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2,587,206

CENTRIFUGAL SEPARATOR

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FIG. 1.

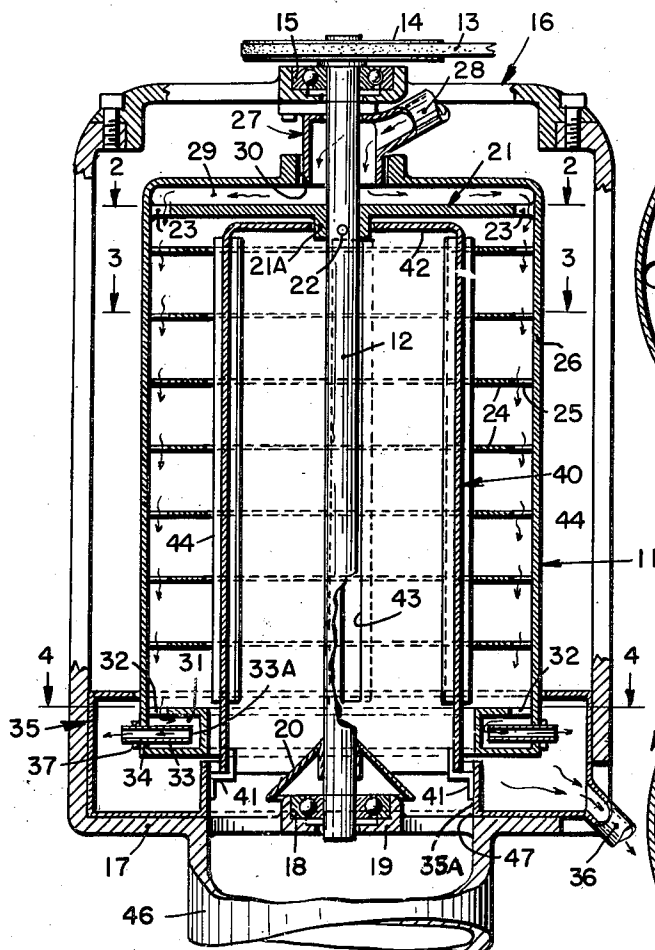


FIG. 2.

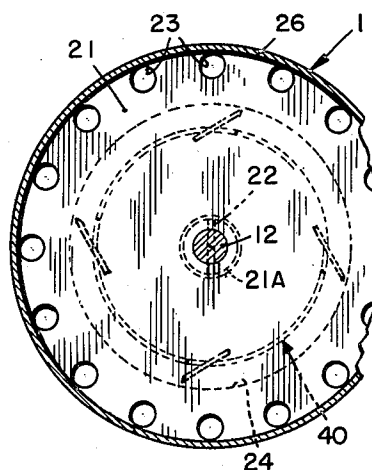


FIG. 3.

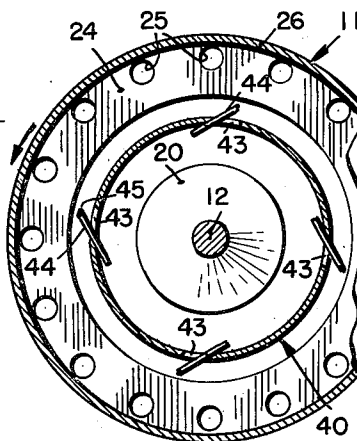
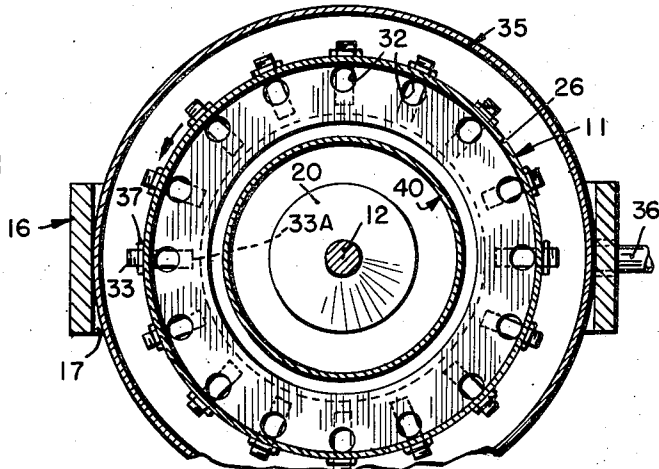


FIG. 4.



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CENTRIFUGAL SEPARATOR

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5 Claims. (Cl. 233—21)

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This invention relates to a centrifugal separator and in particular to one which will separate solids from liquids of greater specific gravity than the solids.

One object of the invention is to provide an inverted bowl type centrifugal separator especially adapted to separate solids from a liquid of greater specific gravity than the solids. Another object is to provide a continuous centrifugal separator in which the lighter weight solid particles are collected in the central portion. A further object is to provide a centrifugal separator which will separate all or any portion of the liquid from a suspension of lighter weight solids in a liquid of greater specific gravity. A further object is to provide a centrifugal separator to separate ice crystals from aqueous liquids.

