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STEAM GENERATOR

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Fig. 1.

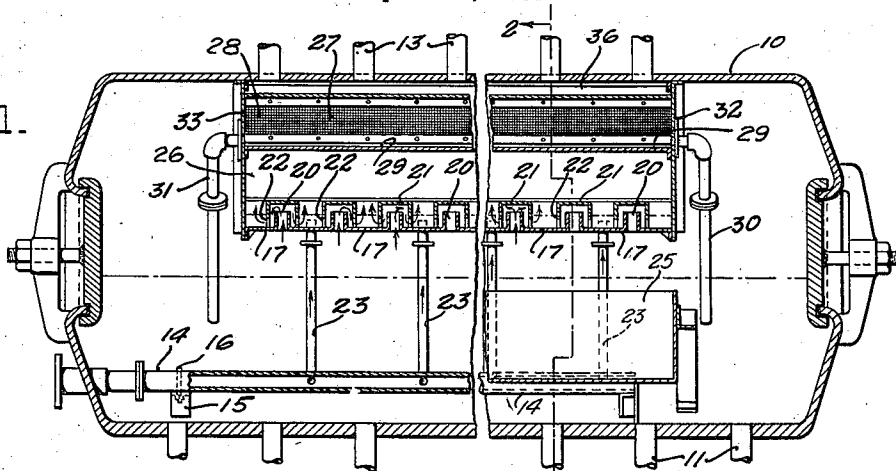
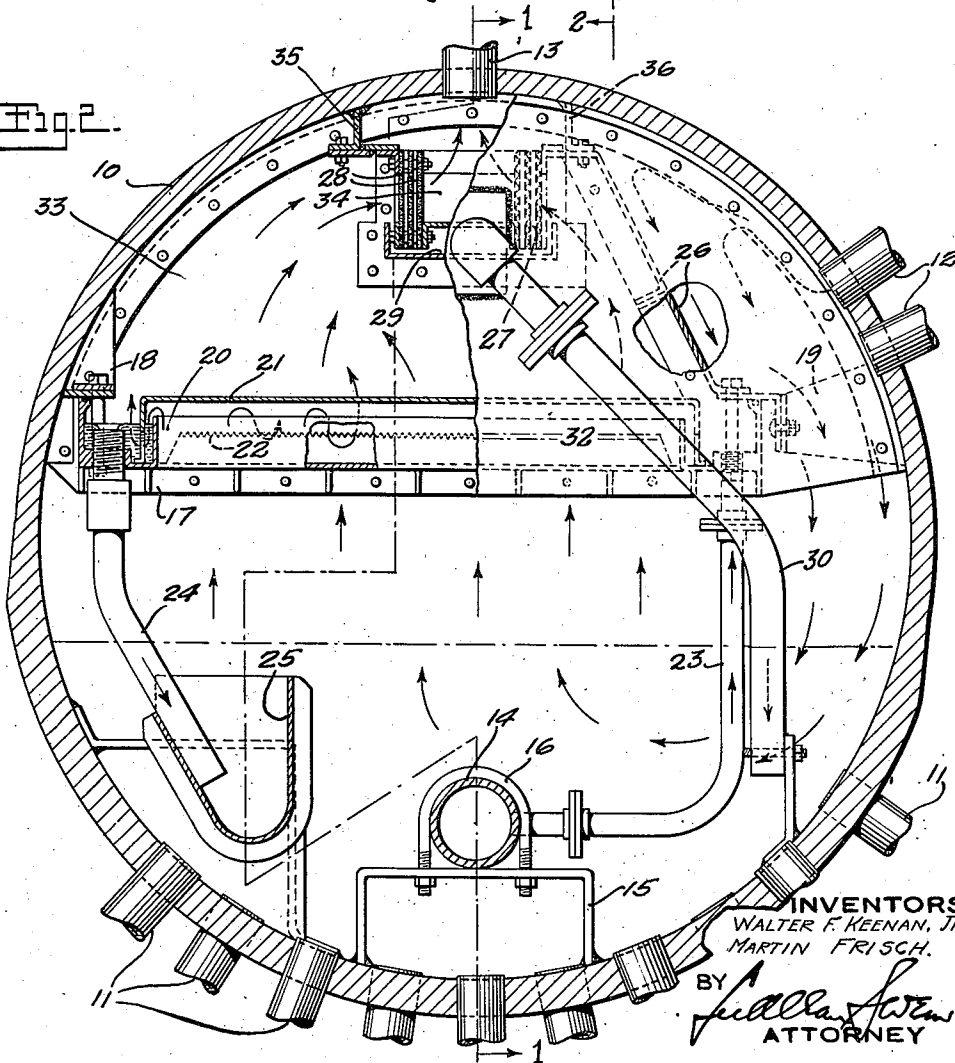


