is a sectional view similar to a portion of Figure 1, showing various positions assumed by the connecting means between the power means, the water pumping piston and the control valves of the pump.

On the accompanying drawing I have used the reference numeral 10 to indicate a base on which is mounted a boiler feed pump P and a steam engine E for operating the same. The pump P comprises a cylinder 12 having a water piston 13 therein. A piston rod 14 extends from the piston 13 through a packing gland 15 and ter-

minates in an abutment member 16. The member 16 is guided on a way 17 which is a cross piece between side plates 18 of a valve actuating head. The sides of the abutment member 16 are guided by the sides 18, as shown in Figure 2.

Water inlet and outlet connections 19 and 20 are provided for the left hand end of cylinder 12, and steam inlet and outlet connections 21 and 22 are provided for the right hand end thereof. Balanced plunger type valves 24 and 25 are provided for controlling the flow of water and steam to and from the cylinder 12. The plunger 24 has a water control section 26 which is merely a reduced portion on the plunger. It also has a similar steam control section 27, and the plunger 25 has water and steam control sections 28 and 29. The plungers 24 and 25 are sealed relatively to the pump P, each by two packing glands 30, as shown in Figure 1.

An intake check valve 31 is associated with the water inlet connection 19 and the connections 19 and 22 extend to a reservoir R while the connections 20 and 21 extend to a boiler B. The connection 19 is adapted to receive water from the bottom of the reservoir R and the connection 22 to discharge steam and/or water into the reservoir, an outlet to atmosphere being shown at 32. The connections 20 and 21 are at about the desired water level in the boiler B.

The valve actuating head 18 includes a cross piece 33 in addition to the cross piece 17, the two cross pieces being guided on a bar 34 extending from a standard 35 of the base 10. The head 18 is thereby guided and is operatively connected with the plungers 24 and 25 by the plungers extending into hubs 36 and 37 of the valve actuating head and suitably pinned therein.

The steam engine E consists of a cylinder 38 mounted on the base 10 and having a power piston 39 therein. A piston rod 40 extends from the piston 39, through a packing gland 41 to a cross head 42. The cross head 42 is guided in upper and lower ways 43 and 44 and includes a wrist pin 45.

A pair of connecting rods 46 are connected with the wrist pin 45 and extend in Figure 1 toward the left outside of the sides 18 of the valve actuating head. A cross pin 47 connects the left hand ends of the connecting rods 46 together. This pin is guided in a pair of similar slots 48 of the sides 18, which slots have upwardly inclined ends 49 and 50.

A balanced piston valve 51 is associated with the power piston 39 for controlling the flow of steam thereto and therefrom in the usual man-

ner of a double acting steam engine. This valve may also be operated by the valve actuating head 18, a valve operating rod 52 being illustrated as pinned to the hub 36. A steam inlet 53 and a steam exhaust pipe 54 are provided for the valve 51.

#### Practical operation

In the operation of my boiler feed pump, when the valves 24, 25 and 51 are in the position of Figure 1, steam enters from the steam pipe 53 and acts on the right hand end of the power piston 39 to force it toward the left, as indicated by the arrow A. At this time the water and steam sections 26 and 27 of the valve 24 are open, so that water in the left hand end of the cylinder 12 may be forced through the connection 20 into the boiler. At the same time, steam may flow out of the boiler through the connection 21 and into the right hand end of the cylinder 12. There is, therefore, a substantial balance between opposite sides of the piston 13 except for the area of the piston rod 14, and consequently it does not take much power to move the piston. A relatively small power piston 39 may therefore be provided, thus reducing the initial expense and likewise operating expense is reduced because there is less displacement and consequently less steam is needed to operate the power piston 39.

Adjacent the end of the stroke, the abutment member 16 or rather a cam face 16a thereof, which was heretofore engaged by the cross pin 47 to effect an operative connection between the power piston and the pump piston rod 14, causes the pin 47 to be lifted, as shown by solid lines in Figure 4, as soon as the pin enters the inclined portion 49 of the slot 48. This position is indicated as 47a.

The water piston 13 at this time is at the left end of the stroke, but the power piston continues to move, thereby causing the pin 47 to reach the end of the slot (position 47b) and then move this end to the dotted position shown at 47c. The valves 24 and 25 are then in the position of Figure 3, thereby closing the sections 26 and 27 of the valve 24 and opening the sections 28 and 29 of the valve 25. The valve 51 is also in its opposite position for effecting movement of the power piston 39 toward the right.