These and other objects are attained by my invention which will be understood from the following description, reference being made to the accompanying drawing which forms a part hereof, in which:

Figure 1 is a side elevational view partly in section showing a preferred form of my centrifugal separator;

Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 1; and

Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 1.

Referring to the drawings, my invention consists of an inverted bowl 11 which is mounted for rotation on the vertical shaft 12, the shaft being driven by the belt 13 on the pulley 14. The shaft is mounted for rotation in the upper ball bearing 15 which is supported on the frame 16 which extends on opposite sides from the bottom plate 17 over the top of the separator. The lower ball bearing 18 for the shaft 12 is supported in the bearing hub 19 extending upwardly from the bottom plate 17, the bearing being protected by a conical shield 20 around the shaft. The bowl 11 is suspended from the shaft by the end disk 21 which is keyed at the hub 21A to the shaft 12 by the pin 22. The end disk 21 is provided with feed openings 23 near the periphery which are adapted to distribute the incoming mixture of solids and liquids to the outer wall 26 of the inverted bowl 11. The bowl 11 is provided with a number of stabilizing rings 24 extending inwardly from the inside wall 26 at different elevations, the stabilizing rings 24 being also provided with a plurality of

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holes 25 adjacent the peripheries which guide the movement of the liquid at least in part down the wall 26 of the inverted bowl 11. The liquid mixture is introduced into the centrifugal separator at the top through the stationary feed ring 27 which is connected through the feed pipe 28 to a source of material to be treated. The stationary feed ring 27 is attached to the frame 13 and enters the feed opening 29 in the entrance port section 30 of the inverted bowl 11.

At the lower edge of the inverted bowl there is provided an annular channel 31 which extends inwardly from the wall 26 of the bowl to about the same extent as the stabilizing rings 24, the channel being closed except for the series of entrance ports 32 which correspond generally to the holes 25 in the stabilizer rings. The outlet for the annular channel 31 consists of a plurality of discharge tubes 33 extending radially inwardly from the walls 26 of the bowl inside the channel 31, the discharge tubes being disposed horizontally and being opened at both ends, the inner end being adapted to receive the liquid entering the channel 31 and discharging it through the tubes into a stationary collecting ring 35 which is arranged outside of the inverted bowl and is supported generally on the bottom plate 17. The discharge tubes 33 are threadedly attached in threaded holes 34 in the lower edge of the bowl 11 adjacent the channel 31, lock nuts 37 being provided to secure the positioning of the tubes 33. An outlet pipe 36 permits the discharge of liquid from the collecting rings 35.

The stationary cylinder 40 is arranged inside of the bowl 11 and is supported by the brackets 41 supported on the annular inside wall 35A of the collecting ring 35. The cylinder 40 is provided with an end closure disk 42 at the top which fits loosely around the hub 21A on the end disk 21. The cylinder is provided with vertical slots or openings 43 spaced at intervals around the circumference thereof, there being also provided adjacent the trailing edge of each of the slots a diverting blade 44 which extends angularly outwardly and inwardly from the walls of the cylinder 40, the outer edge 45 of the blade being arranged to clear the inside edges of the stabilizer rings 24. The diverting blades 44 pick up the solids and direct them inside the cylinder 40 where they will drop into the discharge cylinder 46 below the bottom plate 18, there being openings 47 through the bottom plate 18 for the discharge of the collected solids.

The method of operating my centrifugal separator has been indicated in the above descrip-

tion. The inverted bowl 11 is rotated at the desired speed while the mixture of liquid and lighter weight solids is continuously introduced through the feed pipe 28 leading to the stationary feed ring 27 into the entrance port section 30 of the bowl where the liquid is carried to the outer periphery and discharged downwardly through the feed openings 23. The liquid mixture then travels down the outer periphery of the bowl 11 through the holes 25 in the stabilizer rings 24, the stabilizer rings retarding the downward flow and the centrifugal action tending to separate the heavier liquid medium toward the periphery of the bowl while the lighter suspended solid particles migrate toward the axis of the bowl. The thickness of the liquid layer which is thrown out against the wall 26 of the bowl is regulated by the inside length of the discharge tubes 33, the position of the inner end 33A of the tubes 33 being variable through means such as the screw-threaded attachment of the tube previously described. The solids which are accumulated toward the inner ends of the stabilizing rings 24 are picked up by the diverting blades 44 and discharged into the stationary cylinder 40 from which they are removed through the discharge opening 46. The liquid which has been more or less freed from solid particles is discharged through the tubes 33 into the collecting ring 35 from which it is discharged to a suitable receiver through the outlet pipe 36.

The advantages of my centrifugal separator will be apparent from the above description. The device is simple, having only a single moving part and the degree of separation is easily controlled by the positioning of the discharge tubes 33 along with the regulation of speed of operation, so that the separator is adaptable for use on a wide variety of liquid-solid mixtures in which the particles are lighter than the liquid.