Fig. 2.



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## STEAM GENERATOR

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7 Claims. (Cl. 122-459)

This invention relates to steam generators and particularly pertains to the purification of the steam generated therein. More particularly, it is the object of the invention to provide an improved steam washer for removing solids which ordinarily are entrained by the steam generated in the boiler, by washing the saturated steam released in the boiler with fresh feed water of relatively low solid concentration. Subsequently the steam so purified may be dried by suitable means before it leaves the boiler. A further object of the invention is to provide a novel and effective steam drying device.

For a clear understanding of the special features and advantages that characterize the invention, reference may be had to the following description considered in connection with the accompanying drawing forming a part thereof and in which:

Fig. 1 is a longitudinal vertical sectional view, illustrating more or less diagrammatically, a boiler steam and water drum within which is disposed washing and drying devices embodying the preferred form of the invention, taken substantially on line 1-1 of Fig. 2, and

Fig. 2 is an enlarged transverse sectional view taken substantially on line 2-2 of Fig. 1.

Referring to the drawing, reference character 10 designates a steam and water drum of a steam generator of suitable construction. A plurality of tubes 11 connected to the lower portion of the drum, represent boiler circulating and steam generating tubes. A group of steam circulators 12 communicate with the steam space of the drum, while a plurality of outlet tubes 13 are provided to conduct steam from the drum to a superheater, not shown. Fresh feed water is supplied to the generator through feed pipe 14 which enters the drum at one end thereof and extends horizontally for the greater part of the length of the drum at a level well below the normal water line therein. The feed pipe 14 is adequately supported and secured in the drum by brackets 15 and U-bolts 16.

The steam washer in the form shown, comprises a series of parallel bubble trays 17 which extend transversely to the longitudinal axis of the drum and are supported above the water line therein by bracket members 18 and 19, the former of which are also arranged to prevent the steam from by-passing the trays. The assembly of these trays 17 provides a single steam washing tray which extends for the major portion of the length of the drum, as indicated in Fig. 1. In the form illustrated, each tray contains an elongated nozzle

20 and is provided with an upstanding flange on each side edge which cooperates with a corresponding flange on an adjacent tray to form or provide another nozzle 20. Obviously, other specific forms of trays may be employed so long as the nozzles 20 or their equivalent are provided. Covering each of these nozzles is an inverted light metal cap 21, the sides and ends of which, in the embodiment selected for illustration, are cut away to provide raised edge portions 22 which are serrated as shown. These serrated edge portions 22 are normally under the level of a body of fresh feed water which is maintained in the trays, and the dimensions of the serrations may be varied to provide the desired degree of sub-division of the streams of steam flowing through the nozzles 20 and under the caps 21 as hereinafter described. Also the sides and ends of the caps 21 need not, in all instances, be cut away to provide the raised edge portions illustrated, in which event, the serrations will extend upwardly from the lowermost edges of the caps.

