

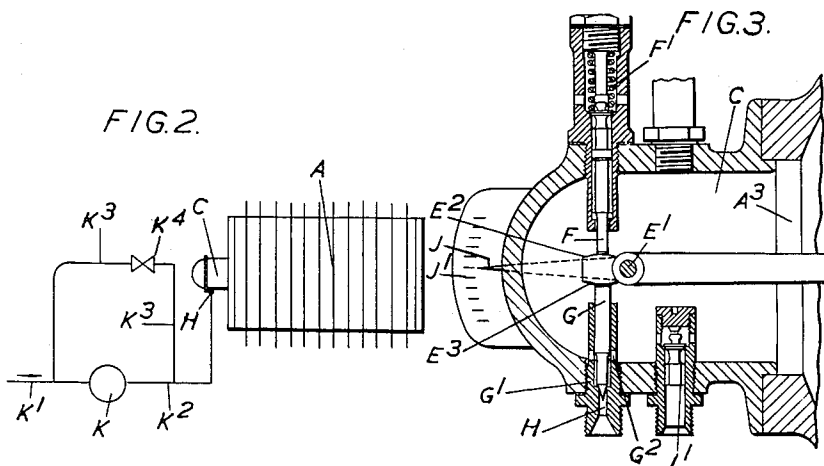
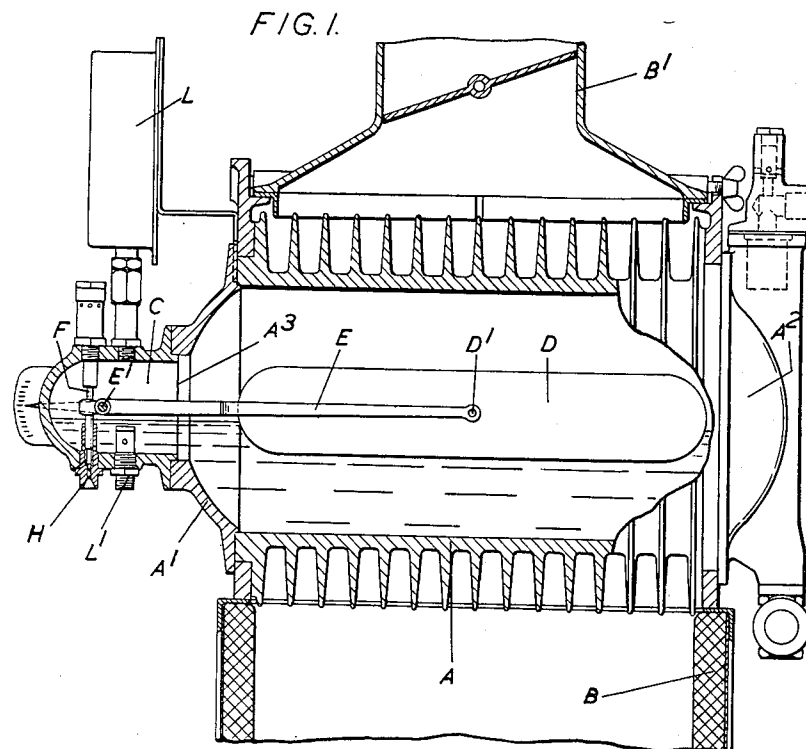
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SAFETY APPARATUS FOR STEAM BOILERS

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## SAFETY APPARATUS FOR STEAM BOILERS

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This invention relates to safety apparatus for steam boilers and has for an object to provide a form of apparatus, particularly but not exclusively applicable to small boilers, which will be simple in construction and reliable in operation for preventing a dangerous condition occurring in a boiler.

According to the present invention safety apparatus for a steam boiler comprises float apparatus including a float responsive to the water level in the boiler, an automatic pressure-operated safety valve subject to the steam pressure in the boiler, and means whereby the steam pressure required to cause the safety valve to open is automatically reduced by the downward movement of the float due to a drop in water level.

Since, with apparatus according to the invention, as the water level drops, the steam pressure required to lift the safety valve becomes less the escape of steam through the safety valve may constitute a warning that the water level has dropped undesirably. Moreover the arrangement is preferably such that, if the water level falls to a dangerous degree the float will cause the safety valve to open irrespective of steam pressure and thus substantially relieve all steam pressure within the boiler, thus avoiding risk of explosion.

