

Oct. 24, 1933.

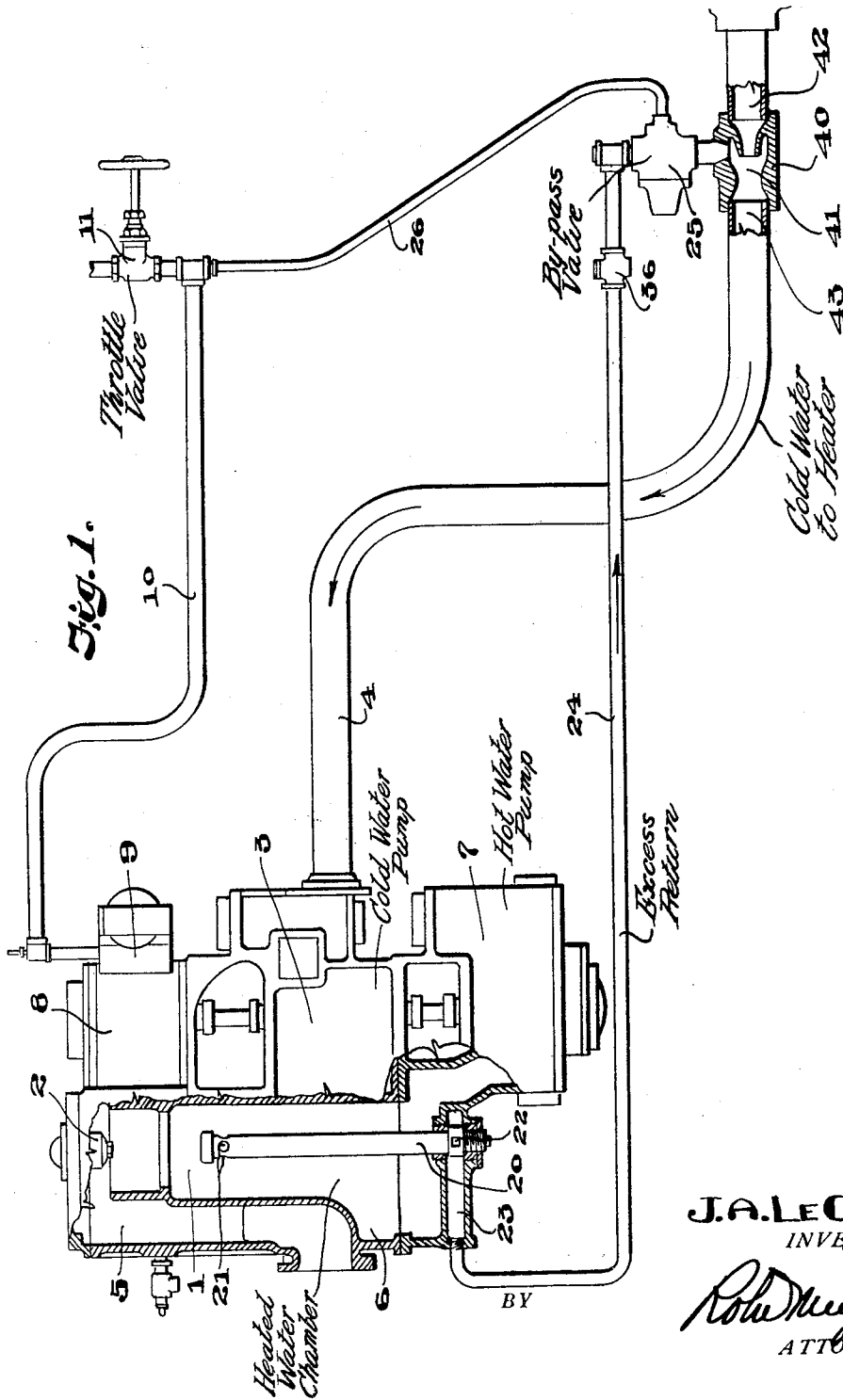
J. A. LE CAIN

1,932,111

FEED WATER HEATER

Filed Feb. 14, 1933

2 Sheets-Sheet 1



J. A. LE CAIN.  
INVENTOR

*Robt Meyer*  
ATTORNEY

Oct. 24, 1933.

J. A. LE CAIN  
FEED WATER HEATER  
Filed Feb. 14, 1933

1,932,111

2 Sheets-Sheet 2

Fig. 2.

