Jan. 22, 1929. 1,699,997

L. SIMMONS

AUTOMATIC WATER SUPPLY FOR LOW PRESSURE STEAM BOILERS

Filed March 28, 1927 2 Sheets-Sheet 1

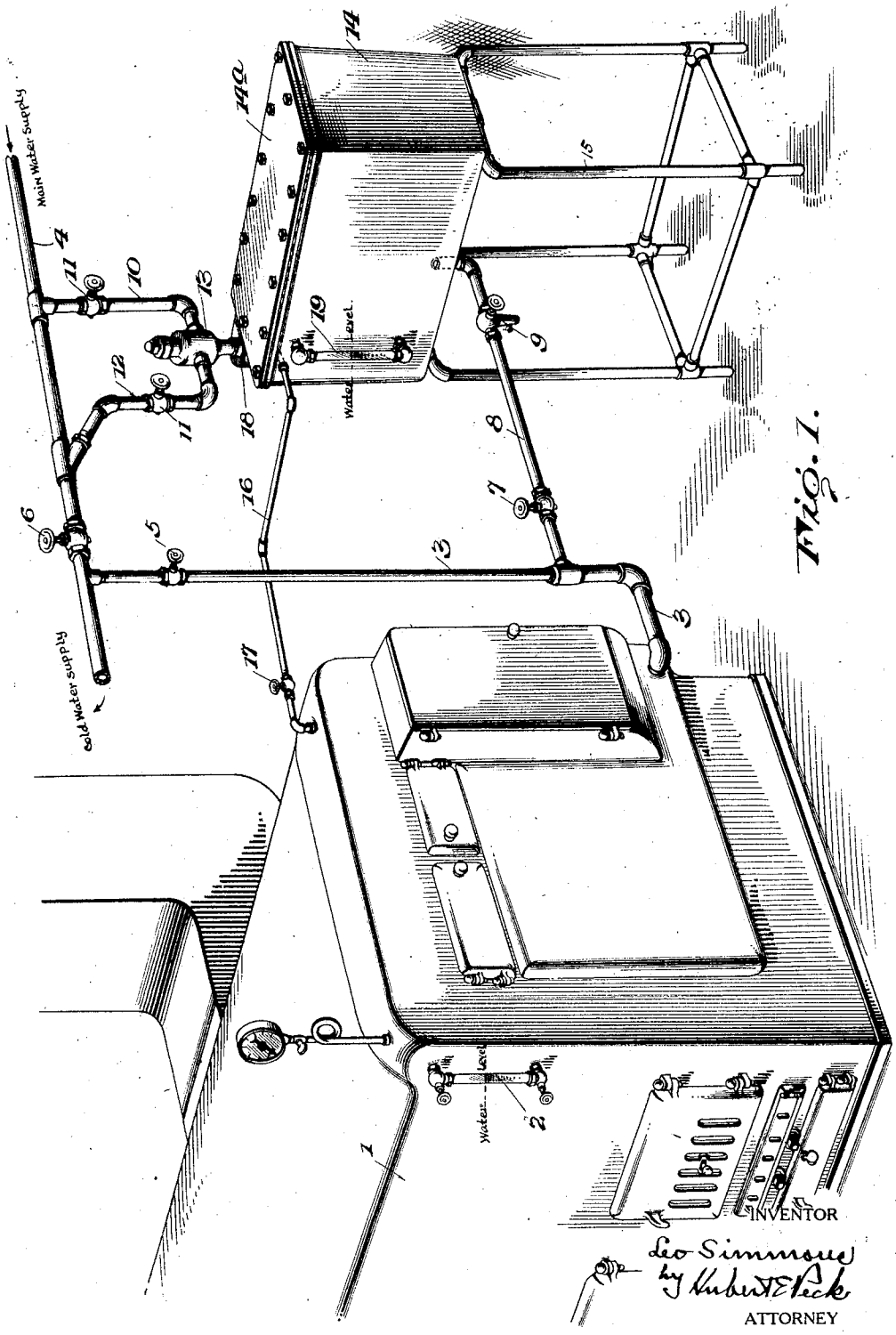

Fig. 1.

