

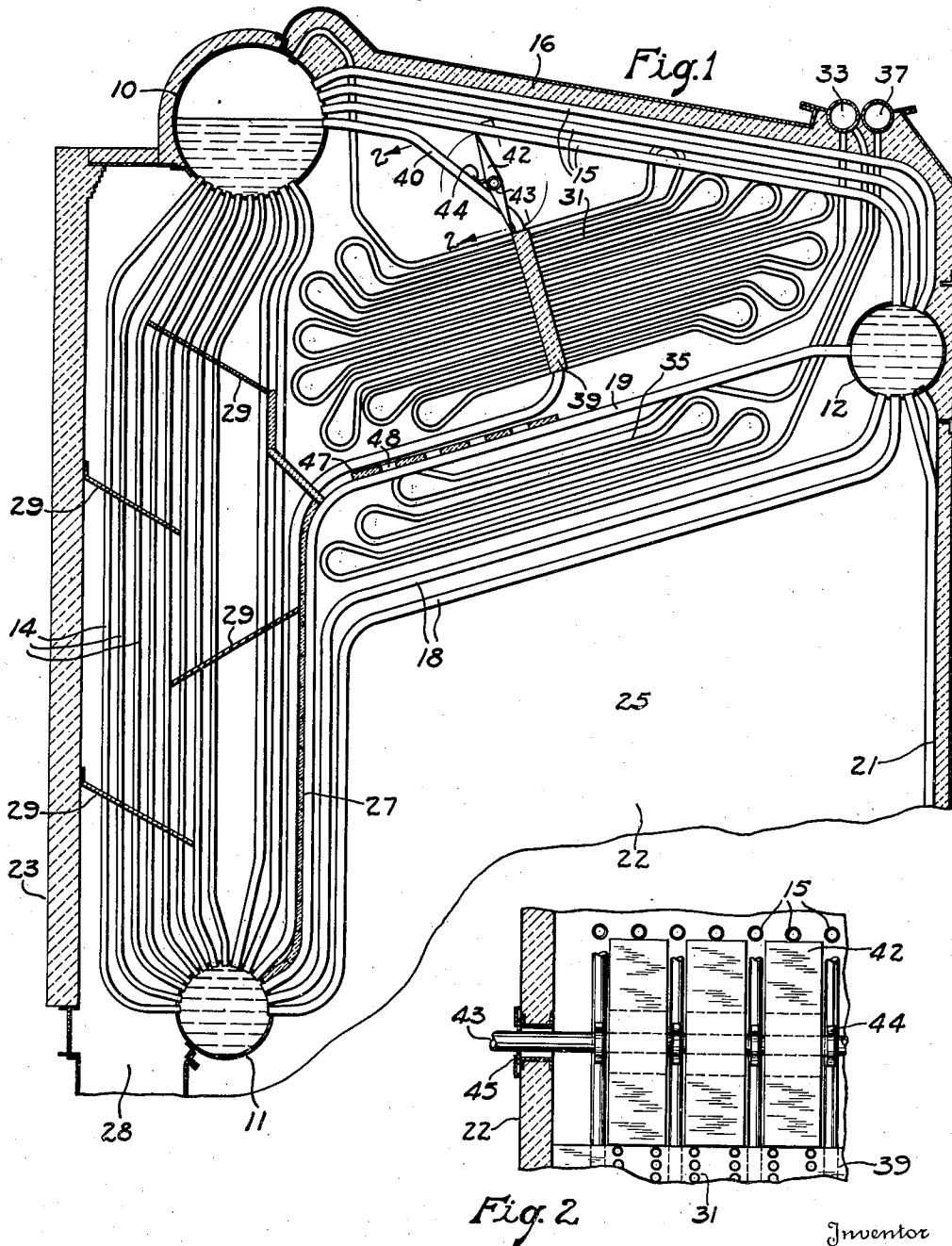
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STEAM GENERATOR

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STEAM GENERATOR

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This invention relates to steam generators, and more particularly to steam generators of the water tube type having means for superheating the steam which is generated in the water tubes.

