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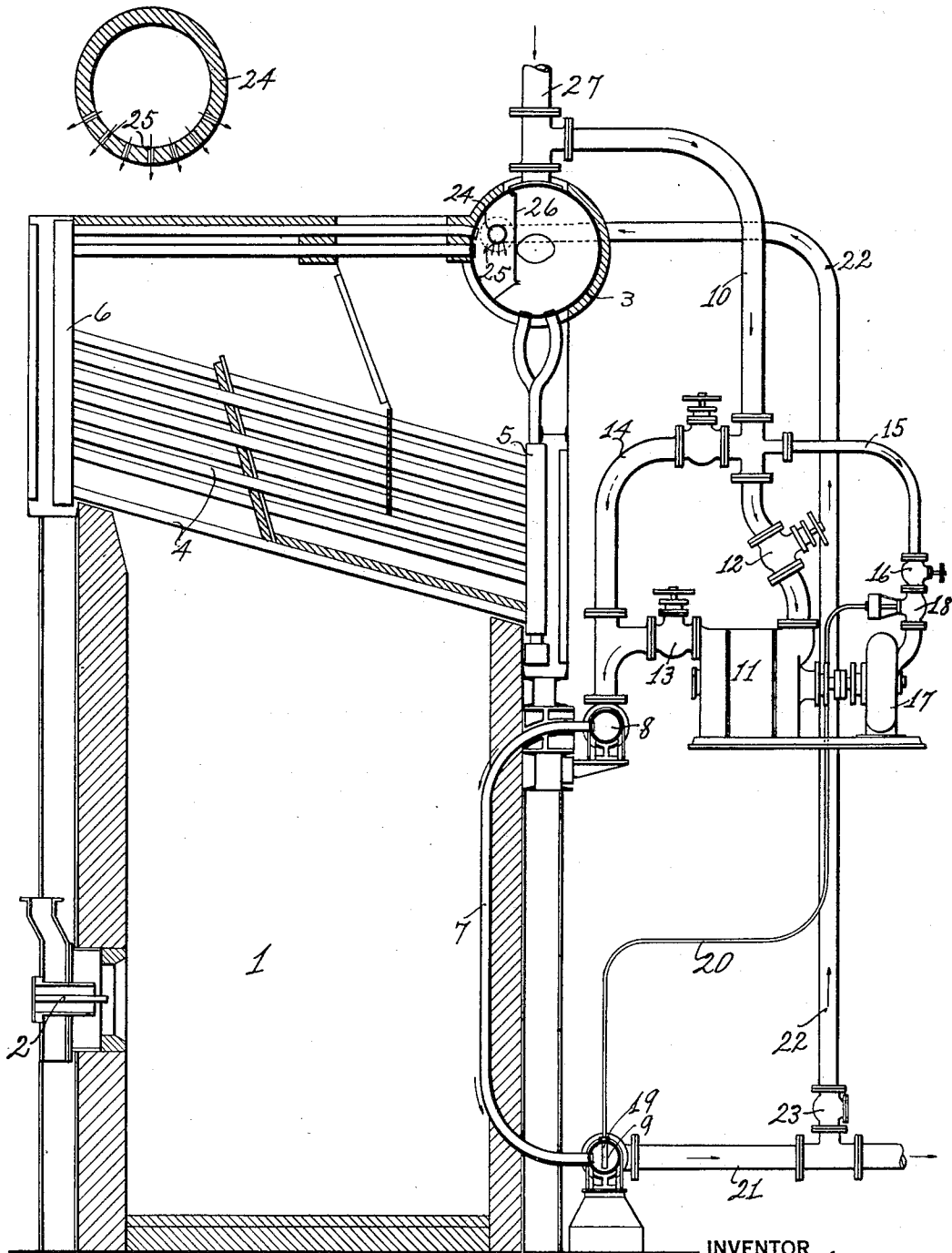
STEAM BOILER WITH SUPERHEATER