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Fig. 2.

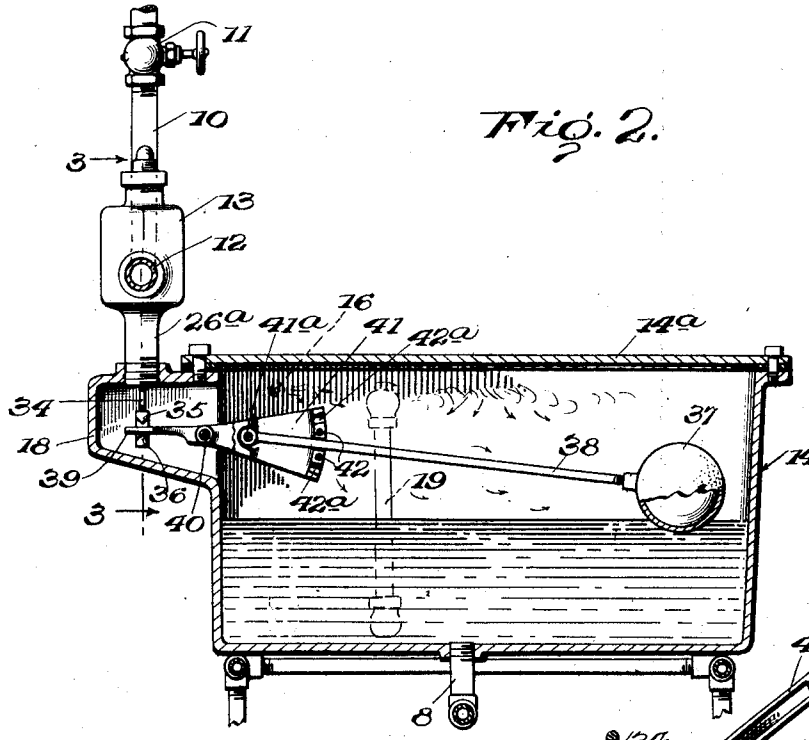


Fig. 3.

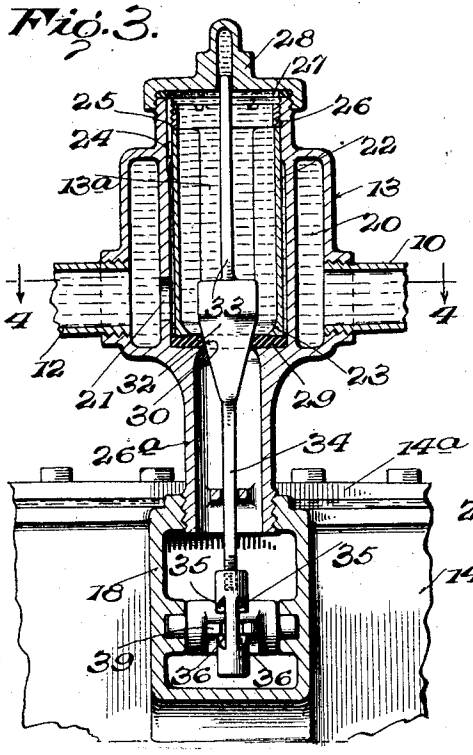


Fig. 6.

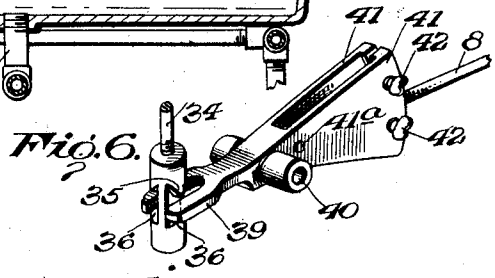


Fig. 4.