I claim:

1. A centrifugal separator adapted particularly for separating a mixture of suspended solid particles in a liquid of greater specific gravity than said particles comprising an inverted cylindrical bowl mounted for rotation on a vertical shaft, a distributor disk attached at its periphery to said bowl near the top thereof, said disk being provided with apertures near the inside wall of said bowl, and being attached concentrically on said shaft, said bowl having stabilizer rings disposed horizontally on its inside surface at different elevations, said rings extending inwardly and being provided with a multiplicity of holes in each ring adjacent the bowl surface, said bowl at its lower edge having a closed annular channel adapted to collect the liquid reaching the said lower edge, said channel having entrance ports on its upper surface, and discharge tubes for said channel, said discharge tubes being disposed radially and extending into the channel; a stationary cylindrical member disposed concentrically about said shaft within said bowl including diverting means disposed adjacent the inner edges of said stabilizer rings and adapted to collect the material discharged at the inner edges of said stabilizer rings; and means for feeding the mixture into the upper portion of said bowl.

2. A centrifugal separator adapted particularly for separating a mixture of suspended solid particles in a liquid of greater specific gravity than said particles comprising an inverted cylindrical bowl mounted for rotation on a vertical shaft, a distributor disk attached at its periphery

to said bowl near the top thereof, said disk being provided with apertures near the inside wall of said bowl, and being attached concentrically on said shaft, said bowl having stabilizer rings disposed horizontally on its inside surface at different elevations, said rings extending inwardly and being provided with a multiplicity of holes in each ring adjacent the bowl service, said bowl at its lower edge having a closed annular channel adapted to collect the liquid reaching the said lower edge, said channel having entrance ports on its upper surface, and discharge tubes for said channel, said discharge tubes being disposed radially and extending into the channel with means for varying the tube length inside said channel; a stationary cylindrical member disposed concentrically about said shaft within said bowl including diverting means to collect the material discharged at the inner edges of said stabilizer rings; and means for feeding the mixture into the upper portion of said bowl.

3. A centrifugal separator adapted particularly for separating a mixture of suspended solid particles in a liquid of greater specific gravity than said particles comprising an inverted cylindrical bowl mounted for rotation on a vertical shaft, a distributor disk attached at its periphery to said bowl near the top thereof, said disk being provided with apertures near the inside wall of said bowl, and being attached concentrically on said shaft, said bowl having stabilizer rings disposed horizontally on its inside surface at different elevations, said rings extending inwardly and being provided with a multiplicity of holes in each ring adjacent the bowl surface, said bowl at its lower edge having a closed annular channel adapted to collect the liquid reaching the said lower edge, said channel having entrance ports on its upper surface, and discharge tubes for said channel, said discharge tubes being disposed radially and extending into the channel with means for varying the tube length inside said channel; a stationary hollow cylinder disposed concentrically about said shaft within said bowl, said cylinder being vertically slotted, with diverting blades attached angularly to the trailing edges of said slots, said blades being adjacent the inner edges of said stabilizer rings; and means for feeding the mixture into the upper portion of said bowl.

4. A centrifugal separator adapted particularly for separating a mixture of suspended solid particles in a liquid of greater specific gravity than said particles comprising an inverted cylindrical bowl mounted for rotation on a vertical shaft, a distributor disk attached at its periphery to said bowl near the top thereof, said disk being provided with apertures near the inside wall of said bowl, and being attached concentrically on said shaft, said bowl having stabilizer rings disposed horizontally on its inside surface at different elevations, said rings extending inwardly and being provided with a multiplicity of holes in each ring adjacent the bowl surface, said bowl at its lower edge having a closed annular channel adapted to collect the liquid reaching the said lower edge, said channel having entrance ports on its upper surface, and discharge tubes for said channel, said discharge tubes being disposed radially and extending into the channel with means for varying the tube length inside said channel; collecting ring means for receiving the discharge from said discharge tubes; a stationary hollow cylinder disposed concentrically

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about said shaft within said bowl, said cylinder being vertically slotted with diverting blades attached angularly to the trailing edges of said slots, said blades being adjacent the inner edges of said stabilizer rings; and means for feeding the mixture into the upper portion of said bowl.

5. A centrifugal separator adapted particularly for separating a mixture of suspended solid particles in a liquid of greater specific gravity than said particles comprising an inverted cylindrical bowl mounted for rotation on a vertical shaft, a distributor disk attached at its periphery to said bowl near the top thereof, said disk being provided with apertures near the inside wall of said bowl, and being attached concentrically on said shaft, said bowl having stabilizer rings disposed horizontally on its inside surface at different elevations, said rings extending inwardly and being provided with a multiplicity of holes in each ring adjacent the bowl surface, said bowl at its lower edge having a closed annular channel adapted to collect the liquid reaching the said lower edge, said channel having entrance

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ports on its upper surface, and discharge tubes at the periphery of said channel; a stationary hollow cylinder disposed concentrically about said shaft within said bowl, said cylinder being vertically slotted with diverting blades attached angularly to the trailing edges of said slots, said blades being adjacent the inner edges of said stabilizer rings; and means for feeding the mixture into the upper portion of said bowl.

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