May 15, 1923. 1,455,211

J. F. KELLY

BOILER WATER LEVEL CONTROLLER

Filed Feb. 21, 1920 2 Sheets-Sheet 1

Fig. 1.

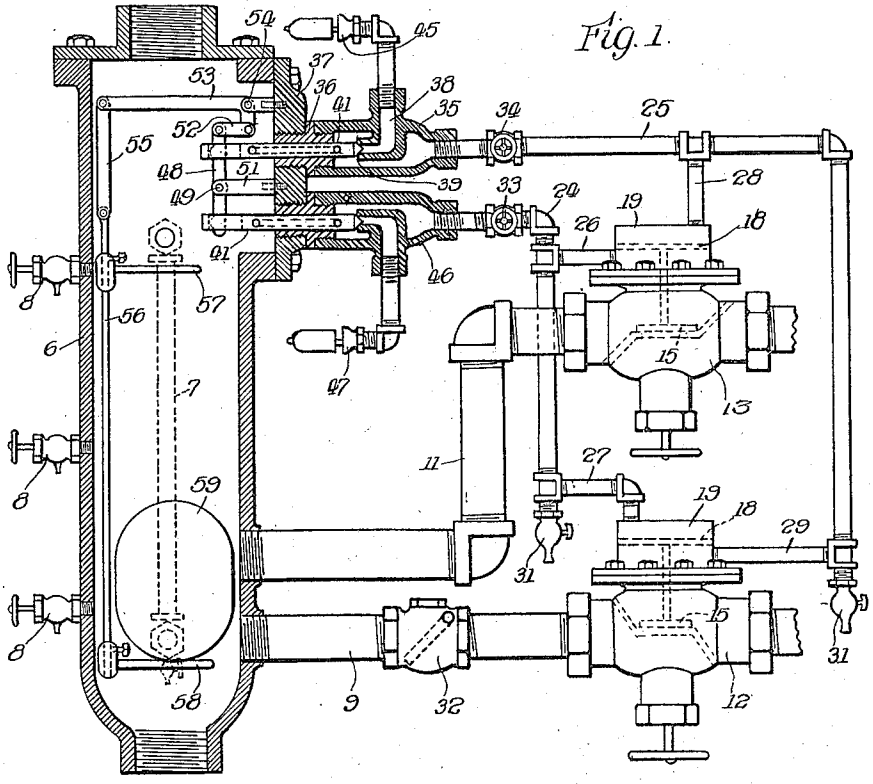


Fig. 2.

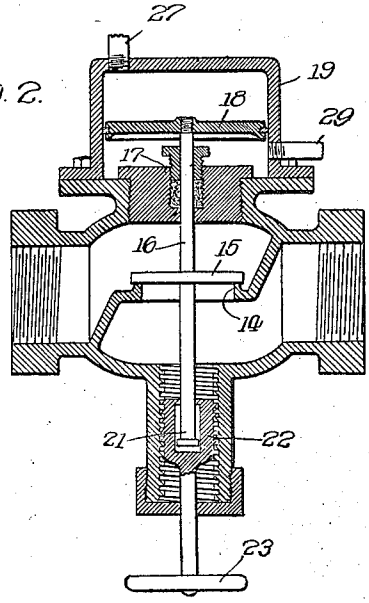
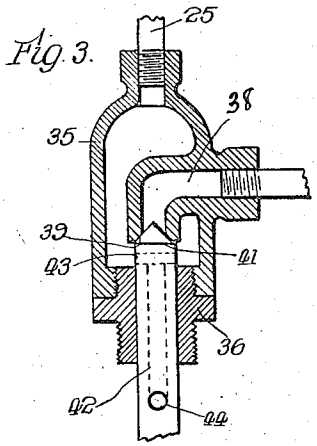


Fig. 3.



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Fig. 4.