During movement toward the right, water is drawn in from the reservoir R through the connection 19 and the check valve 31 into the left hand end of the cylinder 12 and the steam in the right hand end of the cylinder is discharged through the connection 22 into the reservoir R. Such discharge may be into the upper part of the reservoir and from thence to atmosphere through the vent 32, or under the level of the water therein, as from perforations in the pipe 22, for the purpose of warming the water. With this arrangement it is unnecessary to utilize much power on the return stroke of the piston 39 as it is only necessary to lift the water from the reservoir. Preferably, the reservoir is mounted higher than the pump to minimize the power needed to operate the engine E.

At the beginning of the return stroke, the pin 47 is guided by the inclined portions 49 of the slots 48 to the position 47d, where it engages the reverse side of the abutment member 16, or rather a cam face 16b thereof, and pulls the rod 14 in the opposite direction. Release of the rod is effected at the end of the stroke by the inclines 50 and the valves are operated after which the pin 47 again engages the cam 16a, as previously described in connection with the cam 16b. Thus a

mechanical connection is provided which insures a full stroke of the pump piston before the valves are changed in position and the pump piston remains stationary during the change-over.

By making the connections 20 and 21 at the desired water level in the boiler B, the pump may be operated continuously and will maintain the desired water level. Any water that is pumped into the boiler above this level is returned through the connections 21 and 22 to the reservoir, thus automatic water level control is had without the necessity of providing further automatic controls as for the supply of steam to the engine E, or the like.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope without sacrificing any of the advantages thereof.

I claim as my invention:

1. In a boiler feed pump of the character disclosed, a reciprocating water pump having a cylinder and a piston therein, water inlet and outlet connections to one end of said cylinder, steam inlet and outlet connections to the other end of said cylinder, said water outlet and inlet connections communicating respectively with a boiler at the water level and with a reservoir to receive water therefrom, said steam inlet and outlet connections communicating respectively with the boiler at the water level and with the reservoir to discharge steam thereinto, power means for reciprocating said piston, and valve means between said one end of said cylinder and said water inlet and outlet and said steam inlet and outlet connections, said valve means being operated by said power means at the ends of the stroke of said piston to open the water outlet and the steam inlet when the piston travels in one direction and to open the water inlet and the steam outlet when the piston travels in the other direction.

2. In a boiler feed pump, a pump having a cylinder and a piston, water inlet and outlet connections to the other end of said cylinder, said water outlet and inlet connections respectively communicating with a boiler and with a reservoir to receive water therefrom, said steam inlet and outlet connections respectively communicating with the boiler and with the reservoir to discharge steam thereto, power means for reciprocating said piston, and valve means between said one end of said cylinder and said water inlet and outlet connections, and between said other end of said cylinder and said steam inlet and outlet connections, said valve means opening the water outlet and the steam inlet when the piston travels in one direction and opening the water inlet and the steam outlet when the piston travels in the other direction.

3. In a boiler feed pump, a water pump cylinder, a piston therein, water inlet and outlet connections to one end of said cylinder, steam inlet and outlet connections to the other end of said cylinder, said water outlet and steam inlet connections communicating with a boiler, said water inlet and steam outlet connections communicating with a reservoir, power means for reciprocating said piston, and valve means between said one end of said cylinder and said water inlet and outlet connections, and between said other end of said cylinder and said steam inlet and outlet con-

nections, said valve means being operated to open the water outlet connection and the steam inlet connection when the piston travels in one direction and to open the water inlet connection and steam outlet connection when the piston travels in the other direction.

4. In a boiler feed pump of the character disclosed, a reciprocating water pump having a cylinder and a piston therein, water inlet and outlet connections to one end of said cylinder, steam inlet and outlet connections to the other end of said cylinder, said water outlet and inlet connections communicating with a boiler and with a reservoir, said steam inlet and outlet connections communicating with the boiler and with the reservoir, power means for reciprocating said piston, valve means between said one end of said cylinder and said water inlet and outlet connections, and between said other end of said cylinder and said steam inlet and outlet connections, said valve means opening the water outlet and the steam inlet connections when the piston travels in one direction and opening the water inlet and the steam outlet connections when the piston travels in the other direction, and an operative connection comprising a pin and slot connection between the power means and the valve means and an abutment connection between the power means and the piston with said pin engaging said abutment, said slot having inclined ends operable to disengage said pin from said abutment at one end of the piston stroke, said pin thereupon engaging the end of the slot to move said valve means, the incline of the slot guiding the pin to engage the reverse side of the abutment upon the reverse stroke.