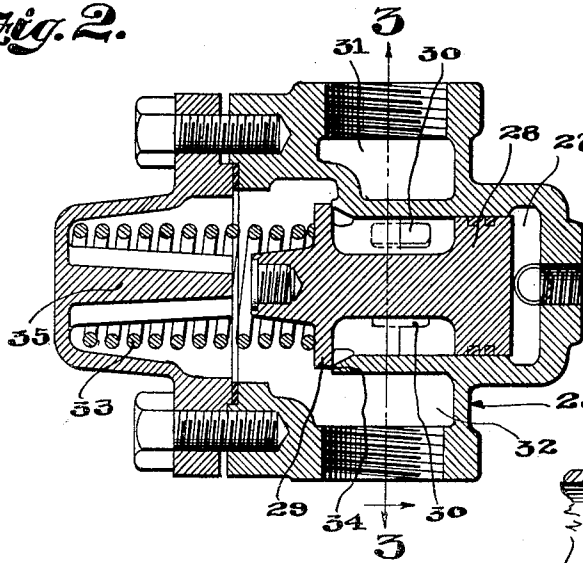


Fig. 5.

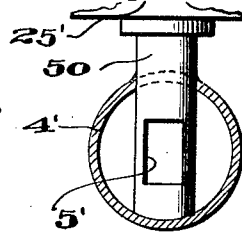


Fig. 6.

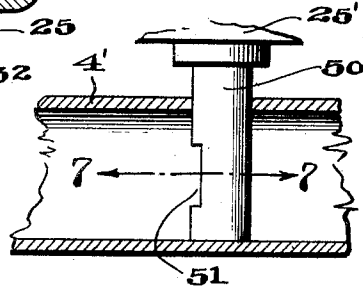


Fig. 3.

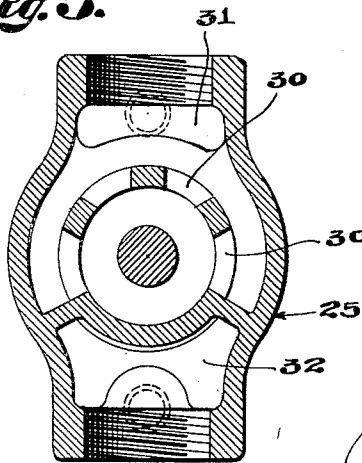


Fig. 4.

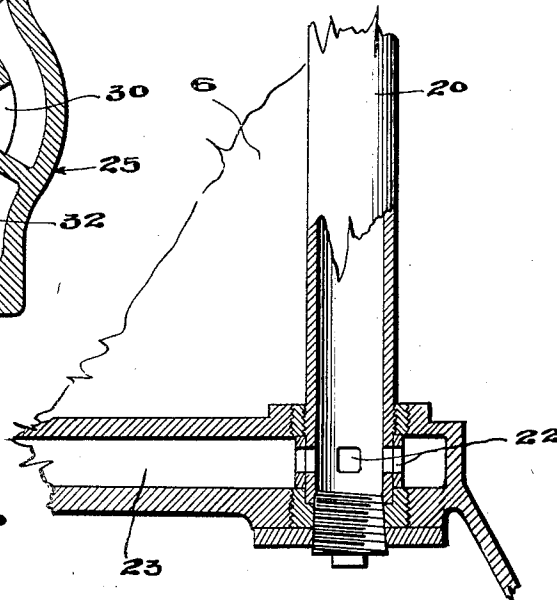
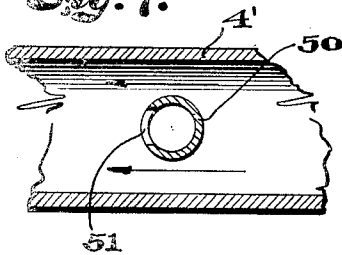


Fig. 7.



J. A. LE CAIN.  
INVENTOR

BY

*Robert M. ...*  
ATTORNEY

# UNITED STATES PATENT OFFICE

1,932,111

## FEED WATER HEATER

John A. Le Cain, East Orange, N. J., assignor to  
Worthington Pump and Machinery Corpora-  
tion, New York, N. Y., a corporation of Virginia

Application February 14, 1933. Serial No. 656,690

6 Claims. (Cl. 261—34)

This invention relates to feed water heaters particularly adapted for use on locomotives and an object of the invention is to provide a heater of the open or direct contact type, which embodies simple, practical means for regulating the water level within the heater and for returning any excess water from the heater to the cold water supply.

