Jan. 21, 1947. A. G. BLOSS 2,414,629

FEED WATER CONTROL AND ALARM FOR STEAM BOILERS

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Fig. 1.

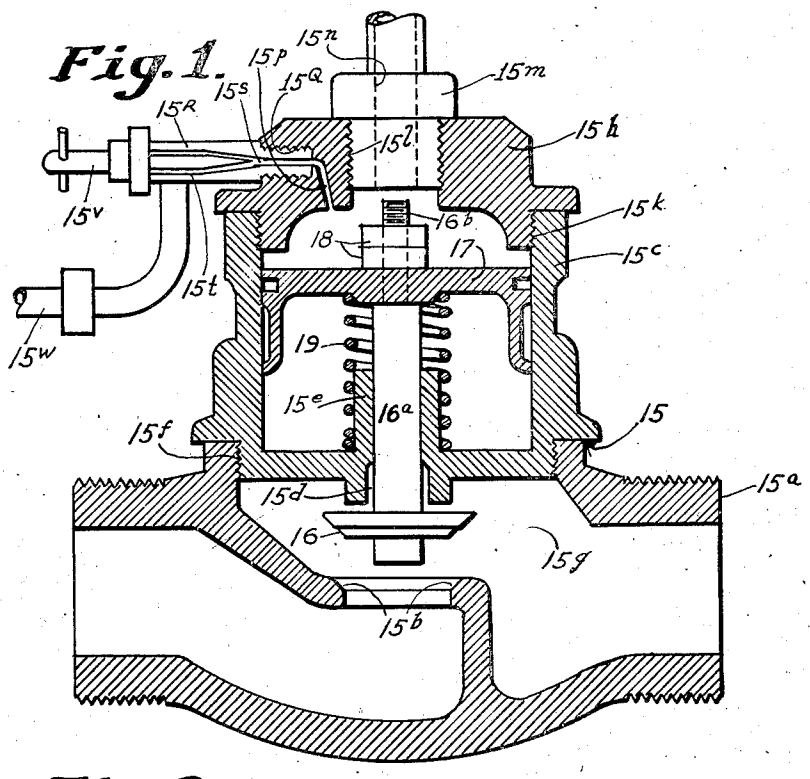
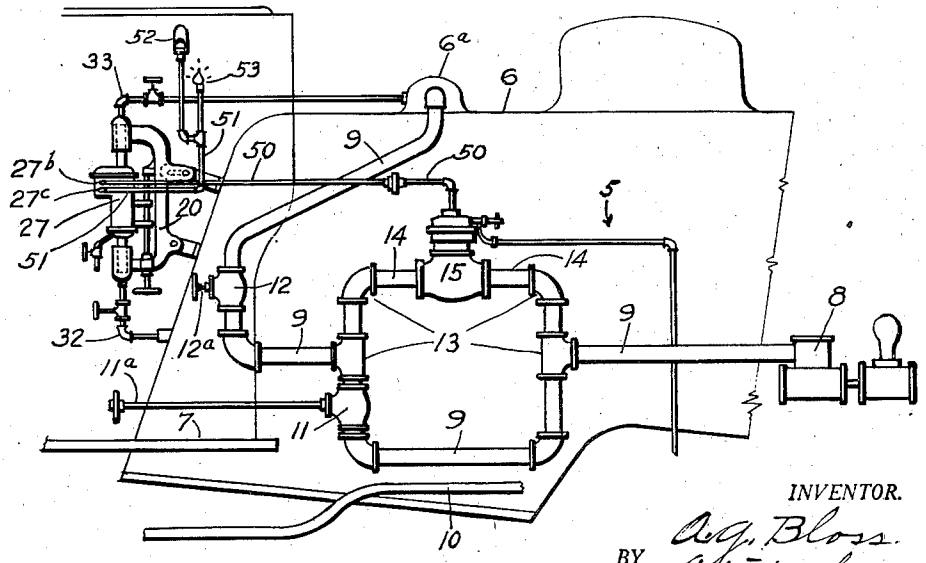


Fig. 2.



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Fig. 3.