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Fig 2

Fig 1



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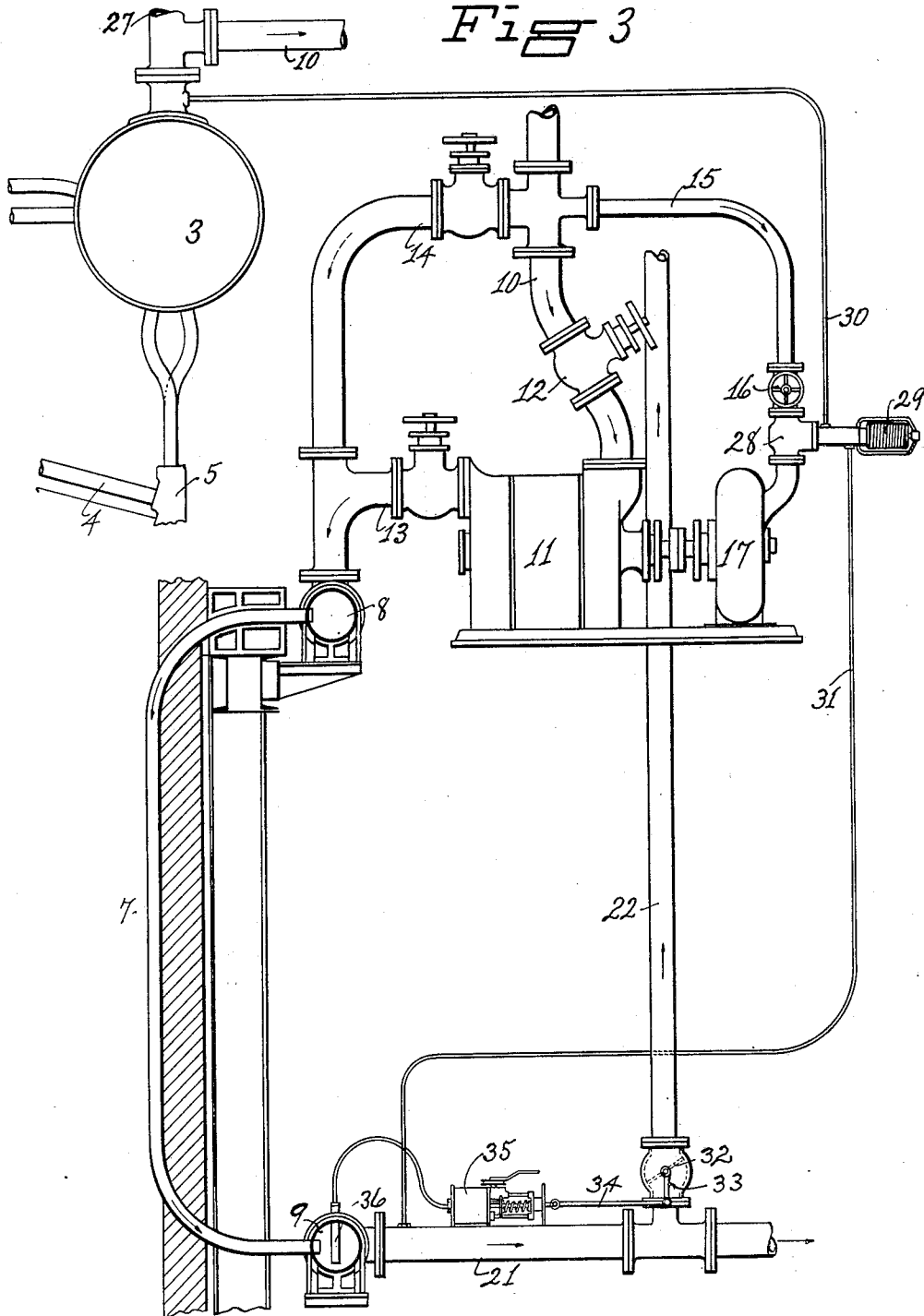
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STEAM BOILER WITH SUPERHEATER

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4 Claims. (Cl. 122-479)

This invention relates to a steam boiler having a superheater and means for circulating steam through the superheater to regulate the final temperature of the superheated steam and also prevent the superheater tubes from being burned out. More steam may be passed through the superheater than passed to the steam mains and more than is generated in the boiler by means of a compressor or turbo-blower that is located between the steam space of the boiler and the inlet header of the superheater.

