Feb. 3, 1942. J. FLETCHER ET AL 2,271,634

FLUID SEPARATOR

Filed Aug. 30, 1939

Fig. 4

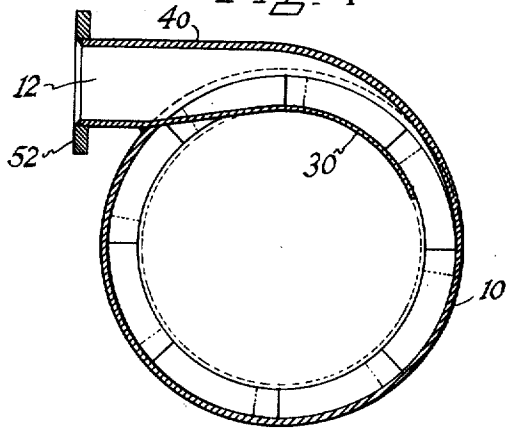


Fig. 1

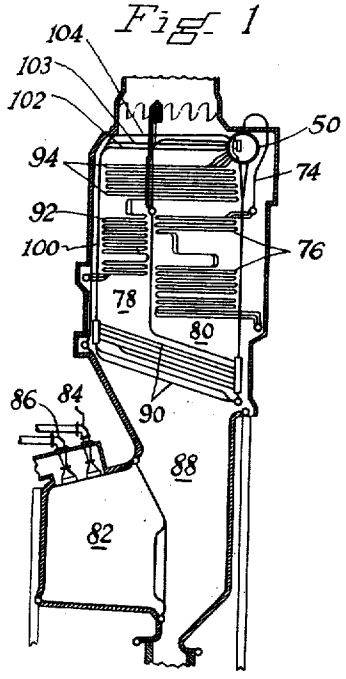


Fig. 3

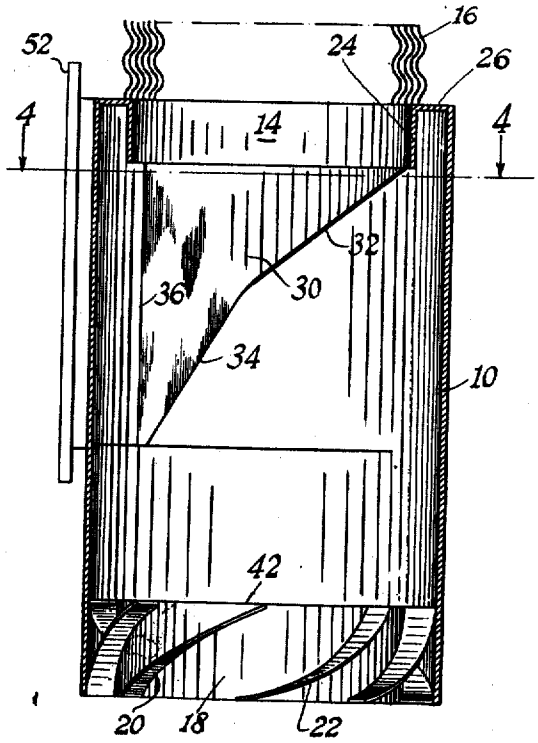
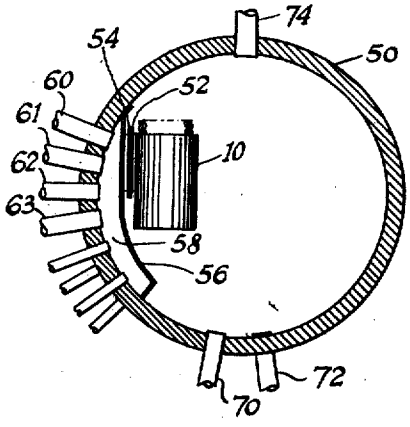


Fig. 2



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FLUID SEPARATOR

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Application August 30, 1939, Serial No. 292,642

6 Claims. (Cl. 183—83)

This invention relates to means for separating fluids of different densities, and it is more particularly concerned with centrifugal means for separating water from steam.