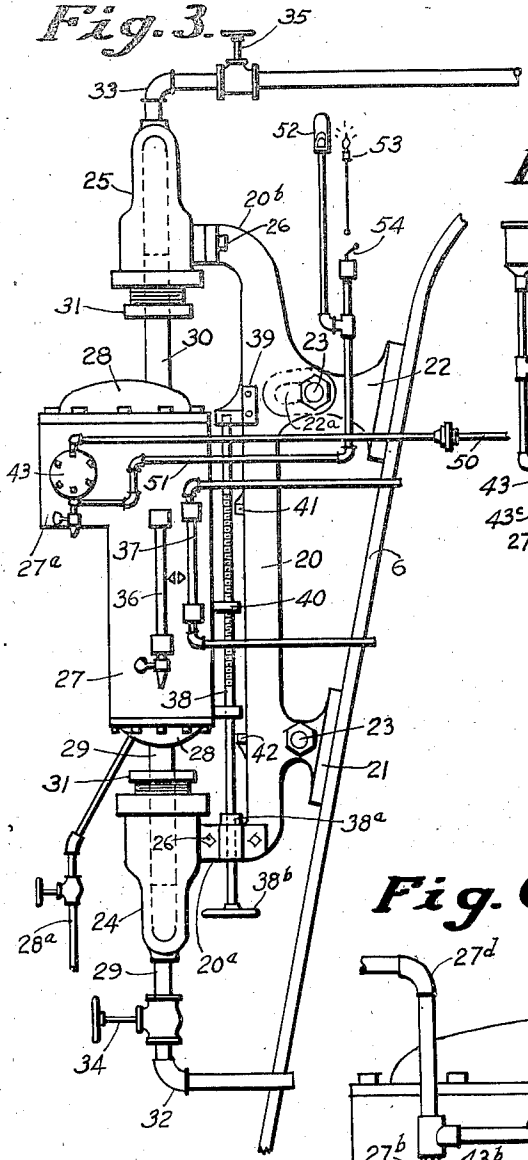


Fig. 4.

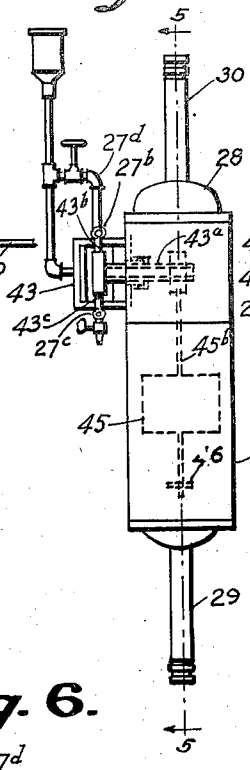


Fig. 5.

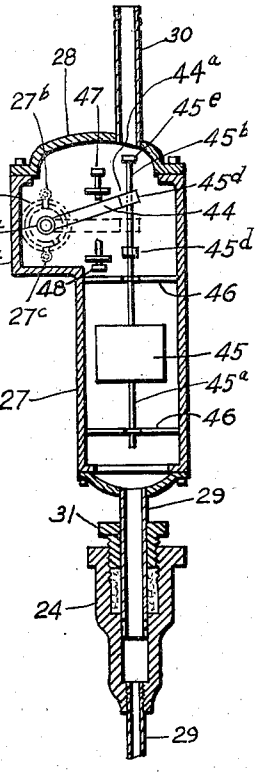
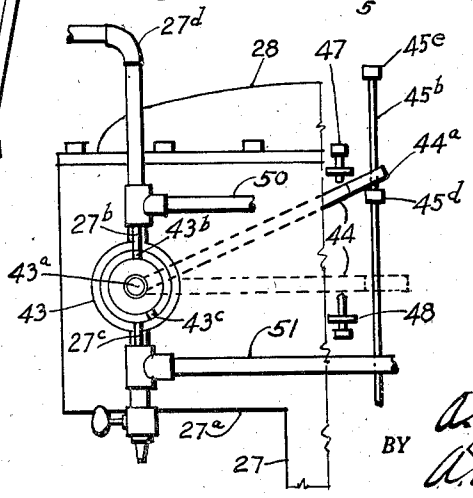


Fig. 6.



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FEED-WATER CONTROL AND ALARM FOR STEAM BOILERS

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Application July 8, 1943, Serial No. 493,884

3 Claims. (Cl. 122—451)

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This invention relates to the automatic control of feed water pumps of steam boilers, for keeping such boilers adequately supplied with water at all times, together with automatic means for actuating suitable alarm signals in case the water falls to dangerous low levels. In addition to the automatic control of the feed water pump and operation of alarm signals, this apparatus offers the advantage of being adjustable within fixed limits for varying the water level in the boiler to meet the various requirements of different territories or jurisdictions.