With steam generators as ordinarily constructed there is usually a considerable variation in the temperature of the superheated steam as the demand for steam varies. This has been recognized heretofore, and many different arrangements have been proposed for controlling the flow of the hot gases over the superheater and thus regulating the steam temperature.

The main object of the present invention is to improve upon these prior arrangements and to provide a steam generator of a comparatively simple and inexpensive construction which will be effective to deliver superheated steam at high rates and with accurate control of the temperature of the steam.

A further object of the invention is to provide a steam generator having comparatively simple means for controlling the temperature of the steam, and to avoid pockets in which soot and fly-ash may accumulate in the gas passages.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawing illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is a longitudinal section through a steam generator; and

Fig. 2 is an enlarged fragmentary view in section on the line 2—2 of Fig 1.

The embodiment illustrated comprises an upper rear transverse steam-and-water drum 10, a lower rear transverse water drum 11 therebeneath, and a front transverse water drum or header 12 located at a height somewhat lower than that of the drum 10. A bank of upright water tubes 14 extends between the drums 10 and 11, and three rows of water tubes 15 extend between the drums 10 and 12, the uppermost row of the tubes 15 forming a support for a roof 16 of refractory material. The drums 11 and 12 are connected by two rows of water tubes 18 and by a third row of water tubes 19. The tubes 18 and 19, after leaving the rear water drum 11, extend substantially vertically upward for a substantial distance and then forwardly at a slight upward inclination to the front drum 12. The inclined portions of the tubes 19 are shown spaced well above the corresponding portions of the

tubes 18 therebeneath. The various parts so far described are mounted within a setting comprising a front wall 21, side walls 22 and a rear wall 23. These walls enclose a combustion chamber 25 located beneath the tubes 18.

A baffle 27 extends upwardly from the rear water drum 11 in the rear of the tubes 19, and terminates some distance below the steam-and-water drum 10. With this construction the hot gases flow upwardly from the combustion chamber 25, past the tubes 18 and 19, and rearwardly over the top of the baffle 27 into contact with the upper portion of the tube bank 14. Thence the gases flow downwardly to a gas outlet 28 near the rear water drum 11, baffles 29 being provided in the rear of the baffle 27 to direct the downwardly flowing gases back and forth across the tubes 14.

A superheater 31 is mounted in the space between the tubes 15 and the tubes 19, and connected to the steam-and-water drum 10 to receive steam therefrom. This superheater comprises a series of parallel tubes, each bent into a sinuous form, with long straight portions connected by loops to provide a large surface area. The straight portions of these superheater tubes are substantially parallel to the water tubes 19. The superheater 31 delivers steam to a header 33 located above the roof 16, and from this header the steam flows to a second superheater 35 located in the space between the tubes 18 and 19. This second superheater is of substantially the same construction as the first superheater, but has considerably less surface area. From the second superheater the steam flows to an outlet header 37 located adjacent the header 33.

In order to control the flow of the hot gases over the superheating surface and thus make possible a regulation of the temperature of the superheated steam, an upright baffle 39 is provided across the superheater 31 intermediate the length thereof. This baffle divides the upwardly flowing gas into two streams, one stream contacting with the rear portion of the superheater and the other stream contacting with the front portion of the superheater. The baffle 39 is preferably of monolithic construction, and it may be supported and cooled by means of a row of water tubes 40. These tubes extend upwardly from the drum 11 directly in the rear of the baffle 27, thence forwardly through the upper portion of the baffle 27 and above the tubes 19, thence upwardly through the superheater baffle 39, and rearwardly to the drum 10. At the top of the baffle 39 there is provided a damper 42 which is

preferably formed in a plurality of sections located between the tubes 40. The damper sections are secured to a horizontal shaft 43 rotatably supported in bearings 44 carried by the tubes 40.

5 This shaft extends outwardly through a sealing ring 45 in one side wall 22, so that it can be actuated manually or by means of any suitable and well-known automatic mechanism (not shown) responsive to the temperature of the steam delivered to the header 37.