One embodiment of the invention involves a substantially circular whirl chamber into which a stream of steam and water mixture is discharged so as to set up a whirling motion within the chamber. As a consequence, the steam is separated from the water and passes from the chamber through an upper outlet while the water is discharged through a separate outlet. An object of this invention is to provide means for maintaining the steam outlet relatively free of water and to deflect the incoming fluid mixture away from the steam outlet and toward the water outlet.

The invention contemplates the use of the illustrative separator in a high pressure steam generator to improve circulation and enable the generator to operate at higher drum water levels and still supply dry steam.

Other objects of the invention will appear as the following description proceeds.

The invention will be described with reference to an embodiment which is illustrated in the accompanying drawing.

In the drawing:

Fig. 1 is a diagrammatic view in the nature of a vertical section showing a steam generator in connection with which the invention is employed;

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

Fig. 3 is a vertical section through the illustrative whirl chamber; and

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

The illustrative separator includes a substantially circular whirl chamber 10 having an inlet 12 through which a mixture of steam and water may be discharged substantially tangentially into the chamber.

Steam is separated from the water within the whirl chamber, the former passing upwardly through a central steam outlet 14 above which is a scrubber, or multiple plate steam and water separator 16. The separated water is discharged downwardly through circumferentially arranged outlets 18 between successive vanes such as 20 and 22.

In the operation of such a separator it is important that the steam be as free from water as possible, and to promote this condition the whirl chamber is provided with a cap or ring around the steam outlet. This structure includes the circular flange 24 integral with and depending from an annular portion 26 which closes the space between the flange and the top of the whirl chamber proper.

It will be seen from an inspection of Figs. 3 and 4 that the steam and water inlet 12 is at the top of the whirl chamber, and the arrangement is such that the inlet communicates directly with the circumferential space between the steam outlet flange 24 and the wall of the whirl chamber. To prevent this space from being flooded and to minimize the passage of water through the outlet 14 to the scrubber 16 means are provided for increasing the downward component of the incoming stream of steam and water mixture. This means includes the segmental plate 30 which is formed with the angularly related outlet edges 32 and 34 as indicated in Fig. 3. The plate 30 joins the metal of the whirl chamber 10 in the upright junction 36 as indicated in Fig. 3, and the upper part of this plate is preferably of the same curvature as the steam outlet flange 34 so that the plate may be secured, as by welding or brazing, to the lower edge of this flange.

The segmental plate 30 co-operates with the opposite wall 40 of the inlet 12 to provide a contracting inlet passage at the top of the whirl chamber, and the downwardly and rearwardly inclined edges 32 and 34 of the plate 30 cause the incoming steam and water mixture to be deflected downwardly toward the steam outlets 18.

Preferably, the water outlet vanes 20 and 22 are secured in an annular passage between the upright wall of a pan 42 and the wall of the whirl chamber, as indicated in Figs. 3 and 4.

A number of the separators may be secured within the steam and water drum 50 as indicated in Fig. 2 of the drawing, and for this purpose the steam and water mixture inlet structure 12 is provided with a heavy flange 52 for securement to a similarly formed flange 54 fixed to the wall 56 of a drum chamber 58.

Steam and water mixtures are discharged into the drum chamber 58 by the circulating connections 60—63, and water from the separators 10 passes downwardly from the drum 50 through the downcomers 70 and 72. Steam from the separator 10 passes from the drum through the steam offtake connections 74 to a superheater 76 which is shown in Fig. 1 as disposed in one of two parallel gas passes 78 and 80.

The boiler furnace 82 is fired by burners 84 and

86, and furnace gases pass from the furnace 82 into a furnace chamber 88. From this chamber the gases pass across a bank of steam generating tubes 90 to the parallel gas passes 76 and 80. In the gas pass 76 there is an economizer section 92 series connected to a second economizer section 94 through which feedwater is passed to the drum 50.