One principal object of the invention is to provide, in combination with the steam boiler and the feed water pump thereof, automatic means for controlling the pump, and alarm signal devices for indicating low or dangerous water levels in the boiler.

Another object is to provide in combination with a steam boiler and the feed water pump thereof, a water bottle mounted thereon and connected therewith, for indicating the water level in the boiler, the said bottle being vertically adjustable relative to the boiler in order to adapt the apparatus to conform to the laws of different jurisdictions relative to the required water levels of steam boilers, and especially as relating to the operation of locomotives in different territories or on different roads, and means operable through the lowering and raising of the water level in the boiler and water bottle for respectively operating the feed water pump or stopping same, together with similarly operated means for actuating visual and audible alarm signals upon the dangerous lowering of water in the boiler.

Another object of the invention is to provide in combination with a steam boiler, the feed water pump connected therewith, the steam line running from the boiler to the pump for operating the same, and steam operable alarm signals for indicating dangerous low water levels in the boiler, steam operable means for controlling the flow of steam through the steam line running to the water pump, a water bottle connected with the boiler for indicating the water level therein, the bottle being adjustable vertically between two fixed or adjustable stops, for adapting the apparatus to the jurisdictional requirements of different localities or territories, steam pipes leading from the boiler into the upper end of the water bottle, separate steam pipes leading from the upper end of the water bottle to the steam operable alarm signals and to steam operable means for controlling the flow of steam to the

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water pump, valves in the upper end of the water bottle for admitting steam to the pipes running to the alarm signals and to the means for controlling the flow of steam to the water pump, and means dependent on the water levels in the water bottle for operating the said valves therein, whereby the feed water pump will be automatically operated to pump water into the boiler to replenish same, or will be automatically stopped when the boiler is so replenished, and whereby the said alarm signals will be automatically operated when the water becomes dangerously low in the boiler.

With the foregoing objects and advantages in view, together with such further objects and advantages as may appear in the following specification, attention is directed to the accompanying drawings as embodying preferred embodiments of my invention, and wherein:

Figure 1 is a longitudinal vertical section on a relatively large scale, of one of the essential elements of the invention, same being a steam housing and valve mechanism, for incorporation in the steam line running from the boiler to the feed water pump, for controlling the flow of steam to the pump.

Figure 2 is an assembly view on a relatively reduced scale, showing in side elevation a medial portion of a locomotive boiler and forward portion of the attached engine cab, and showing the complete apparatus constituting this invention, as mounted thereon in co-operative relation.

Figure 3 is a vertical sectional view on a scale relatively larger than that of Figure 2, of the water bottle or water level control, constituting another very essential element of the invention, as the same appears mounted on the cab end of a locomotive boiler, the system of steam pipes as connected with the bottle and portions thereof immediately adjacent thereto, and certain other elements, being shown in full lines.

Figure 4 is a rear elevation, on the scale of Figure 3, of the water bottle or water level control, portions being broken out to show the arrangement of the interior elements.

Figure 5 is a vertical section on the line 5—5 of Figure 4, showing the enclosed mechanism for operating the signal devices and feed water pump.

Figure 6 is a detail on an enlarged scale of the upper end of the water bottle or water level control, including the steam chest and the rotary valve and connections for controlling the flow of steam through the signal operating pipes and through the pipes supplying steam to the feed water pump.

This invention is designed for installation upon any steam boiler, moving or stationary, but is especially adapted for use upon locomotives, such as here represented generally at 5 in the drawings, and which includes the conventional boiler 6 with its steam turret 6a, cab 7, feed water pump 8 operated by the steam line 9 extended from the turret 6a, and whereby water is pumped through the feed water pipe 10 into the boiler. Manually operated valves 11, 12 are incorporated in the steam line or pipes 9, with their stems and hand wheels 11a, 12a, extended into the cab 7, within easy reach of the engineer or fireman. The structures as so far described are substantially conventional.