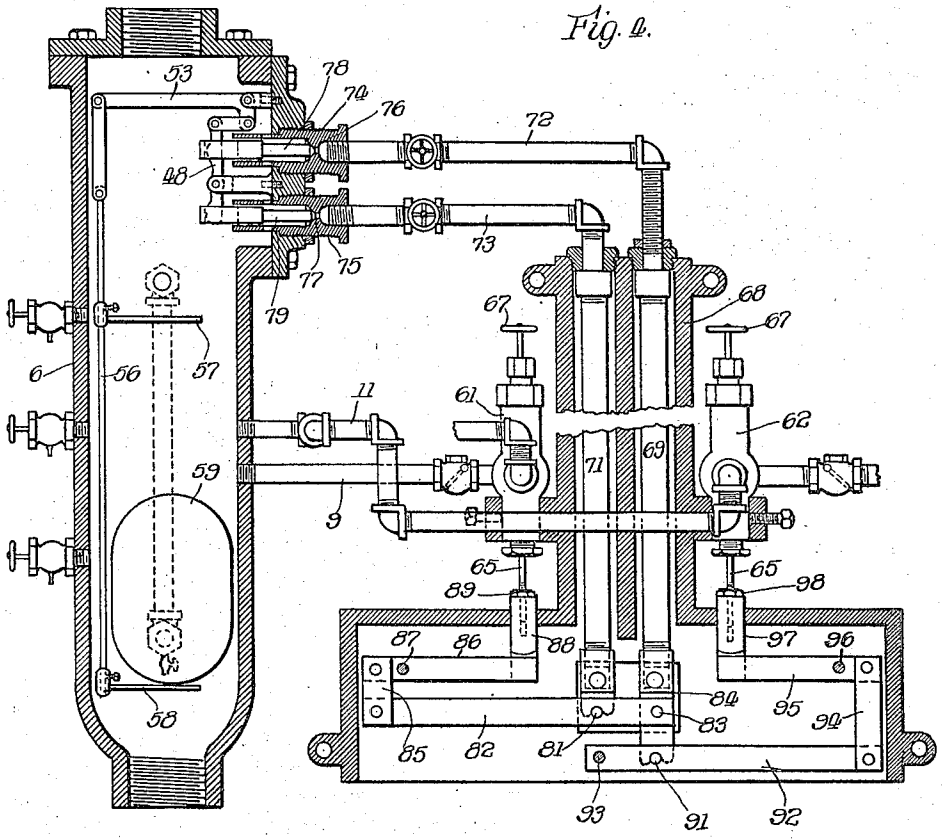
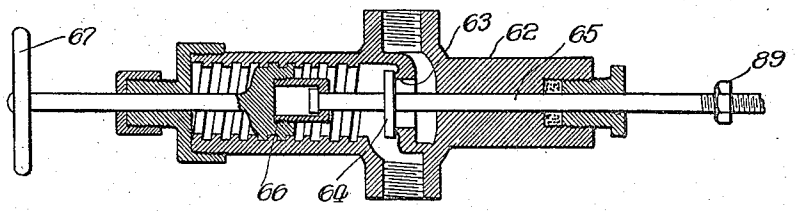


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN F. KELLY, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO KELLY VALVE COMPANY, OF MUSKEGON, MICHIGAN, A CORPORATION OF MICHIGAN.

BOILER-WATER-LEVEL CONTROLLER.

Application filed February 21, 1920. Serial No. 360,532.

To all whom it may concern:

Be it known that I, JOHN F. KELLY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in a Boiler-Water-Level Controller, of which the following is a specification.

In the operation of stationary boilers of either high or low pressure pipe, it has heretofore been the custom, so far as I am aware, for the engineer to maintain the requisite water level in the boilers by periodically admitting water whenever its necessity was indicated by the gauge glass. I am also aware that in some systems which operate steadily and with uniformity, it is customary to leave the water supply valve partially open so that a small quantity of water is continually delivered to the boiler.

It is the purpose of my invention to remove the maintenance of the requisite water level in the boiler from the province of the engineer and to provide an apparatus which will automatically maintain a predetermined water level in the boiler, thus removing this important function from human fallibility, thereby precluding the possibility of accident resulting from a depletion of water in the boiler.

Another feature of my invention resides in the provision not only for automatically supplying water to a boiler when it is required, but also for delivering water therefrom back to the feed water heater or other source of supply should the water level in the boiler become too high, and thus I have obviated possibility of accidents resulting from too much water in the boiler.