5. In a boiler feed pump of the character disclosed, a water pump cylinder and a piston therein, water inlet and outlet connections to one end of said cylinder, steam inlet and outlet connections to the other end of said cylinder, said water outlet and inlet connections communicating with a boiler and with a reservoir respectively to supply and receive water, said steam inlet and outlet connections communicating with the boiler and with the reservoir respectively to receive and discharge steam, power means for reciprocating said piston, valve means between said one end of said cylinder and said water inlet and outlet connections, and between said other end of said cylinder and said steam inlet and outlet connections, and an operative connection between said power means, and said piston and valve means, comprising a pin and slot connection between the power means and the valve means and an abutment connection between the power means and the piston with said pin engaging said abutment, said slot having inclined ends operable to disengage said pin from said abutment at one end of the piston stroke, said pin thereupon engaging the end of the slot to move said valve means, the incline of the slot guiding the pin to engage the reverse side of the abutment upon the reverse stroke.

6. In a boiler feed pump of the character disclosed, a reciprocating water pump having a piston therein, power means for reciprocating said piston, valve means for said power means, and an operative connection between said power means, and said piston and said valve means, comprising a pin and slot connection between the power means and the valve means and an abutment connection between the power means and the piston with said pin engaging said abutment, said slot having inclined ends operable

to disengage said pin from said abutment at one end of the piston stroke, said pin thereupon engaging the end of the slot to move said valve means, the incline of the slot guiding the pin to engage the reverse side of the abutment upon the reverse stroke.

7. In a boiler feed pump, a water pump having a piston, power means for reciprocating said piston, valve means for said pump, valve means for said power means, and an operative connection between said power means, and said piston and said valve means, comprising a pin and slot connection between the power means and the valve means and an abutment connection between the power means and the piston with said pin engaging said abutment, said slot having a portion operable to disengage said pin from said abutment at one end of the piston stroke, said pin thereupon moving said valve means, said portion of the slot guiding the pin to engage the reverse side of the abutment upon the reverse stroke.

8. A boiler feed pump comprising a cylinder and a piston, water and steam valves for controlling the flow of water and steam to and from said cylinder on opposite sides of said piston, power means for operating said piston and said valve means, and an operative connection between said power means, and said piston and said valve means, comprising a pin and slot connection between the power means and the valve means and an abutment connection between the power means and the piston with said pin engaging said abutment, said slot having inclined ends operable to disengage said pin from said abutment at one end of the piston stroke, said pin thereupon engaging the end of the slot to move said valve means, the incline of the slot guiding the pin to engage the reverse side of the abutment upon the reverse stroke.

9. In a boiler feed pump, a cylinder and a piston, water and steam valves for controlling the flow of water and steam to and from said cylinder on opposite sides of said piston, power means for operating said piston and said valve means, valve means for said power means, and an operative connection therefor comprising a pin and slot connection between the power means and the both of said valve means, and an abutment connection between the power means and the piston with said pin engaging said abutment, said slot having a portion operable to disengage said pin from said abutment at one end of the piston stroke, said pin thereupon engaging the end of the slot to move said valve means, said portion of the slot guiding the pin to engage the reverse side of the abutment upon the reverse stroke.

10. In a boiler feed pump of the character described, a water pump having a cylinder and a piston therein, water inlet and outlet connections to one end of said cylinder, steam inlet and outlet connections to the other end of said cylinder, said water outlet and inlet connections communicating with a boiler and with a reservoir, said steam inlet and outlet connections communicating with the boiler and with the reservoir, power means for reciprocating said piston, and valve means between said one end of said cylinder and said water inlet and outlet connections, and between said other end of said cylinder and said steam inlet and outlet connections, said valve means being operated by said power means at the ends of the stroke of said piston by a pin and slot connection to open the water outlet and the steam inlet when the piston travels in

one direction and to open the water inlet and steam outlet when the pistons travels in the other direction.

11. A boiler feed pump comprising a cylinder and a piston, power means for operating said piston, valve means for said pump, and an operative connection between said power means and said piston and between said power means and said valve means comprising a pin and slot connection between the power means and the valve 10

means and an abutment connection between the power means and the piston with said pin, engaging said abutment, said slot having inclined ends operable to disengage said pin from said abutment at one end of the piston stroke, said pin thereupon engaging the end of the slot to move said valve means, the incline of the slot guiding the pin to engage the reverse side of the abutment upon the reverse stroke.

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