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SAFEGUARDING OF SUPERHEATERS

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Fig. 1.

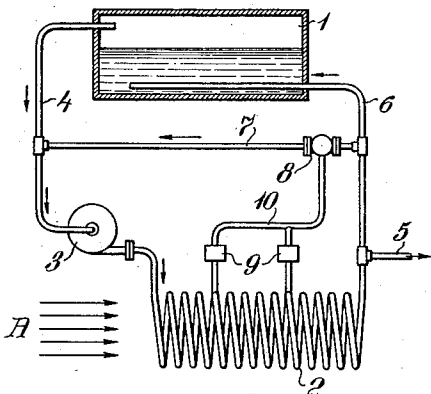


Fig. 2.

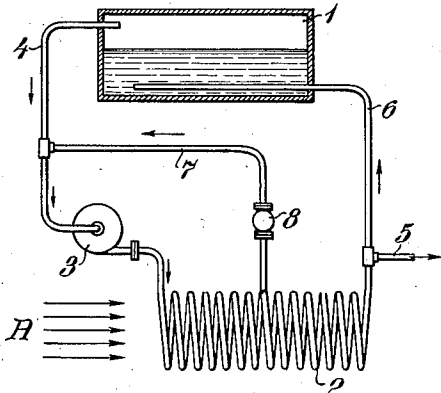
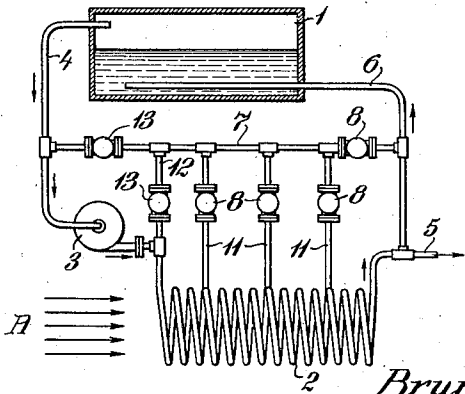


Fig. 3.



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SAFEGUARDING OF SUPERHEATERS

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11 Claims. (Cl. 122-479)

This invention relates to the safeguarding of superheaters, especially those equipped with heating surfaces transmitting heat by radiation and by contact.

For the purpose of safeguarding superheaters in the event of a sudden drop in the load, it has already been proposed to pass the surplus steam, under a positive pressure generated by a pump, through the superheater and then return it, in circulation, into the water space of the boiler.

I develop this method for safeguarding superheaters even in the case of partial loads. During partial loads the superheater tubes are endangered by the circumstance that the steam velocity corresponding to the load on the plant is no longer sufficient for adequately cooling the tube walls. According to the invention superheaters can be safeguarded against undue accumulation of heat during partial loads in that a controllable amount of steam, after superheating, can be returned in circulation, by the positive action of a pump, direct to the superheater or to that part of the superheater which is subjected to the greatest stress. For this purpose the superheater or a portion of same is short-circuited by way of a pump. Alternatively, in plants in which the flow of steam through the superheater is effected by the positive action of a pump, a pipe with a control device on the intake side of the pump is provided in parallel connection with the superheater. In this case, use is made of the phenomenon that the influence of the rise in temperature resulting from the influx of the superheated steam, in circulation, at the point it enters the superheater, is outweighed by the influence of the increased velocity on the conditions of heat transmission.

Apart from the advantage of a positive safeguarding of superheaters under partial loads, the invention ensures that this safeguarding is maintained without any unfavourable reactions on other constructional or working parts, and in particular that there is no need to modify or affect the final superheat of the steam, which can be maintained to the full, under perfect control, down to minimum loads. For superheaters composed of a radiant section and a contact section, there is the further advantage that heating by radiation can be most extensively employed and, consequently, the area of heating by contact can be reduced to a minimum.

Three embodiments of the invention as applied for example to a Löffler boiler, are respectively illustrated by Figs. 1, 2 and 3 of the accompanying drawing.

The Löffler boiler (U. S. Patent 1,740,254) comprises, as is known, a cylindrical boiler 1 in which the evaporation is effected by the admission of superheated steam, a superheater 2 which (as indicated by the arrows) is heated from A and is preferably composed of a section heated by radiation and of a succeeding section (in the direction of the flow of steam) heated by contact with the furnace gases, and a pump 3 which draws saturated steam from the boiler through a pipe 4 and forces it through the superheater 2. After being superheated a portion of the steam is led through the pipe 5 to the utilization points, and the remainder is conducted, under the positive pressure generated in the pump 3, in circulation and as a heat carrier, through the pipe 6 back to the boiler 1.

In the embodiment according to Fig. 1, the present invention provides a pipe 7 fitted with a control member 8 and passing from the pipe 6 to the intake pipe 4 of the pump 3, said pipe 7 being shunted in parallel with the superheater 2. During partial loads a portion of superheated steam, regulated by the control device 8, can be drawn by the pump 3 through the pipe 7 and re-delivered to the superheater 2 together with saturated steam from the boiler 1. In this manner an auxiliary, positive circulatory flow is superimposed, in the superheater 2, on the flow corresponding to the load.