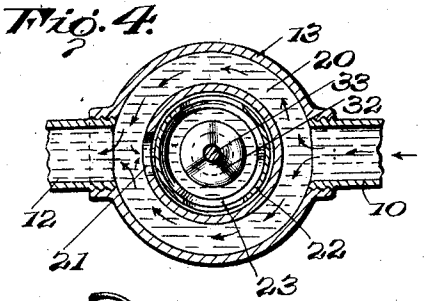
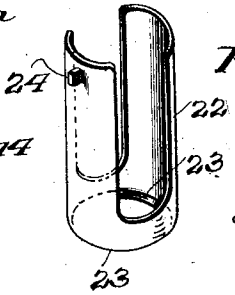


Fig. 5.



INVENTOR

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Patented Jan. 22, 1929. 1,699,997

UNITED STATES PATENT OFFICE.

LEO SIMMONS, OF WASHINGTON, DISTRICT OF COLUMBIA.

AUTOMATIC WATER SUPPLY FOR LOW-PRESSURE STEAM BOILERS.

Application filed March 28, 1927. Serial No. 179,173.

This invention is designed and developed to provide comparatively simple, durable and reliable means for automatically introducing water into a low pressure steam boiler, for instance boilers such as are employed in low pressure heating systems, to maintain the water level in the boiler above the danger point, utilizing water from the ordinary pressure supply system of the municipality to the house or building in which the steam plant is located, and the objects and nature of the invention will be readily understood by those skilled in the art in the light of the following explanations of the accompanying drawings that illustrate what I now believe to be the preferred mechanical expression or embodiment of my invention from among other forms, constructions, and arrangements within the spirit and scope of the invention.

This device is the result of many years study and practical experience in endeavoring to secure a reliable, automatic water supply for low pressure steam boilers. It may be well to distinguish the difference between low pressure and high pressure boilers to give a better idea of applying the principles involved in this invention. As the inventor has learned, the low pressure steam heating system usually has a boiler made of cast iron sections, and the steam generated is rarely in excess of fifteen pounds pressure; fifteen pounds being considered a very high point for the steam gauge to reach, as most of the low pressure boilers are adjusted with a relief valve set to blow off between eight and twelve pounds. In the majority of cases the low pressure boiler never generates a steam pressure, intentionally by the fireman, above four or five pounds; usually it runs between one and four pounds, except in severely cold weather, when it is allowed to move up to between five and seven. The high pressure boiler, in which the water supply is controlled by what is known as an injector, is arranged for a steam pressure far in excess of what is maintained in a low pressure boiler; therefore, the class of high pressure boilers, using injectors, need not be considered in this connection.

The petitioner and inventor has made a very careful study of the question of supplying a low pressure steam boiler with water to avoid the burning out and cracking of the cast iron sections; such trouble has cost him, as owner of various buildings, thousands of dollars for replacements, and untold annoyance because of the breakage of the cast iron boiler sections. Such annoyance and expense while very great, could have no comparison to the danger of exposing tenants in medium sized apartment houses and office buildings to suffering from lack of heat until repairs can be made. Many articles have been produced which can be inserted in cracked boilers with the purpose of temporarily stopping the leakage. Without such ingredients, it is very hard to visualize how great the suffering would have been in the past. Though such remedies have given great relief and benefit to the public, it is a well known fact that the owner, or those responsible for supplying heat to tenants, under such conditions, are in constant fear of the patched-up condition of the boiler.

The inventor is well aware of the numerous attempts which have been made to accomplish this purpose, having learned of such attempts in trying to secure some arrangement which would eliminate the possibility of such conditions for his own use; and, finding none, after careful research and consideration, undertook through his ingenuity, as an inventor, to develop something that would accomplish the object in view, and, with this invention, feels confident he has succeeded.

One of the great difficulties, it seems, was the many varying water pressures in the city systems of water supply, and in the production of a supply valve that would not leak and flood the boiler, or one which would not allow the seat of the valve to be burned out by the very high temperature of the water or steam coming in contact with same.