A further feature of my invention is the provision of a high water and a low water alarm and means for operating the same whenever the water level in the boiler reaches a predetermined maximum or predetermined minimum height to thereby notify the engineer of the condition of the water level in the boiler.

Other features and advantages of my invention will be appreciated as the same becomes better understood by reference to the following description when considered in connection with the accompanying drawings.

Referring to the drawings,

Fig. 1 is an elevation partially in section, of a controller embodying my invention;

Fig. 2 is a vertical sectional view through one of the water controlling valves;

Fig. 3 is an enlarged sectional view of one of the steam controlling valves;

Fig. 4 is a view similar to Fig. 1 of another embodiment of my invention; and

Fig. 5 is an enlarged sectional view of one of the water controlling valves employed in this form of the invention.

Referring now to the drawings more in detail, and particularly to Figs. 1 to 3 thereof, reference character 6 indicates a water column casing adapted to be connected at the top and bottom by suitable pipes with the interior of a boiler. In connecting the water column to a boiler, it is attached at such vertical height that the minimum and maximum safe water levels in the boiler will be embraced in this water column. The ordinary gauge glass 7 may be attached to one side of the column casing and the casing is preferably equipped with the usual gauge cocks 8 disposed at various heights, as is customary.

The water supply pipe through which water is supplied to the boiler is indicated on the drawing by reference character 9 and for convenience, this pipe and also the water delivery pipe 11 are shown as connected into the water column casing, although it should be understood that these pipes may be connected directly to the boiler instead of to the water column casing, if desired, without affecting the reliable operation of the apparatus or departing from the essence of my invention. The water supply pipe 9 is connected with any suitable source of water supply under a pressure greater than that existing in the boiler and the water delivery pipe is preferably connected to the feed water heater, although it may be connected to a sump or any place where it may be desirable to deliver water from the boiler. Since this pipe is largely for emergency purposes, as

in normal operation of the apparatus the water level will very seldom exceed the maximum level for which the apparatus is set, water will be delivered through this pipe very infrequently.

In each of the water supply and delivery pipes, I have interposed shut-off valves 12 and 13 respectively, these valves being of duplicate construction, and one being shown on an enlarged scale in Fig. 2. Referring to this figure, it will be observed that the valve casing is provided with a partition providing a valve seat 14 adapted to be closed by a valve 15 seating thereon, said valve being carried by stem 16 projecting upwardly through a packing gland 17 and equipped at its upper end with a piston 18 snugly fitted within a steam chamber 19. The lower end of the valve has a lost motion connection 21 with a threaded nut 22, which is connected with and adapted to be rotated by a hand wheel 23. By this structure, the valve 15 may be manually opened or closed when desired, but normally, the nut 22 is disposed substantially in the position shown in Fig. 2 so that the valve may be opened and closed by means of the piston 18 without interference by the nut 22, although as will be manifest, this nut may be set so as to limit the extent of opening the valve.

My invention contemplates the automatic opening and closing of these valves by steam pressure acting upon opposite sides of the pistons 18 and since water is never admitted to and discharged from the boiler simultaneously, the control is such that one of the valves is always closed when the other is open. With a view of securing this result, I have provided two steam supply pipes 24 and 25 respectively, the pipe 24 being equipped with a branch 26 connected to the steam chamber of the water delivery valve beneath the piston and with a branch 27 connected with the steam chamber of the water supply valve above the piston. The pipe 25 is similarly connected by branch 28 to the steam chamber of the water delivery valve above the piston and by branch 29 to the steam chamber of the water supply valve below the piston. Steam admitted through the pipe 24 will therefore tend to open the delivery valve and close the supply valve, while steam admitted through the pipe 25 will tend to close the delivery valve and open the supply valve. These pipes 24 and 25 are preferably equipped with test cocks 31, as shown, and the supply pipe 9 is provided with a check valve 32 to prevent back flow of steam or water under pressure into the water supply line. Either the pipe 24 or the pipe 25 may be shut off when desired by means of hand valves 33 and 34 respectively.

