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FEED WATER CONDITIONER

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Fig. 1.

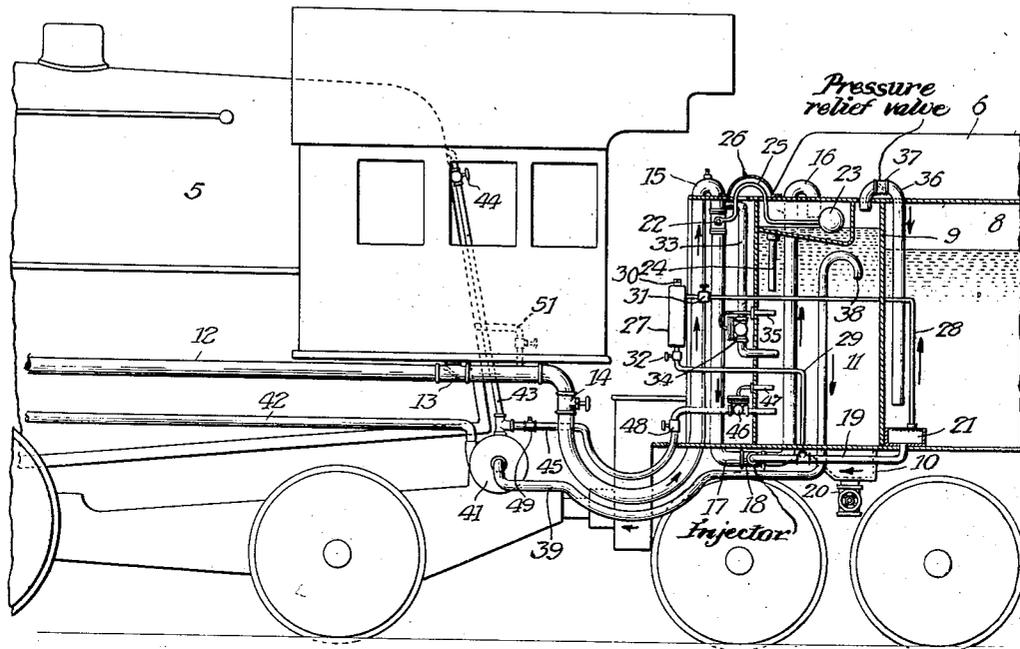
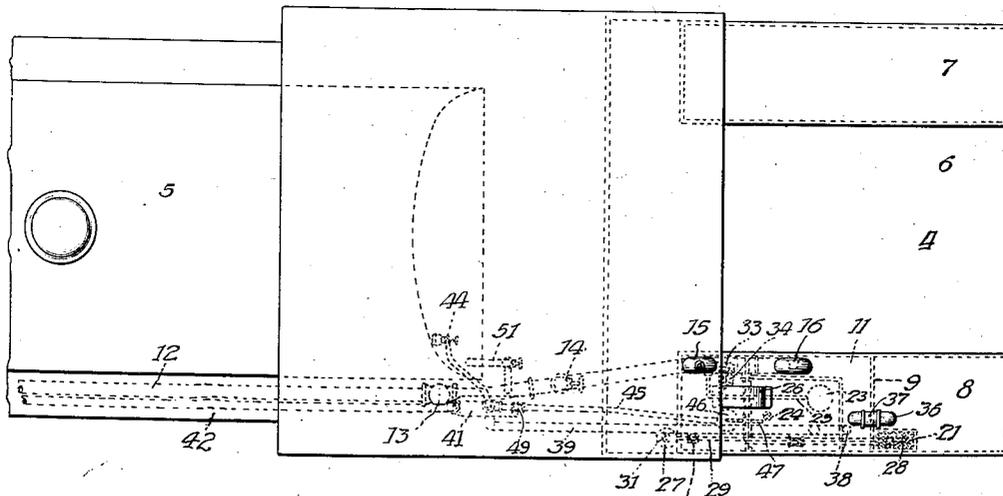


Fig. 2.



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FEED WATER CONDITIONER

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This invention relates to the conditioning of feed water for steam boilers and as illustrative of the principles of my invention I have disclosed herein a method and apparatus for treating and handling feed water for locomotive boilers.

