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LOW WATER AND PRESSURE CONTROL DEVICE

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Fig. 1.

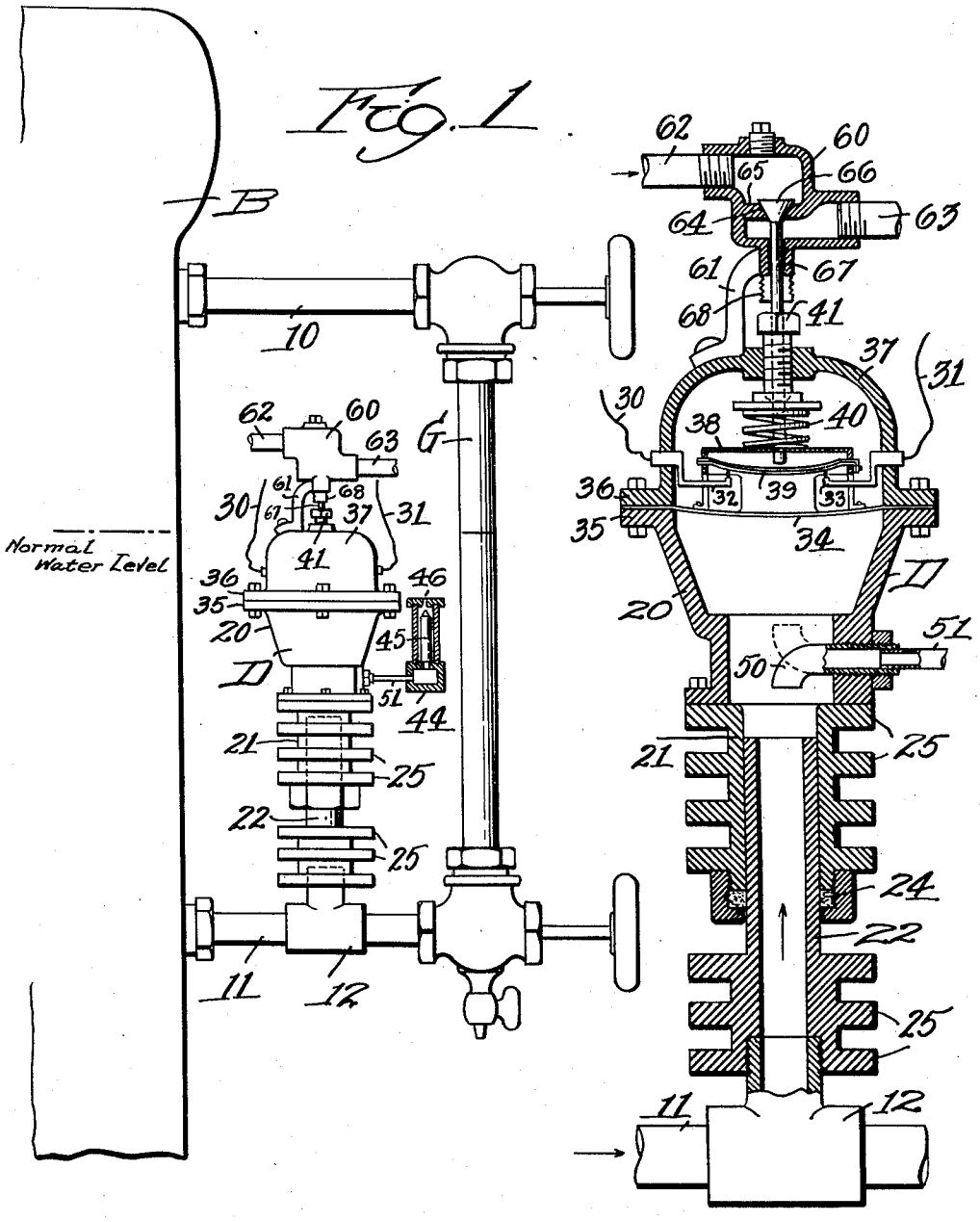


Fig. 2.

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LOW WATER AND PRESSURE CONTROL DEVICE

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15 Claims. (Cl. 122—504)

This invention relates to steam boilers and particularly to a safety-control device for preventing damage in the event of low water or excessive pressure in the boiler.

It is an important object of my invention to provide a temperature-responsive device which will be controlled in its action by the presence of either steam or water in or adjacent the device. No steam can reach the device except in the event of extreme low water.

A further object of my invention is to provide a construction such that the device may be controlled by either temperature or pressure, and in which a substantial temperature differential is established at the device between steam and water conducted thereto.

I further provide means for varying both the temperature differential and the critical pressure, and for adapting the device for use under different operative conditions. As more commonly installed, the device is connected to open the operating circuit of an oil burner when the water in the boiler falls below a predetermined point, or when a predetermined pressure is exceeded.