Saturated steam released in the drum 10 enters the nozzles 20 in the trays 17 of the washer, and after passing upwardly through the nozzles is reversed in direction of flow by the caps 21 and flows downwardly through the fresh feed water on the trays and under the serrations, and thereafter flows upwardly through the water between adjacent caps, and escapes into the steam space above the washer assembly. The serrations along the sides of the caps 21 provide means whereby the steam is divided into a great number of uniformly distributed small streams of steam. Fresh feed water is constantly supplied to the trays at one end thereof by a plurality of feed connections 23 that conduct all the fresh feed water from the feed pipe 14 to the trays. The water from connections 23 flows across the trays around and between the nozzles 20 to overflow connections 24 through which the water flows into feed pan 25 located in the lower portion of the drum at one side thereof and under the normal water level in the drum. The height of the over flow connections 24 determines the level of the fresh feed water maintained on the trays. An inclined baffle 26, which extends from the upper wall of the drum to the feed water inlet side of the tray assembly, directs the steam that enters the drum through the steam circulators 12 downwardly to the steam space between the water line in the drum and the trays. From this steam space, all the steam released in the drum enters the nozzles, and by its passage

through the fresh feed water as already described, any entrained boiler water of high concentration is washed out and replaced by feed water of much lower concentration.

The steam after leaving the washer passes through a steam drier 27 consisting in the form shown, of spaced groups of parallel vertical wire mesh screens 28 which remove such moisture from the steam that has not already been eliminated by gravity in the upper steam space between the trays and the drier. As illustrated, two groups of screens are utilized with three spaced screens in each group. The groups are disposed so that the steam passes through the groups and enters a dry steam space 34 between the two groups. Preferably, adjacent screens in each group are so disposed that the individual wires of adjacent screens are arranged in staggered relationship with respect to the path of steam flow therethrough. The moisture removed from the steam by the drier collects on the drip pan 29, which is positioned immediately beneath the screens 28, and directs the wet steam through the screens 28. This moisture is returned to the body of water in the drum by drain pipes 30 and 31 at opposite ends of the drier. The dry steam leaves the drum through the outlet tubes 13 and is conducted thereby to a superheater, not shown. The drier assembly is supported from the shell of drum 10 by angle plates 35 and 36 which are welded to the drum shell. These plates 35 and 36 also prevent the wet steam from bypassing the drier. End plates 32 and 33 which extend from the inner surface of the upper portion of the drum wall to a point below the bottom of the trays 17 support and enclose the washer and drier assemblies. The washer and drier are arranged and supported in such manner that all the steam released in the boiler must pass through the washer and the drier screens before leaving the boiler.

Steam washers embodying the invention are effective with such low steam velocities that the entrainment of fresh feed water by the steam leaving the washer is very low and therefore comparatively little work remains for the steam drier in the elimination of excessive entrained moisture. The pressure drop through the washer and through the drier is also very low so that internal drainage of washer and drier presents no difficulty.

The feed pan 25 into which the trays 17 drain through pipes 24, may be used for phosphate or other chemical injection when such treatment is used for conditioning the boiler water internally.

The steam nozzles 20 in the trays 17 may be of suitable form other than the elongated rectangular form illustrated. For example, the nozzles may be circular, oval, or square in transverse cross-sectional configuration. The caps 21 for the steam nozzles will, in general, conform to the particular nozzle arrangement utilized.

Although the washer and the drier are disclosed as being disposed in a steam and water drum of a boiler, it will be understood that the washer or the drier or both, may be located outside of the steam and water drum. For example, the washer may be disposed in a separate drum or other enclosure to which feed water is initially supplied and from which it is delivered to the boiler circulation.

It will be understood that the embodiments of the invention disclosed herein are preferred forms, and that modifications may be made therein without departing from the principles of

the invention, which accordingly is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. In a steam and water drum for a water tube steam boiler, steam intakes in the upper portion of said drum, partitioning means forming an upper chamber in said drum above the normal water level therein, one side of said partition being adjacent said steam intakes and positioned to direct steam passing therethrough downwardly, a steam washer positioned in the drum comprising a bubble tray forming the bottom of said partitioning means, said tray having a plurality of steam nozzles therein, bubble caps for said nozzles, means for delivering boiler feed water to said tray, said means extending below said tray and being connected to one side thereof, and means for maintaining feed water at a predetermined level on said tray below the upper ends of said nozzles and for delivering said water to the lower portion of said drum.