A large proportion of the water used in locomotive boilers is of such a character as to require chemical treatment of one kind or another before being introduced into the boiler. It is common practice also on modern locomotives to promote efficiency and economy of operation by the employment of a feed water heater by which the feed water delivered to the boiler is pre-heated before its introduction.

One of the primary purposes of my present invention is to provide an apparatus which will be capable of serving the triple functions of pre-heating the water, thereby performing the function of a feed water heater, of chemically treating the water, and of cleaning the water so as to minimize the scale and sludge in the boiler by permitting the heated and chemically treated water to stand in a compartment for a limited time sufficient to promote the precipitation of matters carried in solution and in suspension in the water, this precipitated sludge being then discharged so that it is never permitted to enter the boiler.

My invention aims to provide an apparatus capable of performing all of the above functions simultaneously or any of them singly if the others are not desired and furthermore, aims to accomplish these results in the most economical and efficient manner and with this end in view my invention contemplates the utilization of the exhaust steam from the locomotive cylinders not only for the heating of water but also for delivering water from the tender tank into the conditioning compartment, thereby effecting a considerable economy over the apparatus disclosed in my copending application, Serial No. 296,180, filed July 30, 1928.

My invention also contemplates not only the automatic maintenance of a predetermined water level in the conditioning compartment but also the maintenance of a pre-

termined temperature of the water therein, irrespective of whether or not the locomotive is in operation. When it is in operation, the greatest economy is effective by utilizing exhaust steam for the purpose of heating the water but when exhaust steam is not available, as is the case when the locomotive is not in operation, live steam is then employed for this purpose.

Another feature of my invention resides in the fact that it precludes the possibility of the delivery of water to the boiler at a low temperature which would be injurious to the boiler structure. This latter desideratum is accomplished by connecting the line which supplies steam to the pump to the compartment by a conduit of sufficient capacity so that when open, the steam from the line will be delivered into the compartment to heat the water therein and insufficient steam will be delivered to the pump to operate the same. A thermostatically operated valve controlled by the temperature of the water in the conditioning compartment opens and closes the conduit connecting the steam supply line with the compartment.

Another feature of my invention resides in the provision of means for chemically treating the water before it is delivered into the conditioning compartment with the result that the solids and semi-solids carried in solution and in suspension in the water are, when the water is both heated and chemically treated, rapidly precipitated in the conditioning compartment, the resultant sludge being drawn off from the bottom of the compartment.

Other objects and inherent advantages of my invention should be readily appreciated as the same become better understood by referring to the following description when considered with the accompanying drawing.

Referring to the drawing:

Fig. 1 is a fragmentary side elevation, partially in section, of a locomotive and tender equipped in accordance with my invention, and

Fig. 2 is a plan view of the structure disclosed in Fig. 1.

Referring now to the drawing more in

detail, reference character 5 indicates generally a locomotive of any preferred type to which is customarily connected a tender referred to generally by reference character 6.

5 The tender comprises the usual water tank terminating at its forward end in two spaced legs 7 and 8 between which is disposed the coal bin 4. This construction is thus far standard.

10 My invention contemplates a conditioning compartment carried by the tender, and while this compartment may be structurally independent of the tender tank, it may consist of a partitioned-off portion of the tank  
15 located at any desired position therein, but for illustrative purposes I have shown the forward end of leg 8 as provided with a transverse partition 9 which provides at the front end of the leg a conditioning compartment 11 separated from the remainder of  
20 the tank. The bottom of this compartment is preferably shaped to provide an incline hopper-like well 10 into which the precipitates and sludge settle, and from which they  
25 may be drawn off through a discharge valve 20.

The exhaust steam pipe 12 leading from the locomotive cylinders and equipped with the usual check valve 13 and hand valve 14 is  
30 connected by a flexible connection, including suitable couplers (not shown) with a pipe carried by the tender and including a vertical loop 15 and a delivery end 16, both disposed above the water level in the compartment 11, thereby precluding back flow of  
35 water into the exhaust steam pipe. The lower horizontal run 17 of the tender pipe is provided with a water lift device 18 in the form of an injector of any ordinary and well  
40 known construction, the suction side of which is connected by pipe 19 with the leg 8 of the tender tank, a strainer box 21 being provided over the intake end of the pipe 19. The delivery of exhaust steam causes water to be  
45 drawn through the pipe 19, and commingled with the steam and delivered by the steam into the conditioning compartment 11, the water being not only elevated and delivered into this compartment but also simultaneously heated by its admixture with this exhaust steam.