In a further application of my invention, I provide means for automatically replenishing the water in the boiler under control of the temperature-responsive device.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawing, in which

Fig. 1 is a side elevation, partly in section, of my improved control device; and

Fig. 2 is an enlarged sectional side elevation of the device.

Referring to the drawing, I have indicated a steam boiler B having a gauge glass G connected to the boiler above and below the normal water level by branch connections 10 and 11. A T 12 is preferably inserted in the lower branch connection 11 and supports my improved control device, indicated generally at D.

The device D comprises a container or receptacle 20 secured to the upper end of a sleeve 21 which telescopes outside of a second sleeve 22, which in turn is threaded on the T 12. This construction permits the receptacle 20 to be raised or lowered relative to the branch connection 11 by sliding the outer sleeve 21 upward or downward on the inner sleeve 22, leakage being prevented by a suitable packing 24.

The sleeves 21 and 22 are preferably provided with a plurality of flanges 25 which serve to more rapidly dissipate heat from the water within the sleeves and thus increase the temperature differential.

Wires 30 and 31 form part of the operating circuit of an oil burner associated with the boiler B and are connected respectively to terminal contacts 32 and 33.

A disc or diaphragm 34 is mounted on the receptacle 20 and is clamped between a flange 35 on the receptacle 20 and a flange 36 at the lower edge of a cover plate 37. The disc 34 is normally convex downward but may be forced upward by excessive pressure in the receptacle 20.

An open-sided casing 38 is mounted on the disc or diaphragm 34 and supports a bi-metallic thermostatic member 39, which member is secured to the casing 38 at one end but is free to slide on a supporting portion of the casing at the other end. The casing 38 is preferably of hard rubber or other non-conducting material.

The member 39 is convex downward and normally engages the terminals 32 and 33 and closes the circuit between them. A spring 40 is mounted above the casing 38. The pressure of the spring may be adjusted by a screw 41 in the cover plate 37. The spring pressure is transferred to the disc 34 by the casing 38 but does not affect the member 39.

In order to permit water to enter the receptacle 20, I provide an air valve 44 having a float 45 which supports a needle valve at its upper end. The float remains in lowered position until the water rises in the sleeves 22 and 21 and in the receptacle 20 to a level at which the float 45 will be lifted to close the vent 46 in the upper end of the air valve.

A so-called "pig-tail" connection 50 may be provided at the inner end of the pipe 51 which connects the float valve to the receptacle 20. By turning this device 50 about its axis, the amount of dead air trapped in the receptacle 20 may be controlled.

The sleeves 21 and 22 should be of substantial diameter, and the inside diameter of the sleeve 22 should be not less than three-quarters of an inch.

Having described the details of construction of my improved control device, the operation and advantages thereof are as follows:—

With the water in the boiler at the normal level indicated in Fig. 1, water will be present in the branch connection 11, the sleeves 22 and 21 and the receptacle 20. When the water reaches the pipe 51, it will flow through the pipe 51 into

the air valve 44 and will raise the float 45, thus preventing further escape of air from the receptacle 20.

The water under boiler pressure will then compress the trapped air against the lower side of the disc or diaphragm 34. The remoteness of the receptacle 20 from the boiler B causes the water in the receptacle to be a number of degrees cooler than the water or steam in the boiler. The air trapped under the diaphragm 34 is also a poor heat conductor and further decreases the temperature to which the diaphragm is exposed.

As long as the water in the boiler is maintained at the normal level and the connections are filled with water as above described, the thermostatic member 39 will remain in its normal position, as shown in Fig. 2, and the operating circuit for the oil burner or other mechanism will remain closed.

When the water falls below the branch connection 11, the device 20 will be vented through the valve 44 and the liquid in the device will flow downward into the boiler. At the same time, steam will pass upward through the sleeves 22 and 21 into the receptacle 20, all without substantial loss in temperature and the diaphragm 34 will thus be exposed to a much higher temperature which will be communicated through the diaphragm 34 to the thermostatic member 39, causing the member to straighten and lift away from the terminals 32 and 33 and thus break the operating circuit.

The temperature differential occasioned by exposure of the control device to water or to steam is substantial, and may be increased or decreased by varying the effective length of the telescoping connections and also by varying the angular position of the part 50.

If the end of the part 50 is turned downward as shown in full lines in Fig. 2, the float 45 in the air valve will be raised more quickly and more air will be trapped in the receptacle 20 than if the part 50 is in the up-turned position shown in dotted lines in Fig. 2. An increase in the amount of trapped air causes a corresponding increase in the temperature differential.

If a sufficient supply of water is maintained in the boiler but the boiler pressure is increased above a predetermined point, the increase in pressure will force the diaphragm 34 upward against the pressure of the spring 40, carrying with it the casing 38 and the thermostatic member 39 supported thereby. The operating circuit will thereupon be broken as in the previously described low water conditions.

