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J. FLETCHER

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SEPARATOR

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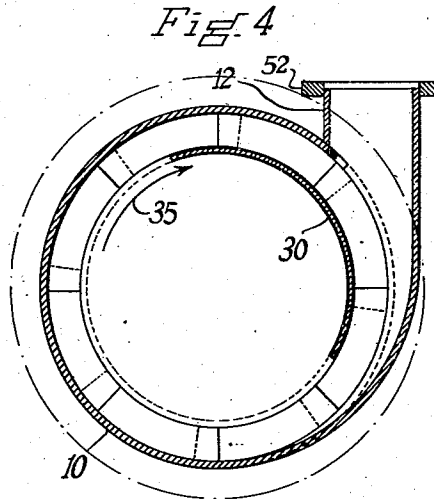
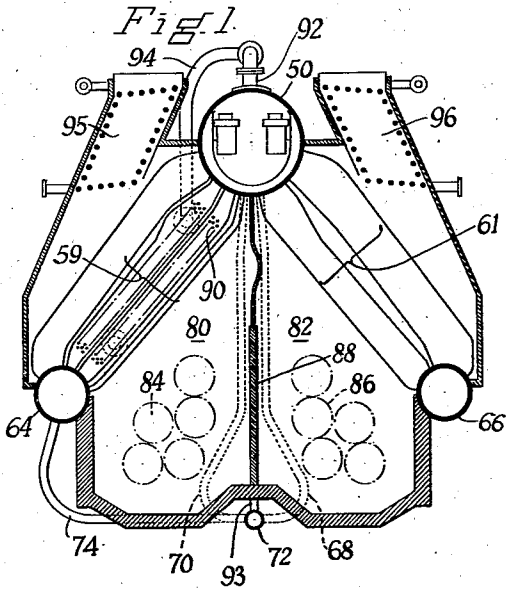


Fig. 3

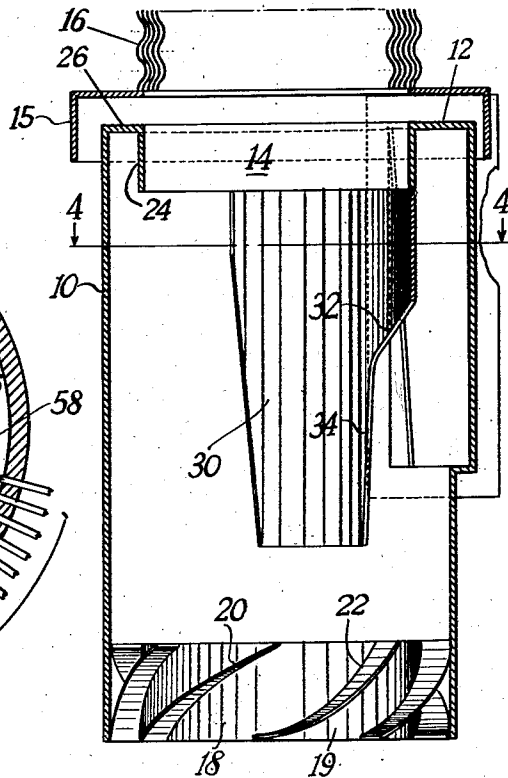
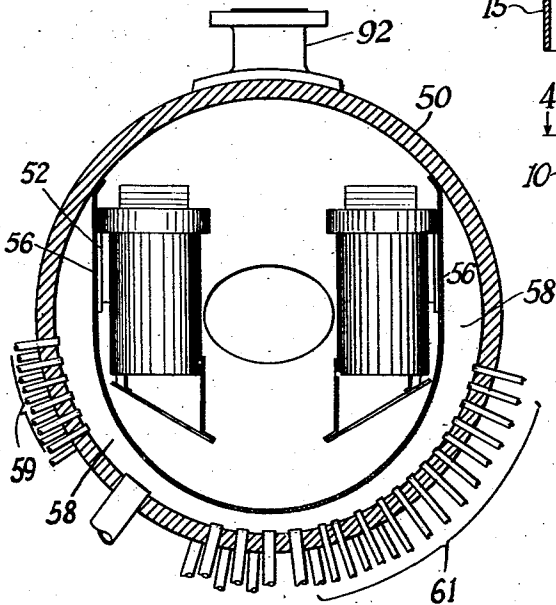


Fig. 2



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3 Claims. (Cl. 183—34)

This invention is concerned with improvements in devices for separating fluids of different densities. In a more specific sense, it involves centrifugal means for the effective separation of fluids.