The pipes 24 and 25 are connected with the water column casing through the intermediary of valves which control the flow of steam to the pipes, as will now be explained. A valve casing 35 is connected at one end to the pipe 25 and at its other end to a hollow plug 36 threaded into the plate 37 forming one of the side walls of the casing 6. This valve casing 35 is shaped to provide a passage 38 terminating in a valve seat 39 disposed in alinement with the bore through the plug 36. A valve 41 is adapted to seat upon the seat 39 and shut off the passage 38. This valve, which is of elongated shape, projects through and slidingly fits within the plug 36, and is provided with a central bore 42 communicating with the interior of the casing 35, through a transverse aperture 43 and with the interior of the casing 6 through a similar transverse aperture 44. Thus it will be seen that communication is established between the casing 6 and the pipe 25 when the passage 38 is closed by the valve 41. When, however, the valve 41 is drawn inwardly into the casing 6, the aperture 43 is brought within the confines of the plug 36, thereby entirely or partially closing this aperture and shutting off flow of steam from the casing 6 into the casing 35. This inward movement of the valve 41 also opens the passage 38 so that steam in this casing 35 in the pipe 25 and in the steam chambers of the valves 12 and 13 may escape through the passage 38 and in so doing, it operates a signal in the form of a whistle 45.

The pipe 24 is also connected to the casing 6 through a similar valve casing 46 with similar valve mechanism, as shown in Fig. 1, which need not be described. This casing 46 is also equipped with a signal whistle 47, this signal constituting a low-water alarm, while the signal 45 constitutes a high-water alarm.

The inner ends of the valve members 41 are slotted to receive a lever 48 pivoted at 49 upon a bracket 51, as shown in Fig. 1. The upper end of this lever is connected by a link 52 to one arm of a bell crank lever 53 pivotally mounted at 54 and connected at the outer end of the long arm to a link 55, which is attached to a rod 56. Upon this rod there is adjustably mounted an upper abutment member 57 and a lower abutment member 58, both disposed in the path of travel of a float 59 in the casing.

The operation of this form of my invention is as follows: When the water level in the boiler diminishes, the float 59 moves downwardly in the casing until its weight rests upon the abutment member 58. The weight of the float pulls downwardly upon the rod 56, and swings the bell crank lever 53 in a counterclockwise direction, thereby swinging the lever 48 in a clockwise direction on its pivot. The upper end of lever 48 moves inwardly in the elongated slot in the valve member 41. The

lower end of this lever, however, abuts against the outer end of the slot in the lower valve member and upon swinging movement of the lever as described, the lower valve member is moved inwardly into the casing 6, thus partially shutting off communication between this casing and the valve casing 46, and opening the passage to the alarm signal 47. The steam in the valve casing 46, in the pipe 24, and in the steam chambers of the respective valves now escapes and actuates the signal 47. The release of pressure in the steam chamber of the delivery valve 13 below the piston merely serves to cause this valve to seat more snugly against its seat under the influence of the pressure exerted upon the upper face of the piston through the pipe 25. The release of pressure above the piston of the supply valve 12, however, causes this valve to open under the influence of the steam pressure exerted upon its under surface through the pipe 25 and branch 29. Water will now flow through the supply pipe 9 into the water column casing and thence into the boiler, and as the water level rises, the float 59 will move upwardly. When it is moved upwardly a sufficient distance, it will engage the abutment 57, thus lifting the rod 56 and the long arm of the lever 53 to swing the lever 48 in a counterclockwise direction. When it is moved sufficiently to release the lower valve member 41, this valve will close against its seat under the influence of the steam pressure in the casing 6 and pressure will thereupon be re-established in the casing 46, the pipe 24, and valve steam chambers connected thereto. The pressure above the piston of the supply valve will now become equal to the pressure below and the valve will seat under the influence of gravity and the influence of the flowing water. If, however, the valve should fail to properly seat, due to some foreign article lodging on the valve seat, or for any other cause, water will still continue to flow in more or less restricted quantities into the boiler. If the water level in the boiler should rise above the desired maximum point, the float 59 will continue to lift the rod 56 and through the bell crank 53, swing the lever 48 in a counterclockwise direction sufficiently to draw the valve member 41 in the casing 35, inwardly into the casing 6, thus partially shutting off communication between the casings 6 and 35 and causing the high water alarm 45 to be actuated by the steam pressure in this casing 35 and in the pipe 25. Release of pressure in the pipe 25 will release the pressure in the steam chamber of the delivery valve 12 above the piston and this valve will thereupon open so that water will be delivered from the casing through the delivery pipe 11 to the feed water heater or other point of reception. When the water level has been lowered by this delivery until upward pressure of the float 59 upon the abutment 57 has ceased, the valve 41 will close again, thus re-establishing the parts in normal position.