10 It will now be apparent that with the damper 42 closed, as shown in Fig. 1, most of the gases from the combustion chamber 25 will be compelled to flow upwardly in the rear of the superheater baffle 39. However, this is the more direct path for the gases even with the damper 42 open, and in order to utilize the full superheater surface under these conditions there is preferably provided a perforated or "filter" baffle 47 beneath the rear portion of the superheater. This baffle 47 may be formed by means of tile supported on the tubes 19 between the baffles 27 and 39, these tile being spaced apart or otherwise arranged to provide openings 48 through which the gases may flow.

The operation of the invention will now be apparent from the above disclosure. Any suitable fuel is burned in the combustion chamber 25, and the hot gaseous products of combustion flow upwardly past the water tubes 13, the superheater 35, the water tubes 19, the superheater 31, and thence downwardly into contact with the tube bank 14 to the outlet 28. Steam generated in the various water tubes passes into the drum 10, whence it flows through the superheaters 31 and 35 in a generally downward direction in counterflow relation with the hot gases and thence to the outlet header 37. If the temperature of the superheated steam becomes higher than that desired, the damper 42 will be moved toward the closed position shown in Fig. 1, whereupon more of the gases will be compelled to flow upwardly through the filter baffle 47 and into contact with the rear portion of the superheater 31. Thus the front portion of the superheater 31 will be rendered less effective, and as a result the steam temperature will be lowered. In case the steam temperature becomes lower than that desired, the damper 42 will be moved toward the open position, whereupon the flow of gases into contact with the front portion of the superheater will be increased and the steam temperature will be raised. With the damper 42 fully open the entire area of the superheater will be effective, since the resistance set up by the filter baffle 47 will cause a considerable proportion of the gases to travel through the less direct path around the front of the baffle 39, while the baffle openings 48 will at the same time allow a substantial gas flow through the more direct path in the rear of the baffle 39. The surface area of the superheater 35 is for the most part effective whatever the adjustment of the damper, since it will be rather completely swept by the gases even

with the damper closed. Moreover, this superheater 35 is subjected to considerable radiant heat from the combustion chamber 25. The entire construction is comparatively simple and inexpensive, and the available space is fully utilized. The baffle construction is such that no great quantities of soot or fly-ash can accumulate thereon, since all pockets and large horizontal surfaces are avoided.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A steam generator comprising a transverse steam-and-water drum, a transverse water drum therebeneath, a bank of upright water tubes connecting the drums, a superheater in front of the water tubes, the superheater having a front portion remote from the water tubes and a rear portion adjacent to the water tubes, a combustion chamber beneath the superheater, means to direct hot gases from the combustion chamber upwardly into contact with the superheater and thence rearwardly into contact with the water tubes, a transverse baffle dividing the gases into two separate streams which contact with the front and rear portions of the superheater respectively, a filter baffle located beneath the rear portion of the superheater to restrict the flow in the rear stream, a row of water tubes extending upwardly from the water drum and forming a support for the filter baffle, and an adjustable damper located above the transverse baffle to control the flow in the forward stream.

2. A steam generator comprising a rear transverse steam-and-water drum, a rear transverse water drum therebeneath, a bank of upright water tubes connecting the drums, a superheater in front of the upper portion of the tube bank and including a series of tubes each bent into a sinuous form with long straight portions connected by loops, the straight portions extending at a slight downward incline toward the rear, means to supply steam from the steam-and-water drum to the superheater for flow through the sinuous tubes in a generally downward direction, a combustion chamber beneath the superheater and so arranged with relationship thereto as to cause the hot gases to flow directly upwardly from the combustion chamber and past the superheater in counterflow relation with the steam, an upright baffle extending transversely of the superheater intermediate the lengths of the straight portions thereof to divide the upwardly flowing gases into front and rear streams which unite as they leave the superheater, a filter baffle located beneath the rear portion of the superheater to restrict the flow in the rear gas stream, an adjustable damper mounted above the upright baffle in a position to control the flow in the front gas stream, and means to direct the united stream of gas into contact with the tube bank while flowing in a generally downward direction.

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