The invention will be understood from the description in connection with the accompanying drawings in which Fig. 1 is a vertical section through an illustrative embodiment of the invention; Fig. 2 is a section on an enlarged scale through one of the details; and Fig. 3 is a view similar to Fig. 1, partly broken away and showing a modification.

In the drawings reference character 1 indicates a furnace that may be fired by means of the burners 2. A steam boiler of the Babcock & Wilcox type is shown in position to be heated by the furnace. It comprises the usual steam and water drum 3 and bank of inclined tubes 4 connected to the downtake headers 5 and uptake headers 6.

A row of radiantly heated superheater tubes 7 is located along the inside wall of the furnace. These tubes have their upper and lower ends extending outwardly through the furnace wall into the upper header 8 and lower header 9.

A pipe 10 extends from the steam space of the steam and water drum 3 to a turbo-blower or compressor 11. A hand controlled valve 12 is located in this pipe 10. A valved pipe 13 extends from the outlet side of the compressor 11 to the upper header 8. A valved bypass pipe 14 is connected on opposite sides of the compressor 11 from the steam pipe 10 to the pipe 13.

A pipe 15 provided with a hand controlled valve 16 leads from the pipe 10 to the steam turbine 17. A thermostatically controlled valve 18 is provided in the pipe 15, being controlled by a thermostat 19 located in the outlet header 9 of the superheater. The thermostat 19 is connected to the valve 18 by means of the connection 20.

A superheated steam pipe 21 connects the header 9 to the steam main. A pipe 22 leads from the pipe 21 to the steam space of the steam and water drum 3 and is provided with a check valve 23. The pipe 22 is connected to a longitudinally extending pipe 24 in the steam space of the steam and water drum 3, which has radial

perforation 25 along its lower sides so that the steam that passes through the pipe 22 into the pipe 24 is projected on to the water in the steam and water drum 3. A baffle 26 is provided in the drum 3 near the pipe 24, this baffle extending below the normal water level in the drum and terminating short of the ends of the drum, so that the steam discharged through the pipe 24 cannot mingle directly with the steam in the steam space of the drum 3, but is first contacted by water in the drum and thus desuperheated.

A pipe 27 from another boiler or source of steam is connected to the pipe 10 so that steam can be passed through the superheater tubes 7 while the boiler is being started up, and thus insure that the tubes will not be burned out during this period when the boiler is not itself supplying sufficient steam to absorb the heat from the tubes.

By locating the turbo-blower or compressor as described above only saturated steam passes through it which permits it to be cooler than would be the case if superheated steam would pass through it. Besides, the steam is of greater density than the superheated steam so that a lower speed and a smaller rotor can be used than would be the case if it were required for superheated steam.

The turbo-blower is operated at different speeds, the speed being controlled by the temperature of the superheated steam in the superheater outlet header 9 by means of the thermostatically controlled valve 18 in the steam line supplying steam to the turbine driving the blower. An increase in the temperature of the steam causes the speed of the blower to increase, thus increasing the amount of the excess steam that returns to the drum 3 through the pipe 22. The superheated steam from the pipe 22 is desuperheated in the drum 3 by being caused to impinge on the water therein and also mingle with the steam and water discharged through horizontal circulator. The superheater 7 can be prevented from being burned out even when no steam is being withdrawn as the blower or compressor 11 will circulate steam to keep the temperature within safe limits. If it should be necessary at any time during the normal operation of the boiler to stop the turbo-blower, this can be done by closing valve 16 in the steam line 15 leading to the turbine and inlet valve 12, and outlet valve 13 of the blower, and opening valve in the connection 14. In this manner the steam will be bypassed around the blower through the connection 14, and thus to the superheater 7.

