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SAFETY DEVICE FOR ELASTIC FLUID GENERATORS
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Inventor:
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by
His Attorney.
SAFETY DEVICE FOR ELASTIC-FLUID GENERATORS.

The present invention relates to elastic fluid generators such as steam boilers, and has for its object generally to provide an improved safety device for such a generator, as hereinafter described.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a diagrammatic view of a boiler furnace provided with mechanism embodying the invention, and Fig. 2 is a diagram.

With elastic fluid boilers, such as steam boilers, it is generally usual to regulate the supply of combustibles, i.e. supply of fuel and air, according to the output demanded or according to an operating value related with the same, as, for example, the boiler pressure, either by hand or by means of automatic devices.

Fundamentally the manner of operation of a steam generator working on a steam power plant may be regarded as of a secondary circuit, which is represented by the circulation of steam and water, is dependent upon a primary circuit, which is represented by the supply of fuel and air. This relationship is diagrammatically illustrated in Fig. 2 in which I represent the primary and the secondary circuit of a steam generator 1, whose firing side receives air and fuel represented by the lines 2 and 3, and delivers smoke and gases and ashes represented by the lines 4 and 5, and whose steam side delivers steam through the line 6 to the prime mover 7 and receives water through a line 8 from the condenser 9 connected to the exhaust of prime mover 7, circulation of the water being effected by the pump 10. It is readily seen that with automatic regulation, a mutual relation exists between the two circuits I and II. Variations in the primary circuit I not only cause corresponding variations of the secondary circuit but also vice versa, on account of the automatic regulation, a variation in the steam and water circulation will correspondingly affect the operations in the primary circuit. This has the result that not only operating variations on the steam side cause a corresponding variation of the supply of fuel and air, but also disturbances, such as may be caused, for example, by pipe breakage or unforeseen load shocks. Therefore, if, for example, a steam pipe bursts, the regulator, on account of the increased flow of steam or the fall of pressure in the boiler, will act in the direction of increasing the firing, whereby the accident is, of course, made worse.

In the case of boilers regulated by hand, in which the automatic reaction on the primary side cannot take place, the breakage of a part of the boiler or a pipe under pressure has not the particularly disadvantageous result of an increase in the supply of heat, but, nevertheless, even in this case, there exists the difficulty that further firing often cannot be prevented, because, on account of the steam escaping, it is impossible to reach the devices for shutting off the supply of air and fuel.

More specifically, the object of the present invention is to provide an improved regulating arrangement which embodies means which comes into action automatically to shut down the boiler in the case of such disturbances. It is characterized essentially by the feature that a supervisory device for the output of the steam generator or for one of the operating values of the secondary circuit related with the output, on a set maximum value being exceeded, acts on the firing operations in the primary circuit (for example, on the devices for supplying fuel or air) in the sense of a partial or complete throttling of the supply of heat. The supervisory device may be constructed electrically and act as a maximum relay, but the essence of the invention is not altered if the device is constructed as a maximum regulator, which throttles the supply of fuel and air of the primary side to such an extent that the set maximum value on the secondary side is not exceeded. The supervisory device may either be mounted on the steam pipes proceeding from the boiler or on the supply pipes leading to the boiler; appropriately, however, the automatic action of the safety device is made dependent both on the steam as well as the water circulation.

On the primary side that operating value will be regulated which determines the output of the boiler completely or partially; these are in general the fuel supply, the air supply and the suction draught. These may be varied readily by acting on the driving motors for the feeding devices, fans and the like.
Referring to Fig. 1 of the drawing, 11 indicates a boiler furnace which is supplied with pulverized fuel by means of a fuel-feeding device 12 operated by an electric motor 13, 14 indicating the powdered fuel burner. Air is supplied to the furnace through a conduit 15 by means of a blower 16 driven by an electric motor 17. Water is supplied to the boiler through a pipe 18 and the steam generated flows from the boiler through pipe 19. The suction draught for the boiler is effected by a suction fan 20 driven by an electric motor 21. Motors 13, 17 and 21 are connected to power lines 22 which receive electrical energy from a suitable source of power through a switch 23. Motors 13, 17 and 21 may be controlled manually or automatically in any suitable manner to regulate the output of the boiler furnace in accordance with the demand, the specific manner for operating them not being shown, as it forms no part of the present invention. The arrangement so far described is to be taken as typical of any suitable boiler furnace and firing arrangement therefor.

In air inlet conduit 15 is arranged a normally open shut-off valve 24 which is biased toward closed position by a weight 25 connected to the valve by a flexible connector 26 extending over a pulley 27. Weight 25 is supported normally by an abutment 28 carried by the plunger of a solenoid 29, and in this position of the weight, valve 24 is open.

In a similar manner, in the gas discharge conduit for the furnace, is a shut-off valve 30 biased toward closed position by a weight 31 normally supported by an abutment 32 carried by the plunger of a solenoid 33.