It is frequently desired that the water in the boiler be automatically replenished on indication of low water, as well as that the oil burner be rendered temporarily inoperative. For this purpose I have provided a special valve mechanism which is indicated as comprising a valve casing 60 which may be mounted on a bracket 61 secured to the cover plate 37. The valve casing 60 provides for a connection 62 to the water main or other supply and for a connection 63 to the boiler.

A port 64 is formed in a partition 65 in the valve casing 60, and a valve 66 is normally seated in the port 64 and prevents flow of water to the boiler. The valve stem 67 may be provided with a bellows packing 68, which permits freedom of movement but prevents escape of water.

The valve stem 67 extends downward through an axial opening in the adjusting screw 41, through the coil spring 40 and through an opening in the casing 38 to a position for engagement by the thermostatic member 39 as the latter straightens or bends upward on increase in temperature.

This upward movement is sufficient to slightly raise the valve 66 and to permit flow of feed water to the boiler until the water level is raised in the control device and the temperature is lowered sufficiently to cause closing of the feed water valve and closing of the oil burner circuit.

When the diaphragm 34 is lifted by excessive pressure, the movement is commonly not sufficient to cause the member 39 to engage the valve stem 67.

With this attachment, the device not only protects the boiler but also replenishes the feed water and causes the oil burner to automatically resume operation.

It will thus be apparent that I have provided a very simple device which acts not only as a safety device in case of low water in the boiler, but also acts with equal effectiveness in case of excessive pressure.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:—

1. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a control element responsive to said differential, and means to vary said differential.

2. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a control element responsive to said differential, and means to trap an amount of air in said receptacle which will only partially fill said receptacle at atmospheric pressure.

3. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a control element responsive to said differential, means to trap a predetermined amount of air in said receptacle, and means to vary the amount of trapped air.

4. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a control element responsive to said differential, and means to vent said receptacle when the water is below a predetermined level therein.

5. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a control element responsive to said differential, means to trap air in said receptacle at a predetermined water level

in said receptacle, and means to vary the water level at which the air becomes trapped.

6. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, and telescoping means to vary the height of the receptacle above the boiler connection.

7. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler and vertically adjacent the water level therein, a temperature responsive circuit-closing device mounted thereon, a connection of substantial diameter between said receptacle and a point below normal water level in said boiler, and means associated with said device and effective to vent said receptacle, said means being responsive to changes in water level in said boiler.

8. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler and vertically adjacent the water level therein, a temperature-responsive circuit-closing device mounted thereon, a connection between said receptacle and a point below normal water level in said boiler which is of sufficient diameter to permit simultaneous counterflow of steam and water through said connection, and means to vary the length of said connection.

9. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler and vertically adjacent the water level therein, a temperature-responsive circuit-closing device mounted thereon, and a connection between said receptacle and a point below normal water level in said boiler which is of sufficient diameter to permit simultaneous counterflow of steam and water through said connection, a portion of said connection being extensible to vary the effective length thereof.

10. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler and vertically adjacent the water level therein, a temperature-responsive circuit-closing device mounted thereon, and a connection between said receptacle and a point below normal water level in said boiler which is of sufficient diameter to permit simultaneous counterflow of steam and water through said connection, said connection comprising telescoping parts relatively adjustable longitudinally to vary the vertical setting of said receptacle.

11. A low water and pressure control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a control element responsive to said differential, a pressure-responsive diaphragm in said receptacle, and an electric circuit controlled in part by said diaphragm and in part by said control element.

12. A low water and pressure control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler of sufficient length to provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a control element responsive to said differential, a pressure-responsive diaphragm in said receptacle, and an electric circuit controlled in part by said diaphragm and in part by said control element, the circuit being closed when water is present in said connection and when the pressure is also below a predetermined amount.

13. A low water control device for a steam boiler comprising a receptacle substantially spaced from said boiler, a connection from said receptacle to the boiler which will provide a substantial temperature differential between said receptacle when containing steam and said receptacle when containing water, a downwardly convex diaphragm on said receptacle, an open casing on said diaphragm, a downwardly convex thermostatic member in said casing and a pair of fixed terminals engaged by said member when both said member and said diaphragm are in normal down curved position.

14. A control device for a steam boiler comprising a feed water valve, a temperature-responsive member, an electric circuit controlled thereby, and an actuating element interposed between said member and said valve, said member being effective to both open said valve and break said circuit on admission of steam only to said device.

15. A control device for a steam boiler comprising a feed water valve, a temperature-responsive member, an electric circuit controlled thereby, an actuating element interposed between said member and said valve, said member being effective to both open said valve and break said circuit at a predetermined temperature, and additional means to break said circuit on the occurrence of excessive pressure in said boiler.

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