The downcomers 70 and 72 are connected with the downtake header construction 96 for the bank of tubes 90 and the uptake header construction at the opposite end of this bank of tubes communicates with the circulatory connections 60—63 by means of the risers 100 and the horizontal circulators 102—104.

In compliance with the Federal statutes relating to such matters, and particularly sec. 4888 R. S., this invention has been concisely described with reference to one particular embodiment thereof. It is, however, to be understood that the invention is not limited to all of the details thereof. It is rather to be taken as of a scope commensurate with the scope of the sub-joined claims.

We claim:

1. In apparatus of the class described, means forming a whirl chamber having an inlet through which a mixture of fluids of different densities is admitted so as to set up a whirling motion within the chamber, means forming an outlet for a fluid of greater density, said outlet being spaced from the inlet in a direction axially of the whirl chamber, and means forming a central outlet for a fluid of lesser density adjacent said inlet, said inlet means including a wall extending from the central outlet toward the outlet for the fluid of higher density and formed with a rearwardly inclined edge receding from the central outlet so as to give the incoming stream an increased component toward the first mentioned outlet, said edge being oblique to the axis of the whirl chamber.

2. In a steam and water separator, means forming an upright whirl chamber, means secured to the whirl chamber and forming therewith an inlet through which a steam and water mixture is discharged into the chamber so as to set up a whirling motion therein, means at the upper end of the whirl chamber forming a steam outlet centrally positioned with respect to the chamber, means forming an outlet for separated water at the bottom of the whirl chamber, and plate means extending downwardly from the steam outlet and formed with a rearwardly inclined and downwardly receding edge which is effective to increase the downward component of the incoming steam and water mixture, said plate means forming one wall of the inlet.

3. In a steam and water separator, means forming an upright whirl chamber, means secured to the whirl chamber and forming therewith an inlet through which a steam and water mixture is discharged into the chamber so as to set up a whirling motion therein, means at the upper end of the whirl chamber forming a steam outlet centrally positioned with respect to the chamber, means forming an outlet for separated water at the bottom of the whirl chamber, and a segmental plate fixed to a wall of said chamber and extending downwardly from the steam outlet and formed with a downwardly receding and rearwardly inclined forward edge which is effective to increase the downward component of the incoming steam and water mixture, said plate means forming one wall of the inlet.

4. In apparatus of the class described, means forming a whirl chamber having an inlet through which a fluid mixture is discharged so as to set up a whirling motion within the chamber, means forming a whirl chamber outlet for a separated fluid of greater density, said outlet being offset from the inlet axially of the whirl chamber, and means forming a central outlet for a fluid of lesser density, said central outlet being disposed so that the inlet is operatively positioned between said outlets, said inlet means including a wall having a rearwardly and downwardly receding forward edge to give the incoming mixture an increased component toward the first mentioned outlet.

5. In apparatus of the class described, means forming a whirl chamber having an inlet through which a fluid mixture is discharged so as to set up a whirling motion within the chamber, means forming a whirl chamber outlet for a separated fluid of greater density, said outlet being offset from the inlet axially of the whirl chamber and means forming a central outlet for a fluid of lesser density, said central outlet being disposed so that the inlet is operatively positioned between said outlets, said inlet means including a wall having a rearwardly and downwardly receding outlet edge to give the incoming mixture an increased component toward the first mentioned outlet.

6. In apparatus of the class described, means forming a whirl chamber having an eccentric inlet nozle through which a fluid mixture is discharged so as to set up a whirling motion within the chamber, means forming a whirl chamber outlet for a separated fluid of greater density, and means forming a central outlet for a separated fluid of lower density, said outlets being oppositely offset from the inlet axially of the whirl chamber, the flow axis of the nozzle being transversely related to the axis of the whirl chamber and the nozzle being of graduated length with its smallest longitudinal dimension on its side toward the first mentioned outlet.

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