One of its embodiments involves a circular whirl chamber into which a mixture of steam and water is discharged at high velocity, this action setting up a whirling motion within the chamber. As a consequence, steam is so separated from the water that it passes from the chamber through an upper outlet while the water is discharged through another outlet preferably disposed at the bottom of the chamber.

An object of this invention is to provide means in such separators for maintaining the incoming mixture of steam and water relatively free from the disturbing influence of impact of the swirling water after it has completed at least one whirl about the chamber, and a further object is to effect this result without involving undesirable reaction due to excessive deflection of the swirling mixture.

The invention contemplates the use of steam and water separators in a high pressure steam generator to improve circulation and to enable the generator to operate at a high drum water level while still supplying satisfactorily dry steam.

The use of the illustrative separators in a steam and water drum of such a steam generator is characterized by the fact that the high velocities of steam and water mixtures discharged into the drum are not dissipated upon entering the drum but are utilized in separating the component parts of the mixture, and this is accomplished without imposing excessive flow resistance. Each separator may be arranged to receive the combined discharge of several water heating or steam generating tubes and yet be so arranged and constructed that it may be easily removed from its operative position for inspection, repair, or cleaning of the tubes.

Other objects of the invention will appear as the following description proceeds, and the invention will be described with reference to an embodiment which is illustrated in the accompanying drawing.

In the drawing:

Fig. 1 is a vertical section of a steam generator in which the invention is embodied;

Fig. 2 is a detail view in the nature of a vertical section through the steam and water drum of the Fig. 1 installation;

Fig. 3 is a vertical section through one of the illustrative separators;

Fig. 4 is a horizontal section on the line 4—4 of Fig. 3.

Referring to the details of structure shown on the drawing, the illustrative separator includes a substantially circular whirl chamber 10 having an inlet 12 through which a mixture of steam and water is discharged at high velocity.

Within the whirl chamber, steam, separated from the water, passes upwardly through the central steam outlet 14 above which is a rim construction 15 and a scrubber or multiple plate separator 16. The separated water is discharged downwardly through circumferentially arranged outlets 18, these outlets being formed by the cylindrical flange of the bottom 19, successive vanes such as 20 and 22, and the wall of the whirl chamber.

It is important that the separated steam be as free from water as possible, and to promote this condition, the whirl chamber is provided with a cap or ring structure around the steam outlet. This structure includes an annular flange 24 integral with and depending from the annular member 26, the latter closing the space between the flange and the whirl chamber proper, as indicated in the Fig. 3 of the drawing. Separation of water and reduction of pressure drop are attained by the co-action of the rim construction 15 with these components and other parts of the illustrative apparatus.

The arrangement of elements is such that the steam and water inlet 12 communicates directly with the circumferential space between the flange 24 and the wall of the whirl chamber. Means is provided for preventing the flooding of this space, and for minimizing the passage of water through the outlet 14 and the scrubber 16, and this means is effective to accomplish these results without involving undesirable reaction arising from excessive deflection of the whirling steam within the chamber. It also serves to increase the downward component of the incoming steam and water mixture. In the present instance, this means includes the segmental plate 30 which is formed with the angularly related outlet edges 32 and 34 as shown on Fig. 3. The plate 30 is preferably substantially concentric with the whirl chamber and it is secured in position by joining it at its upper edge, as by welding or brazing, to the lower edge to the flange 24.

The segmental plate 30 prevents the whirling steam and water mixture flowing as indicated by the arrow 35 in Fig. 4, from interfering with the discharge of steam and water into the whirl chamber through the outlet 12 and does this

without involving the undesirable reactions resulting from an excessive deflection of the whirling steam.