In order to maintain a predetermined water level in the conditioning compartment, the exhaust steam pipe is equipped with a  
55 float valve 22 controlled by a float 23 located in the compartment. Intermittent opening and closing of the float valve which would be induced by surging of the water in the compartment, due to the travel of the tender is  
60 obviated by placing the float in a walled-off chamber 23, communication between which and the compartment 11 is established through a depending pipe 24. Assurance of the same water level in the chamber as exists  
65 in the compartment is obtained by this con-

struction, and at the same time, frequent opening and closing of the valve due to surging of the water in the compartment is obviated. The float rod 25 connecting the float 23 with its valve 22 is protected against injury by a housing or shell 26, as illustrated. 70

In order that the water delivered to the compartment may be treated with a suitable chemical when desired, there is mounted in accessible position, preferably at the front  
75 of the tender, a chemical container 27 which is charged with a chemical suitable for the water being used. The upper portion of this container is connected by a pipe 28 with the strainer box 21 and the lower end is connected  
80 by a pipe 29 with the pipe 19. The suction created upon the pipe 19 by the injector action of the exhaust steam will impose sufficient suction upon pipe 29 to draw water through pipe 28, and the chemical container  
85 so that water delivered by pipe 29 is suitably charged with chemical and is admixed with the water flowing through pipe 19 which water is then admixed with the exhaust steam and delivered into the compartment 11. The  
90 flow of water through the chemical container may be shut off or regulated as desired by manipulation of the valves 31 and 32. The container may be filled by removing the cap  
95 30.

The water in the compartment 11 is automatically maintained at a predetermined temperature and in order that this temperature may be maintained when the valve 22  
100 has been closed by the water level in the compartment, a pipe 33 is employed to establish communication between the exhaust steam pipe above the valve 22 and the interior of the compartment 11. In this pipe there is interposed a thermostatically controlled valve 34, the thermostat 35 of which  
105 is disposed within the compartment. If, therefore, the temperature of the water in the compartment falls below that for which the valve is set, exhaust steam will be admitted  
110 into the compartment to heat the water therein, even though valve 22 be closed.

To obviate the development of undesirable high pressures in the compartment, a pipe 36  
115 is extended from the top of the compartment to a point below the water level in the tender tank, and this pipe is equipped with a pressure relief valve 37 which may be set to open when a certain pressure has been developed in the compartment, thereby relieving the  
120 pressure and permitting the steam to escape into the tender tank where its heat units will be transferred to the tank water.

The water in the compartment 11, by reason of its high temperature and by reason  
125 of having been chemically treated where said treatment is necessary, is rapidly freed by precipitation of its undesirable solids and semi-solids carried in suspension and solution, said solids and precipitates being de- 130

posited in the bottom of the compartment as a sludge which can be periodically discharged through the valve 20. The treated clear hot water is withdrawn from the compartment at a point above the sludge deposited, through the intake end 38 of a pipe 39 including a flexible section and coupling (not shown) by means of a pump 41 which delivers the water through pipe 42 into the locomotive boiler against the pressure therein. The pump 41 is preferably turbine driven, live steam for that purpose being supplied through the steam line 43 controlled by a valve 44. A conduit 45 connected at one end with the steam line 43 and at its other end with the interior of the compartment 11 serves to conduct live steam to the compartment for heating the water therein. This conduit is equipped with a thermostatically controlled valve 46, the control thermostat 47 of which is disposed within the compartment, and also with a hand shut-off valve 48 which may be shut off whenever desired.