The object of this invention being intended to eliminate the possibility of breakage, for lack of the proper water supply, in low pressure steam boilers, and after careful and practical test of this invention, it seems a certainty that the object in view has been accomplished. Specifically pointing out the objects, and in explanation of the various parts of the device says:

The particular object of this invention is to automatically introduce and feed water into a low pressure steam boiler from the ordinary municipal water supply system by simple, durable, improved, and efficient means and to maintain an automatic water supply level.

A further object in connection with this invention is to provide an automatic water feed supply system for low pressure steam boilers, wherein a small, elongated feed water tank is

utilized with means to control the water pressure conditions and maintain a certain and positive water supply to the boiler.

A further object of this invention is that the water forced into the boiler shall not be of a very low temperature; a tank is therefore provided as an auxiliary to be attached to the boiler, as indicated, so as to permit the steam to raise the temperature of the water before it enters the boiler, thereby preventing reduction of the generated steam in the boiler and consequent increased cost in fuel.

A further object of this invention is to provide certain improvements in an equalizing system by connecting the steam generated in the boiler to the tank, whereby the steam will hold the required amount of water to its proper limit in said auxiliary tank and prevent the backing up of the water into same, at the same time preventing a vacuum, and flow stoppage from the tank.

And a further object of this invention is to provide a free, non-leakable, gravity closing valve, without springs or connections for forcing it to its seat; leaving said valve entirely controlled by gravity and water pressure. All of which in combination is arranged as more fully explained and specified hereinafter.

Referring to the accompanying drawings, forming a part hereof:

Fig. 1 more or less diagrammatically illustrates a low pressure boiler for a steam heating plant equipped with water supply means in accordance with my invention.

Fig. 2 is a detail vertical section through the water supply tank and certain other attached parts.

Fig. 3 is a detail vertical section taken in the plane of the line 3—3, Fig. 2, showing the water-cooled, vertical lift valve.

Fig. 4 is a detail horizontal section taken on the line 4—4, Fig. 3.

Fig. 5 is a detail perspective of the water-cooled, washer-holding clamp or open sleeve.

Fig. 6 is a detail perspective of a portion of the adjustable float apparatus and of the operative connection from said apparatus to the cone lift valve.

I show more or less diagrammatically any suitable low pressure boiler 1, for a steam heating plant, and this boiler 1 is equipped with any suitable or usual gauges and indicators, among others such as water gauge 2, indicating the boiler water level.

I show a water supply pipe 4, from the city or municipal water supply system and wherein the water is usually maintained at a considerably higher pressure than the steam pressure generated in such boiler. This pipe 4 is controlled by emergency cut-off valve 6, and usually forms the main water supply system of the house or building to be heated by the steam heating plant that includes the boiler 1 so that the pressure water supply flows through pipe 4 into the building. The pipe by-pass or loop, 10 and 12, Fig. 1, becomes part of the water supply system of the building, where suitable means are provided to maintain the desired water pressure, and should be equipped with suitable emergency cut-off valves, for instance, such as valves 11.

The ordinary manually controlled emergency feed water pipe 3 extends into the lower portion of the boiler 1, as usual, to supply water to the boiler through manual control of the cut-off valve 5 in the usual manner. This pipe 3, while coupled to the pipe 4, receives its water supply therefrom in emergency cases and is only intended for use in case the automatic supply fails.

During the operation of the ordinary low pressure steam heating plants, it is necessary for the fireman to closely observe, from time to time, the water level indicated by the gauge 2, and to supply water to the boiler to maintain the safety level, through manual manipulation of the valve 5. Through carelessness on the part of firemen, and for other accidental reasons, very heavy annual loss is suffered by reason of damaged boilers due to leakage and failure to keep up and maintain the proper water supply in the boiler. To the best of my information, no kind of safe and efficient automatic feed water supply devices for low pressure steam heating plant boilers are on the market, nor are such obtainable.