The illustrative separators are preferably arranged within a steam and water drum 50 in the manner indicated in Figures 1 and 2 of the drawing, and for this purpose, each steam and water mixture inlet structure 12 is provided with a heavy flange 52 for securement to a wall 56, which is associated with the drum in the manner particularly indicated in Fig. 2.

Steam and water mixtures are discharged into the drum chamber 58 by the steam generating tubes of two upwardly converging banks 59 and 61 and the tubes of these banks are in communication, at their lower ends, with the water drums 64 and 66, in the natural circular boiler shown, and circulation is completed by downcomers 68 and 70 which lead to a header 72. This header communicates with the drums 64 and 66 by means of such conduits such as that shown at 74.

The banks of tubes 59 and 61 are disposed above the furnaces 80 and 82, respectively, the latter being fired by the burners 84 and 86.

In the steam generator indicated in Fig. 1 of the drawing, the furnaces 80 and 82 are separated by a wall 88 which may include tubes 93 directly connecting the drum 50 with the header 72.

Steam and water passes from the chamber 58 through the illustrative separators and the separated steam passing from the top of the separators is discharged through the steam off-take 92. Thence, the steam passes through the superheater supply conduits 94 to a superheater 96, preferably arranged between some of the tubes of the bank 59.

Furnace gases and other combustion products, after passing through the tubes of the banks 59 and 61, pass over the heat exchange surface of the economizers 98 and 96, and thence to one or more flues.

While, in complying with the Federal statutes relating to such matters, and in particular Sec. 4888 R. S., this invention has been described with reference to a particular embodiment. It is to be understood that the invention is not limited to all the details thereof. It is rather to be taken of a scope commensurate with the scope of the subjoined claims.

I claim:

1. In a steam and water separator, means forming an exterior chamber in which there is a water level, a steam offtake communicating with the steam space of said chamber, an upright cylindrical casing forming a whirl chamber within the first mentioned chamber, the whirl cham-

ber having a separated water outlet, a cap or rim construction secured to the top of the whirl chamber and including a continuous flange extending downwardly into the whirl chamber, said cap or rim construction forming a central steam outlet and a partial cover for the whirl chamber casing, an annular unit constituting a downwardly opening cup-shaped ring construction spaced from the top of the whirl chamber and co-operating with the top of the whirl chamber to form an annular outlet for separated steam, a multiple plate steam and water separator disposed above a central opening in said rim construction and above the whirl chamber steam outlet, an arcuate baffle plate secured to the downwardly extending flange of said cap or rim construction and correspondingly spaced from the wall of the whirl chamber, and a whirl chamber inlet structure disposed at a position back of said baffle plate and forming an inlet through which a steam and water mixture is directed substantially tangentially into the whirl chamber.

2. In a fluid separator, a whirl chamber, an inlet through which a mixture of different density fluids flows into the whirl chamber and sets up whirling action therein, spaced outlets for separated fluids of different densities, and a curved segmental baffle disposed inwardly of the whirl chamber wall at the zone of the inlet and extending from a position forwardly of the inlet to a substantial distance rearwardly of the inlet, said baffle being spaced from the adjacent whirl chamber wall throughout the effective extent of the former which is less than semi-circular, the baffle limiting the spray or atomized fluid produced at the junction of the incoming stream and the rotating mass in the whirl chamber.

3. In a fluid separator, an upright whirl chamber, substantially tangential inlet through which a mixture of different density fluids flows into the whirl chamber and sets up whirling action therein, spaced outlets for separated fluids of different densities, and an upright curved segmental baffle disposed inwardly of the whirl chamber wall at the zone of the inlet and extending from a position forwardly of the inlet to a substantial distance rearwardly of the inlet, the curvature of the baffle being substantially concentric with the whirl chamber wall and spaced therefrom throughout the effective extent of the former which is less than semi-circular, the passage exteriorly of the baffle being a substantial continuation of the inlet passage, the baffle limiting the spray or atomized fluid produced at the junction of the incoming stream and the rotating mass in the whirl chamber.

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