When the locomotive is in operation, sufficient exhaust steam will be delivered to maintain the water in the compartment 11 at the desired temperature, but when the locomotive is not running, there is of course no exhaust steam available for this purpose, and the water in the compartment will in time cool down. Should the engineer now open the valve 44 to start the pump 41 for the purpose of replenishing the water in the boiler, any possibility of delivering water to the boiler at an undesirably low temperature is obviated because valve 46 will have been opened by its thermostat 47 and the steam admitted to line 43 will follow the line of least resistance and be delivered into the compartment 11 to heat the water therein instead of starting the pump. In other words, the capacity of the conduit 45 is sufficiently great to carry practically all of the steam admitted into the line 43 so that there will not remain sufficient steam to start the pump 41. When the temperature of the water in the compartment has been raised above the desired minimum, valve 46 will be automatically closed, whereupon the pump will immediately start and deliver hot water to the boiler. It will thus be apparent that all danger of injury to the boiler, such as might result from delivering cold water thereto is obviated.

Pipe 45 is provided with a check valve 49 to prevent reverse flow of water from the compartment into the pump turbine, and a live steam connection 51 to the pipe 12 affords provision for testing the apparatus and for initially filling the compartment 11 when the locomotive is not running.

The principles of my invention, its mode of operation, and its inherent advantages should be readily appreciated as also the fact that the specific apparatus disclosed is illus-

trative merely, the true scope of the invention being defined in the following claims.

I claim:

1. A method of conditioning feed water for locomotive boilers, which comprises utilizing exhaust steam from the locomotive boiler to heat and deliver water from a tender tank to a compartment on the tender, utilizing a predetermined water level in said compartment for controlling the steam supplied for said water delivery, utilizing exhaust steam supplemented by live steam without delivering water to maintain the water in said compartment at a predetermined temperature, and delivering the water at said temperature from said compartment to the locomotive boiler.

2. The method of conditioning feed water for locomotive boilers which comprises utilizing exhaust steam from the locomotive boiler to deliver water from the tender tank to a compartment on the tender, chemically treating the water during its passage from the tender tank to said compartment, under control of the water level in said compartment regulating the steam which delivers said water, maintaining a predetermined temperature of the water in said compartment, maintaining the heated chemically treated water in said compartment for a sufficient time to induce the precipitation in said compartment of solids carried by the water, and delivering from said compartment to the locomotive boiler heated water from which solids have been precipitated in said compartment.

3. An apparatus for conditioning feed water for locomotive boilers comprising a compartment carried by the locomotive tender, means utilizing exhaust steam for delivering to said compartment water from the tender tank, thermostatically controlled means for delivering exhaust steam to said compartment to heat the water therein, a pump for delivering heated water from said compartment to the locomotive boiler, steam actuated means for operating said pump, and means for preventing the operation of said pump when the temperature of the water in said compartment is below a predetermined minimum.

4. In an apparatus for conditioning boiler feed water, the combination of a locomotive tender including a tank and a hot water compartment, of an exhaust steam pipe from a locomotive adapted to deliver into said compartment, an injector disposed in said pipe, a water supply pipe leading from said tank to said injector, a pump connected with said compartment and adapted to deliver water therefrom into the locomotive boiler, means for supplying steam to operate said pump, a conduit adapted to establish communication between said steam supplying means and the interior of said compartment, said conduit being of sufficient capacity to prevent oper-

ation of the pump when said conduit is open and a thermostatic valve controlled by the temperature of the water in said compartment whereby the temperature of the water in said compartment is regulated and said pump is prevented from running when said water temperature is below the predetermined minimum.

5. In an apparatus for conditioning feed water for locomotive boilers the combination of a hot water compartment carried by the tender, means utilizing exhaust steam from the locomotive for heating and delivering water from the tender tank to said compartment, a pump for delivering hot water from said compartment to the locomotive boiler, a live steam supply line connected to said pump and to said compartment, a thermostatic valve interposed in said line and controlled by the temperature of the water in said compartment whereby the steam in said line is admitted into the compartment to heat the water therein and preclude said pump from operating when the temperature of said water is below a predetermined minimum.

6. In an apparatus for conditioning feed water for locomotive boilers the combination of a hot water compartment normally sealed from the atmosphere carried by the locomotive tender, means for utilizing the exhaust steam from the locomotive to deliver water from the tender tank into said compartment, a float operated valve controlling the exhaust steam which delivers the water, a float connected to said valve disposed in said compartment, means for automatically maintaining a predetermined temperature of the water in said compartment, means for chemically treating water delivered to said compartment, a pipe leading from the upper portion of said compartment to the tender tank, a pressure relief valve in said pipe and means for delivering hot water from said compartment into the locomotive boiler.