By long study of this subject, experimentation and development, I have discovered that this problem of automatically and reliably maintaining the proper water level in a low pressure boiler within safe limits can be solved by employing a closed or tight feed water supply tank, such for instance as 14, Fig. 1, with the water space of the boiler in open communication with the water space of the tank, and with the space above the water in open communication with the steam space of the boiler, so that the water in the boiler and in the tank will be free to seek a common level and the steam pressure above the water in the tank, carried through pipe 16, will approximately be the same as the pressure on the water in the boiler; and to provide float-controlled means to regulate the level of the water in the tank and to supply the boiler through the tank from the house water supply pressure system, whereby when the water in the boiler drops below the desired water level, the float will fall and a valve will open to replenish such supply.

For instance, I show a closed, elongated water supply tank 14 arranged contiguous to the boiler 1 and at the proper elevation with respect thereto. This feed water supply tank 14 can be supported at the desired elevation in any suitable manner although I show a pipe supporting frame work or stand 15 on which this tank 14 rests.

A feed water supply pipe 8 opens from the bottom of the tank 14, extending to the ordinary feed water supply pipe 3 to the boiler. This pipe 8 can be provided with an emergency hand-operated cut-off valve, 7, and if so desired, with a drain-cock 9.

A steam pipe 16 opens into the steam space of the boiler 1 and extends therefrom to the top of the side of the tank 14 so as to enter the space of the tank 14 above the water therein. This pressure equalizing steam pipe 16 is provided with an emergency hand operated cut-off valve 17.

The feed water supply tank 14 is preferably provided with a glass water gauge level indicator 19 to visibly indicate the water height within the tank. The arrangement of the tank, equalizing steam pipe 16, and water levelling pipe 8, is such that the water level indicator gauges 2 and 19, should indicate the same water level, and the water in the tank and boiler will rise or fall simultaneously and reciprocally. This is rendered possible and in fact is necessitated by the open communications between the boiler and tank through said steam and water pipe connections.

Various means can be provided for automatically maintaining a proper water level in tank 14 from the supply pipe 4 and for shutting off the water when it reaches the desired level.

For instance, in the example illustrated, I show a float to control the opening and closing of the tank water supply from pipe 4, through pipe by-pass 10, 12.

In this example, the tank 14 is provided at its upper portion with a lateral projection 18 forming a lateral chamber open to the interior of the tank above the water level, and a supply pipe connection through the top wall of this projection 18 to supply water to the tank 14. This water supply connection from pipe 4 to tank 14 includes an upright valve casing having a depending water supply neck 26^a screwed into a vertical port in the top of the projection 18.

This valve casing provides an internal horizontal annular seat 29 for a flat compressible washer 30 having a central vertical opening or port for the downflow of water from the valve casing into the interior of the projection 18 through the discharge passage 26^a.

This compressible or cushioning washer forms the seat for vertical water supply controlling lift valve 32 (Fig. 3), which in the particular example shown, decreases downwardly in diameter, i. e. is conical in form, constituting a conical plug valve depending through the port in the washer to normally tightly close the same. The edge of the washer surrounding the port constitutes an annular seat for the valve. The valve casing 13, provides a pressure water supply passage or chamber 13^a, normally closed at the bottom by the washer 29 and valve 32, so that on lifting valve 32, the pressure water supply will flow into tank 14.

The valve casing water chamber 13^a is in constant open communication with pressure water supply by pipe 4 and loop connections, although in the example illustrated, I show the water supply in chamber 13^a, maintained through the medium of radial port 21, from annular water jacket 20, in the valve casing, and surrounding the chamber 13^a, and the valve and its washer, to chamber 13^a, and pipe connections 10, and 12, from pipe 4, to the water jacket 20. These pipe connections 10 and 12, in normal operation, place the water jacket in open communication with pipe 4, and are arranged to provide for a flow of cold water through the water jacket to constantly cool the valve mechanism and washer within the valve casing. In case of emergency, the valve casing can be cut off from the water supply 4, by manually operated cut-off valves 11.