In the form of my invention shown in Figs. 4 and 5, the casing 6, float 59, abutments 57 and 58, bell crank 53, and lever 48 are all substantially like that previously described. The water supply pipe 9 and the water delivery pipe 11 are also connected to the water column casing, as in the manner previously described.

In this instance, however, instead of employing water supply and delivery valves which are actuated directly by steam pressure, I utilize a construction in which the heat units of the steam are utilized instead of the pressure to actuate these valves.

The water supply valve 61 and the water delivery valve 62 are substantially identical in construction, and one of them is shown on an enlarged scale in Fig. 5, from which it will be seen that the valve casing is shaped to provide a seat 63 adapted to be closed by a valve 64, mounted upon a stem 65. This stem has a lost motion connection with a threaded head 66 controlled by a hand wheel 67, by which the valve may be opened and closed manually if desired, but normally it is operated automatically from the lower end of the stem 65 by mechanism which will now be described.

In a suitable casing or housing 68, I have mounted two thermostats 69 and 71 respectively, connected at their upper ends with steam pipes 72 and 73, which pipes are in turn connected to the interior of the casing 6 through couplings 74 and 75 provided with valve seats 76 and 77. These seats are normally closed by valves 78 and 79 and are adapted to be opened by the lever 48 when swung in one direction or the other upon its fulcrum. The lower end of the thermostat 71 rests upon a stud 81, carried by a lever 82 fulcrumed at 83 upon a downward extension 84, carried by the lower end of the thermostat 69. The opposite end of lever 82 is connected by a link 85 with a multiplying lever 86 fulcrumed at 87, the long arm of this lever being engaged with a push member 88, into which the lower end of the valve stem 65 projects. An adjusting nut 89 mounted on this stem determines the position of the levers when the valve 64 is in closed position.

Assume that the water level in the water column casing has fallen to such an extent that the float 59 acting on the abutment 58 swings the lever 48 in a clockwise direction, thus opening the valve 79. Steam will now flow from the casing 6 through the pipe 73 into the thermostat 71, causing this thermostat tube to expand. Since the upper end of this tube is rigidly mounted, the lower end will push downwardly upon the stud 81,

thereby moving the left hand end viewing Fig. 4 of lever 82 downwardly and through the link 85, swinging the lever 86 to elevate the push member 88 and through the stem 65 to lift the valve 64 from its seat, permitting a supply of water to be delivered through the pipe 9 into the casing 6. When the water level is raised, the valve 79 will close under steam pressure as soon as the lever 48 will permit it to do so. Should the water level continue to rise, however, the abutment 57 will eventually be moved upwardly by the float 59, thereby opening the valve 78 and admitting steam through the pipe 72 to the thermostat 69. Expansion of this thermostat will move the pivot 83 of the lever 82 downwardly so that the stud 81 will be moved away from the thermostat 71, whereupon the valve in the casing 6 will close under gravity. This downward movement of the lower end of the thermostat tube 69 will also exert a downward pressure upon a stud 91, carried by a lever 92, pivoted at 93. The opposite end of this lever is connected by a link 94 to a lever 95, fulcrumed at 96 and engaged with a push member 97, to which the valve stem 65 of the valve 62 is connected through an adjusting nut 98. This movement of the levers will elevate the push member 97 so as to lift the valve in the casing 62 from its seat, permitting a delivery of water from the water column casing 6 through the pipe 11, to a feed water heater or other point of reception, as previously explained in connection with Fig. 1.