In practising my invention, and by means of the pipe couplings 13, I incorporate in the conventional steam line 9, a by-pass steam line 14, and which includes a steam valve housing referred to generally at 15, enclosing certain essential elements of the invention, as fully shown in Figure 1, and which will now be described. The housing 15 comprises the relatively large lower pipe joint 15a, formed interiorly with the horizontally disposed circular valve seat 15b. The upper portion of this housing comprises a cylindrical valve chamber 15c, closed at its lower end except for the central valve stem aperture 15d, reinforced around its margins by the upwardly extended and integrally formed sleeve 15e. The lower end of this cylindrical chamber 15c is exteriorly threaded to engage, as shown at 15f, the interiorly threaded margin of the circular opening 15g formed in the upper side of the joint 15a concentrically with the valve seat 15b. Thus the valve seat 15b and sleeve 15e are positioned concentrically in vertical alignment.

The cylindrical chamber 15c is closed at its upper end by a circular cap 15h, which is threadedly seated onto the chamber 15c as shown at 15k. The cap 15h is centrally bored and tapped as at 15l for engaging the complementally threaded plug 15m, which in turn is centrally bored through and tapped, as at 15n, to receive a small steam pipe later to be described. The cap 15h is formed laterally with a small duct 15p which widens into an interiorly threaded socket 15q adapted to threadedly receive a valve plug 15r formed with a duct 15s adapted to align with the duct 15p of the cap 15h when the plug 15r is screwed into the socket 15q. The duct 15s is taperingly expanded at its outer end, as at 15t, and is threaded interiorly at its mouth for engaging a complementally threaded needle valve 15v, for regulating the flow of steam from the chamber 15c, for a purpose later to be explained. A blow pipe 15w is extended laterally from the tapered outer portion 15t of the needle valve duct for blowing off steam condensations. A disk valve 16 is fitted to the seat 15b and is mounted upon the lower end of a valve stem 16a, dimensioned to nicely fit and freely slide through the sleeve 15e within the chamber 15c. A piston 17 is similarly nicely and freely fitted into the cylindrical chamber 15c, and is centrally apertured to pass the reduced upper end of the valve stem 16a, these elements being then locked together by means of lock nuts 18 turned upon the upper threaded extremity of the stem 16a, threaded at 16b for that purpose. A coil spring 19 embraces the sleeve 15e and valve stem 16a, and being braced at its ends between the bottom of the chamber 15c and the piston 17, normally urges that piston and the valve 16 upwardly and clear of the valve seat 15b, thus leaving a clear passage through the joint 15a for the passage of steam. However it is obvious that steam pressure may be employed at the upper side of the piston 17, in the manner and for the purpose later to be described, for forcing this piston and the valve downward upon the valve seat, thus cutting off the flow of steam through the pipe joint 15a, as required in the operation of the invention.

Within the cab 7 and upon the rear end of the boiler 6 is vertically mounted an elongated supporting bracket 20, which is clamped and bolted to the boiler by means of lugs 21, 22, secured to the boiler end in vertically spaced relation, with bolts 23 passed through these lugs and through the ends of the bracket 20, the upper lug 22 being slotted as at 22a to permit of the vertical adjustment of the bracket. The ends of the bracket 20 are turned perpendicularly outward, as at 20a, 20b, and slip-joint socket members 24, 25, are bolted as at 26 to these out-turned ends in exact vertical and axial alignment.

An elongated water bottle 27 is provided, the same being closed at its ends by metal caps 28 into which are screwed in axial alignment the short water and steam pipes 29, 30, the same being passed through packing nuts 31 and then slidably seated in the sockets 24, 25. The pipes 29, 30 communicate interiorly with the bottle 27 through the socket members 24, 25, and leakage is prevented by means of packing (not shown) placed in the expanded mouths of the sockets, after which the nuts 31 are screwed into the interiorly threaded mouths of the sockets, as shown in Figure 3. The outer ends of the socket members 24, 25, are bored and tapped to receive the threaded ends of the water and steam pipes 32, 33, provided with the valves 34, 35, for controlling the flow of water and steam therethrough. The water pipe 32 extends to and is connected with the boiler 6, at the low water line or danger point thereof, this connection being made in conventional manner and not shown in the drawings. Thus the water level in the boiler 6 at any time is faithfully reproduced and shown in the water bottle 27, the bottle being properly located for that purpose. The steam pipe 33 is extended to and operatively connected with the steam turret 6a of the boiler, in conventional manner. To facilitate comparison of levels as between the boiler and water bottle, water glasses 36, 37 are mounted on the bottle 27 and on the boiler 6 respectively, in conventional manner.