The vertically reciprocatory lift valve 32, is guided and maintained in its vertical position by guide rod 33, normally fixed to and upstanding therefrom and by lift pin 34, normally fixed to and depending therefrom, although I do not wish to so limit my invention. The guide rod 33, is freely slidable vertically in and is guided by the removable top screw cap 28, of the valve casing 13.

The lift pin 34, depends through the discharge neck 26^a, into the chamber within projection 18, and is freely vertically movable and is guided by any suitable interior formation of said neck. The said plug valve 32, lift rod 33, and lift pin 34 can be constructed as one integral part.

The vertical position of the lift valve is, in this example, controlled by a suitable float device actuated by the rise and fall of the water in tank 14, Fig. 2. For instance, I show float 37, carried by long lever arm 38, secured to a head that forms a longitudinal continuation thereof and that provides the fulcrum point or axis 40, on which the float arm swings vertically as the float or ball 37 rises and falls. Said head of the float arm provides a short horizontally-disposed lever arm, in the projection 18, which is the form of fork 39, loosely straddling the lower end of valve lift pin or rod 34. The lower end of said lift pin 34, has opposite flat faces within said fork to prevent axial rotation of the lift rod and valve, and with top opposite tapered stop shoulders 35, above the fork and corresponding stop shoulders 36, below the fork. The fork is arranged between said upper and lower spaced stop shoulders, more or less lost motion being provided for, so that downward movement of the float elevates the the lift rod and valve by contact between the fork 39, and shoulders 35, while upward

movement of the float causes the fork to cooperate with shoulders 36, in a downward or valve closing direction.

After the tank 14, is set up and the various pipes are coupled thereto and to the boiler, and the float mechanism is operatively assembled, it is usually necessary to adjust the float with respect to the head of its lever arm, to maintain the desired water level in the tank to accord with the safety water level required by the particular boiler installation. For this purpose, I provide an adjustment whereby the float 37, can be adjusted vertically with respect to the fulcrum or axis 40, and with respect to the head fork 39, and the valve lift rod, so that the float and feed water supply valve controlled thereby, will thereafter act to maintain this particular required boiler water level. For instance, the rear portion of the head of the float or lever arm is formed of longitudinal spaced vertically wide jaws or clamping members 41, between which the float rod 38 extends and to which it is pivotally secured by transverse pivot pin 41ª. The rod 38, is clamped to the head in fixed longitudinal continuation thereof by bolts 42 whereby the jaws 41, are drawn together to tightly grip the rod 38, and whereby the jaws can be loosened with respect to said rod to permit the same relative vertical swing on pivot 41ª, when setting the float to the desired relative vertical adjustment preparatory to securing the same by bolts 42, and jaws 41.

The washer 30, that forms the seat for the supply valve 32, is preferably rendered accessible and renewable. For this purpose, I provide a longitudinally-slidable washer clamping spider or sleeve 22, removably and longitudinally located in the valve casing water chamber 13ª, and at its lower end having washer compressing ring foot 23, fitting down on the top side of the flat washer 30, above the washer supporting annular ledge or shoulder 29, and pressing and holding the same thereto. The vertical port through a cushioning compressible non-metallic washer 30, and the valve seat surrounding said port, are remote from the foot 23, although usually concentrically arranged with respect thereto.

The upper end of the valve casing 13, can be formed with top tubular externally and internally screw-threaded neck 26, in longitudinal continuation of chamber 13ª. This neck is normally tightly closed by removable cap 28. The spider 22, is insertable and removable through this neck, and is held down and adjusted longitudinally by removable ring nut 27. The spider 22, is longitudinally slidable in the valve casing and is preferably held against axial rotation by tit or lug 24, slidable in longitudinal groove 25, (Figs. 3, 5) in the neck 26.

From the foregoing, it will be understood, that the washer can be removed and renewed, on removal of cap 28, ring nut 27, and spider 22, and that the clamping pressure of the spider 22, on the washer 30, can be varied, although I do not wish to so limit all features of my invention.