It will be apparent from the foregoing that I have provided a controller which, acting in one form of my invention through steam pressure and in the other form, through the heat units of the steam, serves to automatically maintain a predetermined water level in a boiler without attention of the engineer. Should the level fall below the minimum for which the apparatus is set, the supply valve will be opened and the water will be replenished. Should for any reason, accidental or otherwise, the water level rise above the maximum height, the delivery pipe valve will be opened and the surplus will be discharged from the boiler. The operation, both of supplying water to the boiler and delivering water therefrom, is entirely automatic and while high-water and low-water alarms are provided which signal the engineer when these operations take place, these alarms may be dispensed with without impairing the usefulness of the automatic control. The details of construction illustrated and described, are obviously capable of considerable modification and variation within the scope of the invention as defined in the appended claims.

I claim:

1. In a boiler water level controller, the combination of a casing, a float therein, a water supply pipe, a water delivery pipe, valves in said pipes, steam actuated means for operating said valves, manually operable means for actuating said valves independently of said steam actuated means, valves for controlling the supply of steam to said steam actuated means, and an operative connection between said float and each of said last mentioned valves.

2. In a boiler water level controller, the combination of a water column casing, a float therein, boiler water supply and delivery pipes, a valve in each of said pipes, steam actuated means for operating said valves, means for controlling the supply of steam to each of said valves, and operative connections between said float and said steam controlling means.

3. In a boiler water level controller, the combination of a water column casing, a float therein, boiler water supply and delivery pipes, a valve in each of said pipes, a steam actuated piston connected to each valve, means for supplying steam from said casing above and beneath each of said pistons, means for controlling the supply of steam to said pistons, and connections between said float and said steam controlling means.

4. In a boiler water level controller, the combination of a water column casing, a float therein, a water supply pipe, a valve in said pipe, a piston connected to said valve, steam supply pipes for delivering steam from said casing to opposite sides of said piston respectively manually operable means for opening and closing said valve, valves for controlling the supply of steam to said pipes, and connections between said valve and said float whereby one of said valves is opened by lowering movement of the float and the other is opened by raising movement of said float.

5. In a boiler water level controller, the combination of a water column casing, a float therein, water supply and delivery pipes connected to said casing, a valve in each of said pipes, a piston connected to each of said valves, steam supply pipes leading from said casing, one of said pipes being connected to deliver steam to said pistons to open the water supply valve and close the water delivery valve and the other pipe being connected to deliver steam to said pistons to close the water supply valve and open the water delivery valve, means for controlling the supply of steam to said pipes, and mechanism actuated by said float for operating said steam supply controlling valves.

6. In a boiler water level controller, the combination of a water column casing, a float therein, water supply and delivery pipes connected to said casing, a valve in each pipe, and steam actuated means con-

trolled by said float for opening the water supply valve and sounding an alarm when the water level in said casing reaches a predetermined minimum and for opening said delivery valve and sounding an alarm when the water level in said casing reaches a predetermined maximum.

7. In a boiler water level controller, the combination of a water column casing, a float therein, water supply and delivery pipes, a valve in each of said pipes, a steam chamber associated with each valve, a piston in each chamber connected to its respective valve, means for normally supplying steam under pressure to opposite sides of said piston, and means controlled by said float for releasing the pressure above the piston of the water supply valve when a predetermined water level is reached in the casing and for releasing the pressure above the piston of the water delivery valve when a predetermined maximum water level is reached in the casing.

8. In a boiler water level controller, the combination of a water column casing, a float therein, water supply and delivery pipes, a valve in each pipe, steam actuated means controlled by said float for opening said valves in alternation, means for sounding an alarm when each valve is opened and manually controlled means for closing each valve independent of said float-controlled means.

9. In a boiler water level controller, the combination of boiler water supply and delivery pipes, a valve in each pipe, a steam-actuated piston connected to each valve, means for supplying steam from the boiler above and beneath each of said pistons, and means controlled by the water level in the boiler for controlling the supply of steam to said pistons.

10. In a boiler water level controller, the combination of water supply and delivery pipes, a valve in each of said pipes, steam actuated pistons for opening and closing said valves, manually operable means for opening and closing said valves independently of the pistons, steam supply pipes for delivering steam to the pistons, and means controlled by the water level in the boiler for controlling the supply of steam to said pistons.

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