A further object of the invention is to provide means in the form of a bypass valve which will automatically cut off communication through the excess water return between the heater and the cold water supply, thereby preventing the flow of steam from the heater into the cold water storage and supply pipe at times when the pumps of the heater are shut down and the locomotive is idling, or standing with the locomotive cylinders using steam.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a feed water heater of the preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Fig. 1 is a diagrammatic view partly in section of the improved feed water heater showing the excess return, steam connections, etc., and showing the application of the bypass valve.

Fig. 2 is a longitudinal vertical section through the bypass valve.

Fig. 3 is a cross section through the bypass valve taken on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged fragmentary section of the heater showing the outlet end of the overflow pipe.

Fig. 5 is a view partly in section of a modified detail of the feed water heater.

Fig. 6 is a longitudinal section of the modified detail shown in Fig. 5.

Fig. 7 is a horizontal section taken on the line 7—7 of Fig. 6.

Referring more particularly to the drawings, a feed water heater of approved construction of the open or contact type is shown in Fig. 1 of the drawings, and this heater comprises a heating chamber 1 into which cold water is sprayed through the sprayer 2 by a cold water pump 3 of approved construction which receives its cold water through the cold water supply pipe 4. In installation of the heater on locomotives, the pipe 4 establishes connection between the pump 3 and the tender (not shown).

The cold water sprayed into the heating chamber 1 through the sprayer 2 is heated by contact with steam which enters the heater through the steam inlet 5 and passes into the heating cham-

ber 1 at its upper end where it contacts with the cold water, resulting in the condensation of the steam and the heating of the water.

The heated water and condensate falls into the hot water chamber 6 from which it is withdrawn by a suitable hot water pump 7 of approved construction. The pumps 3 and 7 are operated by a steam engine construction 8 which receives its operating steam through the valve gear mechanism 9 and the pipe 10. The passage of operating steam into the engine 8 is controlled by the throttle valve 11.

The feed water heater disclosed in Fig. 1 of the drawings and as hereinabove described, is of approved construction and is similar to those disclosed in prior Patents Nos. 1,606,880; 1,566,799 and 1,350,322. However, the present feed water heater structure differs materially from those above referred to in the manner of controlling the water level in the hot water chamber 6 of the heater.

In the present invention an overflow pipe 20 extends upwardly into the hot water chamber 6 and heating chamber 1 of the feed water heater and it is provided with a plurality of openings 21 at a predetermined height so that when the level of the hot water reaches the openings 21 any water in excess of that required to reach such level will flow through the openings 21 downwardly through the pipe 20 and out through the openings 22 into the passageway 23 in the feed water heater body.

From the passageway 23, the excess heated water flows through a pipe or connection 24 into the bypass valve structure 25 from which it passes into the cold water pipe 4 and thence to the suction of the pump 3 for return to the heater through the sprayer 2.

If it were not for the bypass valve 25, the steam entering the heater through the steam inlet 5 would, (at times when the pumps 3 and 7 are shut down and the locomotive running, that is at times when the locomotive cylinders are using steam) back up in the heater and pass out through the overflow pipe 20 into the pipe 4 and eventually into the pump 3 causing the said pump to be steam bound and consequently interfere with its starting when it would be desired to again start the pump.

The bypass valve 25 is constructed so that it will automatically cut off communication between the pipes or connections 24 and 4 when the pump 3 is stopped and this action is controlled by the throttle 11.

When the throttle 11 is open and the pump 3 running, steam is bypassed from the steam supply to the pump structure through the pipe 26 into the chamber 27 in the bypass valve 25. Such steam acting on the piston 28 forces this piston and consequently the valve disc 29, which is at-

tached thereto, inwardly, opening communication through the various ports 30 between the chamber 31 which has connection with the pipe 24 and the chamber 32, which has connection with the pipe 4, thereby allowing the excess water from the hot water chamber 6 of the heater to flow through the bypass valve into the water supply pipe 4.