The valve washers commonly employed are soon destroyed or rendered inefficient by the destructive action of steam and high temperature, and hence where I employ a valve in my apparatus that seats on a compressible washer subject to deterioration under the action of high temperature or steam, I provide means for protecting the washer against the action of steam. It is for this reason, that I provide the valve casing with a valve and washer cooling water jacket 20.

The ordinary house supply water flowing through the valve casing 20, lowers the temperature adjacent to the valve and its washer, and in fact will cause condensation of steam rising in the projection 18, and water passage 26ª, and serves to protect the washer against the softening destroying action of the steam.

It will be obvious from the foregoing, that when the water level in the tank 14, drops below the predetermined level, the float lever will lift the cone valve 32, and permit downflow of feed water through the washer port and into the tank to raise the water level in the tank and boiler. When the desired level is attained, the float will raise to a point so that the lift valve is free to close the port in the washer.

It will be noted that the water in tank 14 is kept hot or at least warm by the steam in the tank and by the open communication between the tank and boiler, and hence that the boiler efficiency is not lowered by feeding cold water thereinto. Also the float and peculiar valve mechanism, serves to constantly maintain the desired water level by frequent inflows of small quantities of feed water, by a sort of frequent bleeding action of the valve 32, as distinguished from infrequent more or less large charges of cold feed water.

In the drawings, for purposes of illustration, the cone valve is exaggerated in length, and the port in the washer in diameter. Notwithstanding the fact that the water pressure in the valve casing exceeds the steam pressure in tank 14, the valve 32, is easily and quickly lifted, the short stroke necessary to open the same, by the float mechanism, and as quickly closed. The valve mechanism is quickly responsive to the rise and fall of the water level.

The closed tank 14, is preferably provided with a removable top wall or cover 14ª, whereby access can be gained to the float mechanism when the valves 7, 17, 6 and 11, are closed.

I have gone into many details in the drawings and description to which I do not wish to limit my invention, and hence the disclosure hereof should be considered merely illustrative and not limiting in character, particularly as various changes, modifica-

tions and variations can be resorted to without departing from the spirit and scope of my invention.

What I claim is:

1. Means for automatically supplying water to a low pressure steam boiler from a pressure water supply, comprising a feed water connection including a closed boiler feed water tank adapted to automatically feed water into the boiler, a valve for controlling the flow of water for the boiler through said connection, and valve controlling means actuated by the fall and rise of boiler heated water in the tank to cause said valve to open and close said connection for automatically maintaining the boiler water level, a non-metallic compressible valve seat washer for said valve, said valve and its said washer being arranged at the exterior of the tank and above the level of the hot boiler-heated water in the tank; and means to constantly maintain circulating cooling feed water over and in contact with said valve and said washer when the valve is in both closed and opened positions to cool and protect the washer against the deteriorating action of the boiler steam and water temperature.

2. An automatic water supply for low pressure steam boilers, comprising a feed water supply connection adapted to be connected with a source of water under pressure to feed water therefrom to the boiler, a valve for controlling the water flow through said connection, and valve controlling means actuated by the rise and fall of the boiler water to cause the valve to close and open said connection to automatically maintain the boiler water level, a non-metallic compressible cushioning valve seat washer being provided for said valve, said valve and its said washer being remote from the hot boiler-heated water; said washer and valve being accessible from below to the boiler steam; and means to circulate cooling feed water in contact with the said washer and said valve to protect the washer against the damaging action of heat.

3. Means for automatically supplying water for low pressure steam boilers, comprising a closed tank adapted to be connected with the steam and water spaces of a boiler to maintain the boiler water level in the tank with a steam space above the boiler-heated water in the tank; a cool water supply connection at the exterior of the tank and opening thereinto above the water level therein and embodying a water supply valve having a non-metallic seat, both at the exterior of the tank and open from below through the said connection to the steam space of the tank, said connection providing an internal feed water passage and chamber for circulating and maintaining cooling water on said seat and submerging the valve above the seat when the valve is in both opened and closed positions; and a valve actuating float in the tank for controlling said valve.