Valve 30 likewise is normally in open position. The windings of the solenoids 29 and 33 are connected in a suitable source of electrical energy 34, the circuit including a circuit closer comprising an adjustable contact plate 35 which is adapted to be engaged by either of two contacts 36 or 37, the circuit being closed whenever either contact 36 or 37 engages contact plate 35. Contact 36 is carried by a lever arm 38 which is connected by a stem 39 to a flexible diaphragm 40 mounted in a fluid-tight casing 41. Casing 41 on opposite sides of diaphragm 40 is connected by pipes 42 and 43 to conduit 19 on opposite sides of a suitable pressure-difference creating device 44. In the present instance, pressure-difference creating device 44 is shown as being in the form of an orifice in a plate, this being a well-known type of pressure-difference creating device. With this arrangement, as is well understood, diaphragm 40 is subject to a differential pressure which bears a definite relation to the rate of flow of fluid through conduit 19 and the arrangement is such that when such rate of flow exceeds a predetermined maximum value the diaphragm will be moved sufficiently to bring contact 36 into engagement with contact plate 35. In a similar manner, contact 37 is carried by a lever arm 45 which is connected by a stem 46 to diaphragm 47 contained in casing 48. Casing 48 on opposite sides of the diaphragm is connected by pipes 49 and 50 to conduit 18 on opposite sides of pressure-difference creating device 51 similar to pressure difference creating device 44. With this arrangement, when the flow of fluid through conduit 18 exceeds a predetermined maximum value, diaphragm 47 will be moved so as to bring contact 37 into engagement with contact plate 36, thus closing the circuit on the windings of solenoids 29 and 33. The flow responsive devices illustrated are shown only diagrammatically and by way of example and are to be taken as typical of any suitable arrangement for accomplishing the desired result. Connected to switch 23 is a solenoid 52 the winding of which is connected in parallel with the windings of solenoids 29 and 33. Switch 23 is normally closed but whenever the winding of solenoid 52 is energized, the solenoid functions to open it, thus disconnecting supply lines 22 from their source of supply.

With the above described arrangement, it will be seen that whenever either the flow of elastic fluid from the boiler or the flow of liquid to the boiler exceeds a predetermined maximum value, the circuits on the windings of solenoids 29 and 33 will be closed simultaneously, thereby opening switch 23 so as to cut off the supply of power to motors 13, 17 and 21 and at the same time releasing weights 25 and 31 to effect the closing of shut-off valves 24 and 30.

Under some circumstances, it will be desirable, in addition to the foregoing, to provide also valve means mounted in conduits 18 and 19, which valve means will be closed along with the operation of the other safety device. Whenever this is desired, it may be accomplished in a manner similar to that already described in connection with the devices specifically illustrated, and for this reason further illustration is believed to be unnecessary. However, under such circumstances, the valve means in conduit 18 for the feed water supply should be placed only under control of the pressure responsive device 47 which responds to the rate of flow of liquid in conduit 18 and should not be placed under control of the pressure responsive device 40.

In connection with the above, it is to be understood that the term "combustible" I mean either fuel or air, or both.

In accordance with the provisions of the Patent Statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I...
desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination with a boiler having means for supplying combustible thereto, of means responsive to the rate of flow of vapor from the boiler for shutting off the supply of combustible when the output of the boiler exceeds a predetermined maximum value.

2. The combination with a boiler having means for supplying fuel and air thereto and motors for driving such means, of means responsive to the rate of flow of vapor from the boiler for disconnecting said motors from their energy sources when the output of the boiler exceeds a predetermined maximum value.

3. The combination with a boiler having means for supplying combustible thereto, of means responsive to the rate of flow of vapor from the boiler for shutting off the supply of combustible when the flow of vapor from the boiler exceeds a predetermined value.

4. The combination with a boiler having means for supplying combustible thereto, of means for shutting off the supply of combustible when the flow of liquid to the boiler exceeds a predetermined value.

5. The combination with a boiler having means for supplying fuel and air thereto and motors for driving such means, of means for disconnecting said motors from their energy sources when the flow of liquid to or the flow of vapor from the boiler exceeds a predetermined value.

6. The combination with a boiler having means for supplying fuel and air thereto, motors for driving said means and a draft damper, of means for disconnecting said motors from their energy sources and for effecting closing of said damper when the boiler output exceeds a certain maximum value.

7. The combination with a boiler having means for supplying fuel and air thereto, motors for driving said means and a draft damper, of means for disconnecting said motors from their energy source and for effecting closing of the said damper when the flow of liquid to the boiler exceeds a certain maximum value.

8. The combination with a boiler having means for supplying fuel and air thereto, motors for driving said means and a draft damper, of means for disconnecting said motors from their energy source and for effecting closing of the said damper when the flow of liquid to or the flow of vapor from the boiler exceeds a certain maximum value.

In witness whereof, I have hereunto set my hand this 20th day of Sept., 1926.

RICHARD TRÖGER.