For the purpose of adjustably raising or lowering the bottle 27 to meet varying conditions and requirements, a worm shaft 38 is journalled at its lower end vertically through the out-turned lower end 20a of the bracket 20, where it is held by means of a stop ring 38a anchored to this shaft immediately above the end 20a of the bracket, and the upper end of this shaft is then journalled in a lug 39 anchored upwardly on the bracket 20. The worm shaft is passed through a screw lug 40 anchored medially to the bottle 27 and adapted to mesh with the worm of the shaft. A wheel handle 38b is anchored to the lower extended end of the shaft 38. Thus the shaft may be rotated to right or left for raising or lowering the bottle 27. Stop lugs 41, 42, are mounted on the bracket 20 in vertically spaced alignment for limiting the upward or downward movement of the water bottle 27, between these stops. A valved drain and blow-out pipe 28a is screwed into the lower bottle cap 28, for the purpose of blowing same out and for testing the operation of the apparatus.

The bottle 27 is formed with a steam chest

27a at its upper end, or which may be incorporated with the cap 23 at that end, and wherein is mounted a rotary valve 43 on a shaft 43a journalled in the chest. The valve 43 is formed with oppositely disposed and spaced steam ports 43b, 43c, adapted to closely and alternately align or register with the ports 27b, 27c respectively of the steam chest 27a. A crank arm 44 is rigidly connected at one end with the shaft 43a and is extended horizontally, medially into the upper end of the bottle 27. A float 45 is mounted medially on a guide rod 45a which is slidably passed through vertically spaced cross-ribs 46 anchored at their ends transversely in the bottle 27. A connecting rod or stem 45b is adjustably joined by means of the adjustment nut 45c to the upper end of the guide rod 45a. The stem 45b is passed slidably through a narrow slot 44a formed in the crank arm 44, and stops 45d, 45e, mounted on the stem serve to limit the upward and downward movement of the stem as they strike the arm at either side under the movement of the float 45. Additional adjustment stops 47, 48, may be mounted on the inner walls of the steam chest 27a, in vertical alignment above and below the crank arm 44, for limiting the vertical movement of this arm. A lubricating pipe 27d may be screwed into the top side of the steam chest 27a for lubricating the mechanism of the steam chest, the rotary valve, etc.

A steam pipe 50 is connected at one end with one of the ports, as 27b of the steam chest 27a, and is extended to and connected at the other end with the plug 15m of the steam valve housing 15, the pipe being for this connection threaded into the tapped bore 15n of the plug. A separate steam pipe 51 is connected at one end with the opposite port 27c of the steam chest, and is extended to and operatively connected at the other end with any conventional forms of alarm signals, such as the whistle 52 and the electric light 53, the latter being energized by means of a steam operable switch 54 set in a suitable electrical circuit.

Constructed as described, and with the several elements of the invention operatively arranged and adjusted, the operation is as follows: The coil spring 19 within the steam valve chamber 15 will normally raise and hold the valve 16 in open position as shown in Figure 1. The valve 11 being normally closed and the valve 12 open, steam will then flow from the steam turret 6a through the unobstructed steam lines 9 and 14, and through the valve chamber or housing 15, to the conventional water pump 8, and will operate same for pumping water into the boiler, the water then flowing by gravity into the water bottle 27 connected as aforesaid with the boiler. This flow of water into the boiler and bottle will continue until the lower stop 45d at the upper end of the guide rod of the float 45 strikes the crank arm 44 and pushes same upward. This action rotates the rotary valve 43 until the steam port 43b aligns with the port 27b of the steam chest 27a. At this time the opposite port 27c will remain closed. Steam will then flow through the steam line 50 into the valve housing or chamber 15 from the upper end of the water bottle and the steam chest 27a which is kept supplied from the steam turret 6a through the pipe 33. Entering the housing 15, the steam will force the piston 17 and the valve 16 downward until the latter seats upon the valve seat 15b, thus stopping the flow of steam to the water pump and stopping the pump. In the process of generating steam in the boiler, the water levels in the boiler and water bottle may fall until the upper stop 45e strikes the upper side of the crank arm 44, which action rotates the valve 43 reversely until the steam port 43c aligns with the port 27c of the steam chest 27a, and which rotation simultaneously closes the port 27b and stops the flow of steam through the line 50 to the housing 15. As the ports 43c, 27c register, steam then flows through the line 51 and energizes the alarm signals 52, 53, but of course this will not occur until the water reaches a dangerous low point in the boiler, all adjustments being made to that purpose. The alarm signals described are primarily intended to warn train operators in case they should leave the engine for too long a period. In any event, as the water lowers in the boiler and water bottle, steam trickles out from the housing 15, through the needle valve 15v, and as the steam line 50 remains closed at this time, steam pressure is gradually removed from the piston 17. When this pressure has been sufficiently reduced, the spring 19 will raise the valve 16 and permit steam again to flow through the lines 9 and 14, and through the housing 15 to the pump 8 for operating the same again for replenishing the boiler. The length of the stem 45b between the stops 45d, 45e, may be regulated as desired by adjusting the stops as desired, thus increasing or decreasing the time periods between the operations of the pump.