4. Means for supplying water for a low pressure steam boiler, comprising a float-controlled water supply valve that embodies a valve casing, a valve seat in said casing having a feed water discharge port, said casing providing a feed water discharge neck depending from said port for delivery of feed water into the steam space of a boiler feed tank, a feed-water-supply controlling tapered lift valve plug in said casing for closing and opening said port and extending above and below the same, a cooling pressure water pipe connected to said casing above said port, said casing providing a cooling pressure water circulating passage and chamber to maintain cooling water over said seat and submerging said valve above the seat when the valve is in both opened and closed positions and to tend to cool the depending portion of the valve and said neck by conduction.

5. An automatic water supply for low pressure steam boilers, comprising an exterior valve for controlling the discharge of feed water to supply the boiler, and mechanism controlling said valve, said mechanism actuated by the rise and fall of water in the boiler, said valve embodying a casing provided with a cushioning non-metallic valve seat having a port for discharge of feed water to the boiler, a lift valve to close and open said port and seat on said washer, said casing having a cooling feed water chamber communicating with said port to provide a body of cooling feed water within the casing to cool the valve, washer and casing when the valve is in both opened and closed positions, and means for connecting said chamber and space with a cool pressure water supply for supplying feed water to and circulating the same in said casing.

6. Means for automatically feeding water to a low pressure steam boiler, comprising an exterior valve for controlling the discharge of feed water to supply the boiler, and mechanism controlling said valve, said mechanism actuated by the rise and fall of water in the boiler, said valve embodying a casing providing an internal water chamber and communicating surrounding cold water circulating space, a cushioning washer at the bottom of said chamber with a feed water discharge port from said chamber and space, and a depending neck to discharge the feed water from said port to the boiler, means being provided to connect said space and chamber with a cool pressure water supply; and a tapered lift valve in said chamber and depending through said port and normally seated on said washer.

7. An automatic water supply for low pressure boilers, comprising a feed water supply valve having a discharge opening for water for the boiler, and providing a cool

pressure water chamber; a cushioning washer held at the bottom of the chamber and having a vertical port forming the chamber outlet into said discharge; a tapered lift valve normally seated on said washer and closing said port and depending therethrough and extending upwardly into said chamber; a float operated lever in said tank actuated by the rise and fall of water therein and having a lost motion connection with the depending portion of said valve to lift the valve and permit the same to drop and freely seat; and means to connect the casing with a cool pressure water supply and maintain a cooling body of feed water in the casing chamber.

8. A feed water supply for steam boilers, comprising a closed tank having steam and water spaces for open connection with the boiler steam and water spaces; a feed water supply valve casing having a non-metallic cushioned seat with a feed water discharge into the tank, said casing providing an interior casing and valve cooling chamber and water circulating space and separate pipe connections therefrom for coupling into a pressure water supply system to maintain cooling water circulation through the casing, a valve in the casing to open and close said discharge, and float operated valve actuating means in the tank.

9. Means for automatically feeding water to a low pressure steam boiler from a pressure water supply for maintaining an approximate water level in the boiler, said means comprising a valve controlling the flow of water for the boiler from said pressure supply, said valve being normally in closed position cutting off said water flow, and valve opening mechanism actuated by the rise and fall of boiler water and controlling the opening and closing movements of said valve, said valve embodying a casing having an outlet port for the flow of pressure water for the boiler, a non-metallic compressible washer in the casing and forming an annular seat, a tapered lift valve plug adapted to depend through said washer and seat thereon to close the same against water leakage and to lift therefrom against the pressure of said supply to permit flow of water for the boiler through the washer and port; said casing providing a cooling water chamber to maintain cooling water in constant contact with the washer and plug to cool and protect the washer against the washer deteriorating action of the heat of the boiler water and steam.

Signed at Washington, D. C., this 28″ day of March, 1927.

LEO SIMMONS.