

Aug. 29, 1933.

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SAFETY VALVE

1,924,563

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Fig. 1

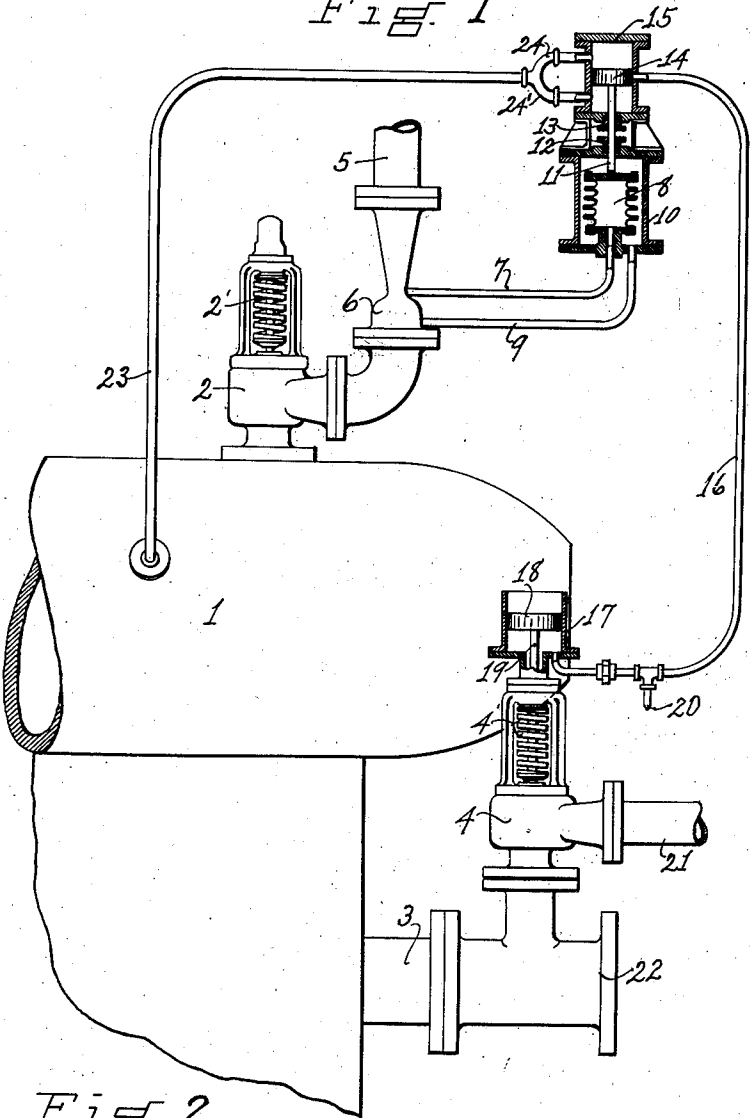


Fig. 2

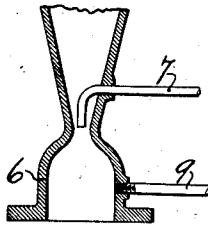
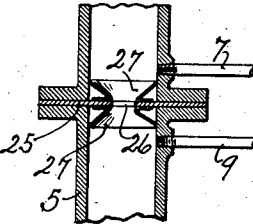


Fig. 3



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SAFETY VALVE

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7 Claims. (Cl. 137—53)

This invention relates to safety valves that are especially useful in connection with steam boilers in which superheated steam is generated. In boilers of this type there is necessarily a drop in steam pressure between the saturated steam space of the boiler and the outlet of the superheater due to the friction of the steam as it passes from the steam and water drum through connections and superheater on the way to the steam main.

In installations that are provided with a safety valve for the saturated steam and also a safety valve for the superheated steam, the saturated steam valve would always open prior to the superheated steam valve during operation of the boiler if they were set at the same pressure. Should this happen the steam would flow from the steam and water drum through the saturated steam safety valve and the flow through the superheater would be diminished until, in the extreme case, it would stop, and the steam in the superheater tubes would be stagnant, and this would result in the burning out of the superheater tubes. In order to prevent the danger of the flow of steam to the superheater diminishing or entirely stopping when the saturated steam valve blows, the superheated steam valve is set to blow at a pressure somewhat lower than that corresponding to the saturated steam operating pressure after allowing for the drop in pressure due to friction, with the result that since the operating pressure is that of the saturated steam, the maximum pressure of the steam that is being delivered to the main is thereby caused to be less since it is governed by the superheated steam safety valve. By the present invention the superheated steam valve can be set to blow at the same pressure as the saturated steam valve, and, while eliminating the danger of the latter blowing before the former, diminishing the supply of steam to the superheater, it also enables higher pressure superheated steam to be delivered from the boiler with safety than was possible in prior installations.

The invention will be understood from the description in connection with the accompanying drawing in which Fig. 1 is a side elevation of an illustrative embodiment of the invention and Figs. 2 and 3 are sections on an enlarged scale showing modifications of one of the parts.

In the drawing reference character 1 indicates a saturated steam drum of a boiler that is provided with the usual safety valve 2 that has a spring 2' by means of which the valve can be

set to open at a pre-determined steam pressure.

Reference character 3 indicates the outlet from the superheater of the boiler that is provided with a superheated steam safety valve 4 having a spring 4' for setting the same to open at a pre-determined steam pressure.