The amount of steam taking part in the short-circuit circulation is regulated in accordance with the temperature of the heated tube walls. For this purpose devices 9 are provided which supervise the temperature of the tube walls at various points and set the control device 8 accordingly, as is indicated by the impulse conductor 10.

Fig. 2 represents a similar embodiment in which, however, the safeguarding action is restricted to the first and most highly stressed section of the superheater 2, for example the radiant-heat section of the latter.

The methods of connection according to Figs. 1 and 2 can be combined (Fig. 3) by arranging a pipe 7, on the intake side of the pump 3, in parallel connection with the superheater 2 and connecting the latter, by sections, with the pipe 7 through pipes 11 also provided with control devices 8. In this arrangement communication is also established, by means of a pipe 12 provided with a control device 13 and connected between the pipe 7 and the delivery side of the pump 3 in front of the superheater, whilst a second control device 13 is provided at the point

where the pipe 7 enters the intake pipe 4 of the pump 3. By means of the pipe 12 and the valves 13, and also by suitably setting the valves 8 in the pipes 11, a controllable amount of the steam can be drawn from individual points of the superheater 2. With this arrangement, therefore, the velocity of flow in the several sections of the superheater 2 can be modified in stages by suitable short-circuiting and by-passing.

The device according to the invention can also be applied with advantage to heating-up Löffler boilers and similar steam generators.

I claim:—

1. The method of safeguarding the superheater of a steam generator system during partial loads, consisting in pumping a controllable amount of steam, after superheating, directly back to that part of the superheater subjected to the greatest stress, and automatically regulating the amount of steam so short-circuited in accordance with the temperature of the superheater tube walls.

2. The method of safeguarding the superheater of a steam generator system during partial loads, consisting in pumping a controllable amount of steam from individual points of the superheater directly back to the superheater inlet.

3. In a steam generator system including a superheater, means for safeguarding the superheater during partial loads comprising a pipe circuit connected across a section of the superheater, a pump in the said circuit, and means for controlling the amount of superheated steam passing through the said circuit.

4. In a steam generator system including a superheater, means for safeguarding the superheater during partial loads comprising a pipe circuit connected across the superheater, a pump in the said circuit, pipes connecting the said circuit with different points of the superheater, and means for controlling the amount of steam drawn from the points of the superheater through said circuit and back to the superheater inlet.

5. A steam generator system comprising in combination, a boiler, a superheater having its inlet connected with the steam space of the boiler and its outlet also connected with the boiler to form a circuit, a superheated steam supply main connected with the superheater outlet, a pump in the inlet connection to the superheater, a pipe leading from an intermediate point of the superheater to the inlet side of the pump to form an auxiliary circuit, and valve means in the pipe.

6. A steam generator system comprising, in combination, a boiler, a superheater having its inlet connected with the steam space of the boiler and its outlet also connected with the boiler to form a circuit, a superheated steam supply main connected with the superheater outlet, a pump in the inlet connection to the superheater, a pipe connecting the superheater outlet with the inlet side of the pump, pipes leading from individual points of the superheater to said first mentioned pipe, and valve means in each of said pipes.

7. The method of safeguarding the superheat-

er of a steam generator system during partial loads, consisting in positively superimposing a controllable circuit of superheated steam on the flow of saturated steam through the superheater corresponding to the load, said circuit leading from individual points of the superheater directly back to the superheater inlet.

8. A steam generator of the character set forth in the Löffler Patent #1,740,254 dated December 17, 1929 comprising in combination, a boiler, a superheater having its inlet connected with the steam space of the boiler and its outlet also connected with the boiler to form a circuit, a superheated steam supply main connected with the superheater outlet, a regulable pump in the inlet connection to the superheater, a pipe leading from an intermediate point of the superheater to the inlet side of the pump to form an auxiliary circuit, and valve means in the pipe.

9. A steam generator system of the character set forth in the Löffler Patent #1,740,254 dated December 17, 1929 comprising in combination, a boiler, a superheater having its inlet connected with the steam space of the boiler and its outlet also connected with the boiler to form a circuit, a superheated steam supply main connected with the superheater outlet, a regulable pump in the inlet connection to the superheater, a pipe connecting the superheater outlet with the inlet side of the pump, pipes leading from individual points of the superheater to said first mentioned pipe, and valve means in each of said pipes.

10. In a steam generator including a boiler and a superheater, particularly of the type provided with radiating and convection heating surfaces, means for safeguarding the said superheater, a short circuiting conduit extending from an intermediate point of the superheater directly back to the inlet of the superheater, a mechanically operated regulable pump disposed in the said short-circuiting conduit and means for controlling the amount of superheated steam passing through the said circuit.

11. In a system of the character described including a boiler and a superheater, particularly of the type provided with radiation and convection heating surfaces, means for safeguarding the said superheater, said means comprising in combination a short-circuiting conduit extending from an intermediate point of the superheater directly back to the inlet of the superheater, a regulable pump disposed in the said short-circuiting conduit, said pump withdrawing with small partial loads a predetermined and regulable quantity of steam at the said intermediate point of the superheater and by passing the same through said conduit directly back to the superheater inlet, the quantity of steam passing through the said superheater portion being increased by this predetermined and regulable amount over that quantity which corresponds to the load.

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