In the modification shown in Fig. 3 the speed of the turbine 17 is regulated by the difference in pressure between the drum 3 and the superheater steam outlet pipe 21, the structure being otherwise similar to that already described. The valve 28 in the pipe 15 is a pressure controlled valve being controlled by the valve control 29, one portion of which is connected by the connection 30 to the drum 3 and another portion by the connection 31 to the pipe 21 just outside of the header 9. The regulation of the valve 28 may, however, be by means of a pressure drop between other portions of the system than that of the boiler steam and water drum 3 and the outlet pipe 21 from the superheater. An increase in the drop of pressure between the two points to which the valve control 29 is connected speeds up the turbine 17.

The amount of steam that passes back through the pipe 22 to the steam and water drum in this modification is determined by the temperature in the outlet header 9. For this purpose a butterfly valve 32 is provided in the pipe 22 in place of the check valve 23, shown in Fig. 1. The stem of the valve 32 is connected by a crank 33 and arm 34 to a device 35 of a well-known type that is controlled by the thermostat 36 in the header 9 so that a decrease of the temperature of the superheated steam in the header 9 will decrease the opening of the valve 32, thus causing a decrease in the amount of superheated steam that passes through the pipe 22 into the steam and water drum 3.

I claim:

1. In a steam boiler having a superheater, a desuperheater, a blower located between the steam space of said boiler and said superheater, a connection from the outlet of said superheater through the desuperheater to the inlet of the blower, a valve in said connection, temperature control means causing the valve to be automatically operated in response to temperature changes in the superheated steam, and means controlled by drop in pressure of steam on opposite sides of said superheater and acting simultaneously with the temperature control to regulate the speed of the blower so as to vary the amount of steam returned from the outlet of the superheater to the inlet of the superheater.

2. In combination, a boiler affording a supply of saturated steam, a steam superheater, a desuperheater, tubular connections conducting steam from said supply to the inlet end of the superheater, an impeller disposed in said connections to boost the movement of saturated steam to and through the superheater, a prime mover for operating the impeller, a controller for said prime mover responsive to changes in the pressure differential between the said supply of saturated steam and the superheated steam discharging from the superheater, a supply connection from the discharge end of the superheater

for delivering superheated steam to a point of use, a connection for delivering superheated steam from said supply connection to the desuperheater, a valve in said last named connection, and temperature control means causing the valve to be automatically operated in response to temperature changes in the superheated steam and acting in conjunction with the pressure-responsive controller to vary the weight of saturated steam delivered to the superheater and thereby control the temperature of the superheat.

3. In combination, a boiler affording a supply of saturated steam, a steam superheater, a desuperheater, tubular connections conducting steam from said supply to the inlet end of the superheater, an impeller disposed in said connections to boost the movement of saturated steam to and through the superheater, a prime mover for operating the impeller, a controller for said prime mover responsive to changes in the pressure differential between the said supply of saturated steam and the superheated steam discharging from the superheater to vary the speed of operation of the impeller, connections from the discharge end of the superheater providing for the simultaneous delivery of superheated steam to the desuperheater and for delivery of superheated steam to a point of use, and a valve in the connection between said superheater and said desuperheater controlled by changes in the temperature of the superheated steam and acting in conjunction with the pressure controller for varying the weight of that steam delivered to the superheater.

4. In combination, means affording a supply of saturated steam, a steam superheater having parts forming a combustion chamber wall, tubular connections conducting steam from said supply to the inlet end of the superheater, an impeller disposed in said connections to boost the movement of saturated steam to and through the superheater, a prime mover for operating the impeller, a controller for said prime mover responsive to changes in the pressure differential between the said supply of saturated steam and the superheated steam discharging from the superheater, a supply connection from the discharge end of the superheater for delivering superheated steam to a point of use, a return connection for delivering superheated steam from the supply connection to the supply of saturated steam, a valve in said return connection, and temperature control means causing the valve to be automatically operated in response to the temperature changes in the superheated steam and acting in conjunction with the pressure responsive controller to vary the weight of saturated steam delivered to the superheater and thereby control the temperature of the superheat.

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