A waste steam pipe 5 leads away from the saturated steam valve 2. A venturi 6 is provided in the pipe 5. A pipe 7 leads from the throat of the venturi 6 to the inside of a siphon below 8. A pipe 9 leads from the entrance of the venturi to a cylinder 10 in which the siphon 8 is located so that the siphon will be contracted by the difference in pressure on the inside and outside thereof due to the steam flowing out of the safety valve 2 and through the venturi 6 to the waste steam pipe 5.

A piston rod 11 extends from the siphon 8 through the stuffing boxes 12 and 13 to the piston 14 that is fitted in the cylinder 15. A pipe 16 leads from the cylinder 15 to the lower end of an open ended cylinder 17 beneath a piston 18 in the cylinder. The piston 18 is connected by means of the piston rod 19 to the valve disc of the superheated steam safety valve 4 so that upward movement of the piston 18 will open this valve. A vent 20 is provided for the pipe 16.

A pipe 21 leads the waste steam away from the valve 4. A flange 22 is provided on the superheater outlet 3 for connection to a steam main.

A pipe 23 with branches 24 and 24' leads to the cylinder 15 on opposite sides of the piston 14 and is supplied with a fluid under pressure, such as steam from the drum 1, for example, although other fluids under pressure could be employed to equally good advantage.

In the modification shown in Fig. 2 the pipe 7 terminates in a bent end near the throat of the venturi 6 so that a difference in pressure between the pipes 7 and 9 is created by the flow of steam through the venturi 6.

In the modification shown in Fig. 3 the difference in pressure between the pipes 7 and 9 is obtained by means of a restricted orifice comprising an orifice plate 25 with an orifice 26 extending through it with conically shaped connections 27 through the inside of the pipe 5 to the orifice 26 on opposite sides of the plate 25. The flow of waste steam from the valve 2 passing through the orifice 26 causes a difference in pressure in the pipes 7 and 9.

The operation is as follows:

As soon as the saturated steam valve 2 blows or opens, the difference in pressure created in

the pipes 7 and 9 connected to the venturi 6 causes the siphon 8 to contract and move the piston 14, thus permitting the fluid under pressure that enters the cylinder 15 from the pipe 23 to flow through the pipe 16 and lift the piston 18 in the cylinder 17, thus promptly opening the valve 4, even though the steam pressure in the outlet 3 is not sufficient to open this valve. In this way the flow of steam through the superheater is maintained, thus avoiding the danger of the superheater being burned out.

As soon as steam ceases to flow through the outlet 5 from the valve 2 the equalized pressures in the pipes 7 and 9 will permit the siphon 8 to extend to its normal length and move the piston 14 to close the entrance to the pipe 16, whereupon the fluid in the pipe 16 and under the piston 18 in the cylinder 17 will escape through the vent 20, thus permitting the valve 4 to close promptly after the valve 2 closes. However, the vent 20 is not large enough to permit escape of fluid sufficiently rapidly to prevent the piston 18 from opening the valve 4 when the valve 2 opens.

I claim:

1. In a boiler, a safety valve for saturated steam, a safety valve for superheated steam, and means to cause the latter valve to open by opening the former, said means comprising a differential pressure creating device in the outlet from said saturated steam valve.
2. In a boiler, a safety valve for saturated steam, a safety valve for superheated steam, a pressure differential device connected to the outlet from said saturated steam valve, and means operated by said pressure differential device for opening said superheated steam valve.
3. In a boiler, a safety valve for saturated steam, a safety valve for superheated steam, a

cylinder, a piston in said cylinder operated by escape of steam from said saturated steam valve, a second cylinder, a piston in said second cylinder connected to said superheated steam valve, and a pipe connecting said cylinders.

4. In a boiler, a safety valve for saturated steam, a safety valve for superheated steam, a cylinder, a piston in said cylinder operated by escape of steam from said saturated steam valve, a second cylinder, a piston in said second cylinder connected to said superheated steam valve, and a vented pipe connecting said cylinders.

5. In a boiler, a safety valve for saturated steam, a safety valve for superheated steam, a cylinder, means for supplying fluid under pressure to said cylinder, a piston in said cylinder operated by escape of steam from said saturated steam valve, a second cylinder, a piston in said second cylinder connected to said superheated steam valve, and a pipe connecting said cylinders.

6. In a boiler, a safety valve for saturated steam, a safety valve for superheated steam, a cylinder, a connection from the steam space of said boiler to said cylinder, a piston in said cylinder operated by escape of steam from said saturated steam valve, a second cylinder, a piston in said second cylinder connected to said superheated steam valve, and a pipe connecting said cylinders.

7. In a superheater boiler, a safety valve for saturated steam having a continuously open discharge passage connected thereto, a safety valve for superheated steam, and means actuated by the escape of saturated steam through said discharge passage for opening said superheated steam safety valve.

CHARLES E. LUCKE.

CERTIFICATE OF CORRECTION.

Patent No. 1,924,563.

August 29, 1933.

CHARLES E. LUCKE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, lines 66, 68, 69 and 74, and page 2, lines 2 and 14, for "siphon" read silphon; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of May, A. D. 1934.

Bryan M. Battey

Acting Commissioner of Patents.

(Seal)

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