7. In an apparatus for conditioning feed water for locomotive boilers the combination of a hot water compartment normally sealed from the atmosphere carried by the tender tank, a pipe for conducting exhaust steam from the locomotive to said compartment, means connected with said pipe for causing the delivery of water from the tender tank into said compartment commingled with said exhaust steam, a float valve in said pipe, a float disposed in said compartment and controlling said valve, a chamber in said compartment in which said float is disposed, means establishing communication between said compartment and said chamber and adapted to prevent surging of the water in said chamber, means for chemically treating the water delivered to said compartment, means for relieving exhaust pressure in said compartment including a pipe for deliver-

ing the relieved steam into the tender tank water, means independent of the water delivery means for automatically maintaining a predetermined temperature of the water in said compartment, means whereby sludge may be drawn off from the bottom of said compartment and means whereby the heated and treated water in said compartment is delivered to the locomotive boiler.

8. Feed water apparatus for locomotive boilers comprising a feed water compartment, means for delivering water from the locomotive tender tank into said compartment, thermostatically controlled means for delivering steam to said compartment to heat the water therein, steam actuated means for delivering heated water from said compartment to the boiler, and means for preventing the operation of said steam actuated means when the temperature of the water in said compartment is below a predetermined minimum.

9. Feed water apparatus for locomotive boilers comprising a feed water compartment, means for delivering water from the locomotive tender tank into said compartment, thermostatically controlled means for delivering steam to said compartment to heat the water therein, means actuated by live steam for delivering heated water from said compartment to the boiler, and means for preventing the operation of said steam actuated means when the temperature of the water in said compartment is below a predetermined minimum.

10. Feed water apparatus for locomotive boilers comprising a feed water compartment, means for delivering water from the locomotive tender tank into said compartment, steam actuated means for delivering heated water from said compartment to the boiler, and thermostatically controlled means for supplying steam to the water in said compartment to heat the same when it is below a predetermined temperature and arranged to prevent operation of said steam actuated means while said steam is being so supplied.

11. Feed water apparatus for locomotive boilers comprising a feed water compartment, means for delivering water from the locomotive tender tank into said compartment, steam actuated means for delivering heated water from said compartment to the boiler, and thermostatically controlled means for admitting steam into said compartment to heat the water therein when it is below a predetermined temperature and so connected and arranged in conjunction with said steam actuated means to render the latter inoperative during said admission of steam by reducing the steam supply to said actuating means below its effective operating pressure.

12. Feed water apparatus for locomotive boilers comprising a feed water compartment, means utilizing exhaust steam for forc-

ing water from the locomotive tender tank into the compartment while mingling it with said steam, steam actuated means for delivering heated water from said compartment to  
5 the boiler, and thermostatically controlled means for admitting steam into said compartment to heat the water therein when it is below a predetermined temperature and so connected and arranged in conjunction with  
10 said steam actuated means to render the latter inoperative during said admission of steam by reducing the steam supply to said actuating means below its effective operating pressure.

15 13. Feed water apparatus for locomotive boilers comprising a feed water compartment, means utilizing exhaust steam for forcing water from the locomotive tender tank into said compartment while mingling it with  
20 said steam, means for shutting off said delivery of water and steam when a desired level has been attained, thermostatically controlled means for injecting steam into said compartment to maintain a desired temperature  
25 therein, steam actuated means for delivering heated water from the compartment into the boiler, and means connected with said actuated means and thermostatically controlled for preventing operation of the  
30 said actuated means whenever the water temperature in the compartment is below a predetermined temperature.

14. A method of conditioning and feeding water to locomotive boilers comprising segregating in a compartment separate from the  
35 main tender tank a body of water, forcing water into said compartment up to a predetermined level by means of the locomotive exhaust steam, admitting steam into the compartment to maintain a desired temperature  
40 therein, while said water level is maintained, only under thermostatic control arranged to prevent overheating of the water, and delivering water into the boiler from said compartment subject to control by the temperature  
45 in said compartment only when said water exceeds a predetermined minimum temperature.

In witness of the foregoing I affix my signature.  
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LYNDON F. WILSON.

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