When the throttle valve 11 is closed and the supply of steam to the bypass valve 25 is cut off, the spring 33, acting on the valve disc 29 will force the valve disc 29 into engagement with its seat 34 and cut off communication between the chambers 31 and 32 and consequently cut off communication between the overflow connection 24 and the water supply pipe 25. A suitable stop 35 is provided for limiting the movement of the piston 28 and the valve disc 29.

In order to bypass the excess hot water from the hot water chamber 6 to the cold water supply a restriction is placed between the bypass connection and the cold water supply. In Fig. 1 of the drawings this restriction is shown in the form of a Venturi tube 40 which will cause a considerable drop of pressure at 41, directly opposite the bypass opening into the cold water supply pipe 4 with very little loss of pressure between the points indicated at 42 and 43.

In Figs. 5, 6 and 7 of the drawings, a modified form of the pressure lowering restriction is shown. In this modified form, the pipe connection 50 between the bypass valve 25' and the cold water supply pipe 4' extends through the cold water supply pipe 4' and has an opening 51 formed therein and opening out in the direction of flow of the cold water. The cold water dividing as it flows past the connection 50 will provide a low pressure area directly outwardly of the opening 51 which will allow the excess hot water to flow into the pipe 4' and mingle with the cold water flowing to the heater.

A check valve 36 of any approved construction is mounted in the pipe or connection 24 so as to prevent the flow of cold water through the pipe 24 and in reverse direction from its normal passage into the heater structure for preventing the improper passage of cold water at times when the water level of the locomotive (not shown) is above the heater.

From the foregoing description taken in connection with the accompanying drawings, it will appear that a feed water heater structure has been provided which will effectively take care of any excess water which may accumulate in the hot water chamber of the heater and which will return this water to the heater for reheating, thereby saving not only the water but whatever might be contained therein and also that simple and efficient means has been provided for preventing the cold water pump from becoming steam bound through the idling of the locomotive.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a feed water heater, a pump for supplying cold water to the heater, an overflow pipe in the heater, means for delivering excess water from

the overflow pipe to the suction of said pump, and a bypass valve operable upon cutting off of operating power to the pump to close the connection between the overflow pipe and pump suction.

2. In combination, a feed water heater having a hot water compartment, a pump for supplying cold water to the heater, a throttle for controlling operation of said pump, a connection for delivering excess water from said heating chamber to the suction of said pump, and a bypass valve interposed in said connection and controlled by said throttle whereby flow of fluid through said connection will be cut off upon stoppage of the pump.

3. In a feed water heater, a hot water compartment, an overflow pipe extending into said compartment and provided with openings therein at a predetermined point to regulate the water level in the heating compartment, a pump for supplying cold water to said heater, and a connection between said overflow pipe and the suction of said pump for delivering excess water from said hot water compartment to the pump suction, and means for cutting off communication between said overflow pipe and pump suction upon stoppage of the pump.

4. In combination, a feed water heater, having a hot water compartment, a pump for supplying cold water to the heater, an overflow pipe extending into said hot water compartment and provided with openings at a predetermined point to regulate the water level in the heating compartment, a connection for delivering excess water from said overflow pipe to the suction of said pump, a throttle valve for controlling operation of said pump, and a bypass valve interposed in said connection and controlled by said throttle whereby flow of fluid through said connection will be cut off upon stoppage of the pump.

5. In a feed water heater, a hot water compartment, an overflow pipe extending into said compartment and provided with openings therein at a predetermined point to regulate the water level in the heating compartment, a pump for supplying cold water to said heater, a connection between said overflow pipe and the suction of said pump for delivering excess water from said hot water compartment to the pump suction, means for cutting off communication between said overflow pipe and pump suction upon stoppage of the pump, and pressure reducing means at the point of connection between said overflow pipe and the pump suction.

6. In a feed water heater, a hot water compartment, a pump for supplying cold water to said heater, a cold water supply pipe for delivering cold water to said pump, an overflow pipe communicating with said hot water chamber for taking hot water above a predetermined quantity from the hot water chamber, said overflow pipe having communication with said cold water supply pipe, a pressure reducing restriction in said cold water supply pipe at the point of connection between said overflow pipe and said cold water supply pipe, a throttle for controlling operation of said pump, and a bypass valve in said overflow pipe and controlled by said throttle whereby flow of fluid through said overflow pipe will be cut off upon stoppage of the pump.

JOHN A. LE CAIN.