While a rotary form of valve is here shown at 43 in the drawings, other forms of valves might be substituted, and while this valve is here shown as float controlled, other methods of control might be substituted therefor. In case of emergency, such as might arise if the described mechanisms became inoperative for any reason, then resort would be had to the emergency valves 11, 12, for directing steam to the water pump, the steam then passing through the valve 11 opened for the purpose and through the lower pipe 9, the other valve 12 being left constantly open. Thus I have provided a relatively simple and practical apparatus for controlling the supply of water in a steam boiler, with provision made for the automatic operation of the water pump in case the water reaches a dangerously low level, and for sounding or energizing alarm signals in such event, with automatic means for stopping the pump after the boiler is replenished with water, and with provision for emergency operation of the pump when necessary.

While I have herein shown and described certain preferred embodiments of the elements of my invention, and a preferred method of assembling and associating these elements, variations may be made both in the formation of the elements and the mode of assembling same, within the scope of the claims.

I claim:

1. In a device of the kind described, for mounting upon a steam boiler having a feed water pump operable through a steam line from the boiler and having alarm signals for indicating low water in the boiler, an elongated water bottle for vertically and adjustably mounting on the boiler for adjusting vertically to meet varying conditions of the boiler in motion, as on a locomotive, the said mountings including slip-joint connections at top and bottom ends of the bottle for connecting with a steam pipe at its top end and a water pipe at its bottom end, a float guide rod vertically and slidably mounted through the water bottle, a float fixedly seated on the lower end of the guide rod, a steam chest at the upper

end of the bottle and communicating therewith through its lower side, a rotary valve on a shaft journaled transversely through the steam chest, said valve being formed with a pair of angularly spaced steam ports communicating with the steam chest and leading outward through the periphery of the valve, a crank arm rigidly connected at one end with an outer end of the shaft of the rotary valve, the free end of the crank arm being extended horizontally into the upper end of the water bottle over the upper end of the said guide rod, said free end of the crank arm being slotted to slidably engage the upper end of the float guide rod, spaced stops on the guide rod above and below the engaged end of the crank arm for partially rotating the rotary valve on the rising or falling of the water in the water bottle and consequent movement of the said float, a pair of steam pipes extended from the rotary valve with their inner ends arranged to closely and alternately align with the ports of the valve as the latter is rotated, for operating by one of the pipes and the steam flowing therethrough from the steam chest the said feed water pump and by the other pipe the said low water alarm signals.

2. In a steam boiler having a feed water pump and line for replenishing the boiler, said pump

being controlled by a valved steam line from the boiler the valve thereof being spring set to normally open the line to the pump and closable by steam pressure through a separate steam line from the boiler, and there being a needle valve for gradually releasing such steam pressure for allowing the pump valve to gradually reopen, a water bottle mounted upon the boiler and arranged for vertical adjustment thereon to meet varying requirements, said bottle communicating through its lower end with the boiler for indicating water levels therein and there being a steam line leading from the boiler into the upper end of the bottle, a separate steam line leading from the upper end of the water bottle to the said pump valve for closing same as described, and means operable through the raising of the water level in the bottle for opening the valved steam line leading from the upper end of the bottle to the pump valve as the water in the boiler and bottle rises, for the purpose of stopping the pump.

3. In a structure according to claim 2, a low water alarm signal operable through the lowering of the water in the boiler and bottle by means of a separate steam line leading from the upper end of the bottle to the signal.

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