2. In a steam and water drum for a water tube steam boiler, steam intakes in the upper portion of said drum, partitioning means forming an upper chamber in said drum above the normal water level therein, one side of said partition being adjacent said steam intakes and positioned to direct steam passing therethrough downwardly, a steam washer positioned in the drum comprising a plurality of bubble trays extending transversely of the longitudinal axis of said drum and forming the bottom of said partitioning means, each tray having a steam nozzle therein, a bubble cap for each of said nozzles, means for delivering boiler feed water extending below said trays, a conduit from said boiler feed water delivering means to one side of each tray, and means for maintaining feed water at a predetermined level on said trays below the upper ends of said nozzles and for delivering said water to the lower portion of said drum.

3. In a steam and water drum for a water tube steam boiler, steam intakes in the upper portion of said drum, partitioning means forming an upper chamber in said drum above the normal water level therein, one side of said partition being adjacent said steam intakes and positioned to direct steam passing therethrough downwardly, a steam washer positioned in the drum comprising a bubble tray forming the bottom of said partitioning means, said tray having a plurality of steam nozzles therein, bubble caps for said nozzles, means for delivering boiler feed water to said tray, said means extending below said tray and being connected to one side thereof, a feed pan positioned in the lower portion of the drum, and means for maintaining feed water at a predetermined level on said tray below the upper ends of said nozzles and for delivering said water to said feed pan.

4. In a steam and water drum for a water tube steam boiler, steam intakes in the upper portion of said drum, partitioning means forming an upper chamber in said drum above the normal water level therein, one side of said partition being adjacent said steam intakes and positioned to direct steam passing therethrough downwardly, a steam washer positioned in the drum comprising a bubble tray forming the bottom of said partitioning means, said tray having a plurality of steam nozzles therein, bubble caps for said nozzles, means for delivering boiler feed water to said tray, said means extending below said tray and being connected to one side thereof, a feed

pan positioned in the lower portion of the drum, means for maintaining feed water at a predetermined level on said tray below the upper ends of said nozzles, and means for conducting liquid from the tray to said feed pan.

5. In a steam and water drum for a water tube steam boiler, steam intakes in the upper portion of said drum, partitioning means forming an upper chamber in said drum above the normal water level therein, one side of said partition being adjacent said steam intakes and so inclined upwardly to the wall of said drum as to direct steam from said intakes downwardly, a steam washer positioned in the drum comprising a bubble tray forming the bottom of said partitioning means, said tray having a plurality of steam nozzles therein, bubble caps for said nozzles, means for delivering boiler feed water to said tray, said means extending below said tray and being connected to one side thereof, and means for maintaining feed water at a predetermined level on said tray below the upper ends of said nozzles and for delivering said water to the lower portion of said drum.

6. In a steam and water drum for a water tube steam boiler, steam intakes in the upper portion of said drum, partitioning means forming an upper chamber in said drum above the normal water level therein, one side of said partition being adjacent said steam intakes and positioned to direct steam passing therethrough downwardly, a steam washer positioned in the drum compris-

ing a bubble tray forming the bottom of said partitioning means, said tray having a plurality of steam nozzles therein, bubble caps for said nozzles, means for delivering boiler feed water to said tray, and means for maintaining feed water at a predetermined level on said tray below the upper ends of said nozzles and for delivering said water to the lower portion of said drum.

7. In a steam and water drum for a water tube steam boiler, steam intakes in the upper portion of said drum, partitioning means forming an upper chamber in said drum above the normal water level therein, one side of said partition being adjacent said steam intakes and positioned to direct steam passing therethrough downwardly, a steam washer positioned in the drum comprising a bubble tray forming the bottom of said partitioning means, said tray having a plurality of steam nozzles therein, bubble caps for said nozzles having means for dividing the streams of steam which have passed through said nozzles into a relatively large number of substantially uniformly distributed small streams of steam, means for delivering boiler feed water to said tray, said means extending below said tray and being connected to one side thereof, and means for maintaining feed water at a predetermined level on said tray below the upper ends of said nozzles and for delivering said water to the lower portion of said drum.

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