The invention is particularly applicable to boiler installations including a feed water pump and means for automatically controlling the delivery of feed water to the boiler by the feed water pump to maintain a substantially constant water level in the boiler, and one particularly convenient arrangement of combined feed water control and safety apparatus according to the invention comprises float apparatus including a float responsive to the water level in the boiler, a feed water pump, means responsive to movement of the float apparatus for controlling the delivery of feed water to the boiler in a manner tending to maintain a substantially constant predetermined water level in the boiler, an automatic pressure-operated safety valve subject to the steam pressure in the boiler, and mechanism actuated by the float apparatus whereby the steam pressure required to cause the safety valve to open is automatically reduced by downward movement of the float below a predetermined point due to the water level dropping below the predetermined level. In such an arrangement the feed water pump may be arranged to deliver water to the boiler at a pressure somewhat greater than that of the steam therein and the float apparatus may operate a feed water admission valve so as to open such valve when the water level drops below the predetermined level and to close it when it rises above such predetermined level, the admission valve conveniently being in the form of a needle valve which is maintained closed against the feed water pressure by the float apparatus when the water level is at the predetermined level and is permitted to open when the water level drops below such predetermined level.

In any case in apparatus according to the invention the reduction in the steam pressure necessary to open the safety valve when the water level drops is preferably

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effected by arranging the float apparatus so that when the float drops below a predetermined point the float apparatus exerts a force on the valve member of the safety valve tending to open it.

Constructions according to the invention may vary widely according to the type of boiler to which the invention is applied and other considerations but one construction according to the invention is illustrated somewhat diagrammatically by way of example in the accompanying drawings, in which

Figure 1 is a side elevation mainly in section of a form of boiler having associated therewith combined feed water control and safety apparatus according to the invention,

Figure 2 shows diagrammatically the feed water system associated with the boiler, and

Figure 3 is an enlarged view in section of the left hand end of Figure 1.

In the construction shown in Figure 1 the boiler is of horizontal cylindrical form and comprises a circumferential wall A having external heat transfer ribs thereon and end walls A<sup>1</sup> and A<sup>2</sup>, the boiler being supported on a fire box generally indicated at B, so that the hot gases pass around it and escape through a smoke stack or the equivalent indicated at B<sup>1</sup>.

The end wall A<sup>1</sup> has mounted on it a dome like housing or chamber C the interior of which opens into the interior of the boiler through a central aperture A<sup>3</sup> in the end wall A<sup>1</sup> as shown.

An elongated float D, which as shown extends nearly throughout the length of the boiler A, A<sup>1</sup>, A<sup>2</sup>, is arranged within the boiler and pivoted at D<sup>1</sup> at approximately the centre of its length and about a horizontal axis to the forked end of an arm E the other end of which is pivoted at E<sup>1</sup> on a horizontal pin within the chamber C so that the float D and arm E lift and fall with rises and falls in the level of water within the boiler A, A<sup>1</sup>, A<sup>2</sup>.

Mounted in the upper wall of the chamber C is a safety apparatus comprising a valve member F normally pressed onto its seating by a spring F<sup>1</sup>, which may be adjustable in known manner to enable the pressure at which the valve blows off to be adjusted. The stem of the valve member F projects vertically downwards as shown into the interior of the chamber C on an axis which lies to the side of the pivot E<sup>1</sup> remote from the float D.

Coaxial with the stem of the valve member F but arranged in the lower wall of the chamber C is a feed water admission valve G in the form of a needle valve arranged within a housing G<sup>1</sup> so as to control the admission of feed water from an inlet passage H to ports G<sup>2</sup> in the housing G<sup>1</sup>.

The float arm E is provided with an extension having upper and lower cam surfaces E<sup>2</sup>, E<sup>3</sup> one of which is arranged to bear upon the lower end of the valve member F for the safety valve while the other is arranged to bear upon the upper end of the feed water admission valve G.

The arrangement is such that normally when the float D occupies a position corresponding to the predetermined water level within the boiler at which it is desired to maintain the water, the cam surface E<sup>3</sup> maintains the feed water admission valve G on its seat while the cam surface E<sup>2</sup> is out of contact with the valve member F. If, however, the float D drops by a small predetermined amount due to the water level dropping below such predetermined level, the cam surface E<sup>3</sup> permits the feed water admission valve G to move from its seat to admit feed water and thus restore the predetermined water level, the cam surface E<sup>2</sup> still remaining, however, out of contact with the valve member F.

If, however, the water level drops to a small degree still further, the cam surface E<sup>2</sup> will act on the valve

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member F and tend to lift it, thus reducing the steam pressure at which the safety valve will open.

Moreover, if the water level drops to a dangerous degree the weight of the float D will cause the cam surface E<sup>2</sup> to lift the valve member F from its seat and thus relieve all pressure within the boiler.

The extension carrying the cam surfaces E<sup>2</sup> and E<sup>3</sup> may in some cases carry a pointer visible from outside the chamber C through a transparent window therein or, alternatively, the pin E<sup>1</sup> may be rigid with the arm E and rock in bearings in the wall of the chamber C and project at one end from the chamber and carry a pointer as indicated at J moving over a scale J<sup>1</sup>.

With the arrangement shown in Figure 1 the feed water pump would be arranged to deliver water continuously at a pressure somewhat in excess of the pressure in the boiler but not sufficiently in excess to lift the valve G from its seating when maintained thereon by the float. Thus, in the example diagrammatically shown in Figure 2 a constantly driven feed water pump K draws water from a water supply pipe K<sup>1</sup> and delivers it continuously to a delivery pipe K<sup>2</sup> having two branches one of which K<sup>3</sup> leads through a relief valve K<sup>4</sup> back to the inlet side of the pump K while the other leads to the water inlet passage H of the valve G, the relief valve K<sup>4</sup> being set to open at a pressure somewhat greater than the steam pressure maintained within the boiler.

A pressure gauge L may be provided on the chamber C while a water inlet connection L<sup>1</sup> having a nonreturn valve therein may be provided for the admission of water from a hand-operated or like pump for priming the boiler when it is to be brought into use.

What I claim as my invention and desire to secure by Letters Patent is:

1. Combined feed water control and safety apparatus for a steam boiler including a float responsive to the water level in the boiler, a feed water pump, means responsive to movement of the float for controlling the delivery of feed water to the boiler by the feed water pump so as to maintain a substantially constant predetermined water level in the boiler, safety valve apparatus comprising a safety valve and means tending to close the safety valve against the action of the steam pressure in the boiler, and a connection between the safety valve apparatus and the float whereby the steam pressure at which the safety valve opens is automatically reduced as the water level in the boiler drops.

2. Combined feed water control and safety apparatus as claimed in claim 1, in which the weight of the float

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and the connection between the safety apparatus and the float is such that if the water level drops below a predetermined level the safety valve is opened and maintained open by the said connection and the steam pressure in the boiler is thereby substantially completely relieved.

3. Combined feed water control and safety apparatus for a steam boiler including a float responsive to the level of water in the boiler, a feed water pump arranged to deliver water continuously at a pressure somewhat greater than the normal steam pressure in the boiler, feed water admission apparatus including an admission valve and controlling the flow of water from the feed water pump into the boiler, an operative connection between the float and the feed water admission apparatus serving to maintain the admission valve closed when the water level is above a predetermined level and to permit the valve to open when the water level drops below such predetermined level, safety valve apparatus comprising a safety valve subject to the steam pressure within the boiler and means tending to close the safety valve against the action of the steam pressure, and an operative connection between the float and the safety valve apparatus whereby when the float drops below a predetermined point the steam pressure at which the safety valve will open is automatically reduced.

4. Combined feed water control and safety apparatus for a steam boiler as claimed in claim 3, in which the said connection between the float and the safety apparatus includes a part which when the float drops below said predetermined point due to the water dropping below a predetermined level, acts on the safety valve in a direction tending to open the valve and thus serves as means for reducing the steam pressure at which the safety valve will open.

5. Combined feed water control and safety apparatus for a steam boiler as claimed in claim 4 in which the weight of the float is such that if the water drops below a lower predetermined level, the said connection between the float and the safety apparatus will lift the safety valve from its seating and thus relieve the steam pressure in the boiler substantially completely.

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