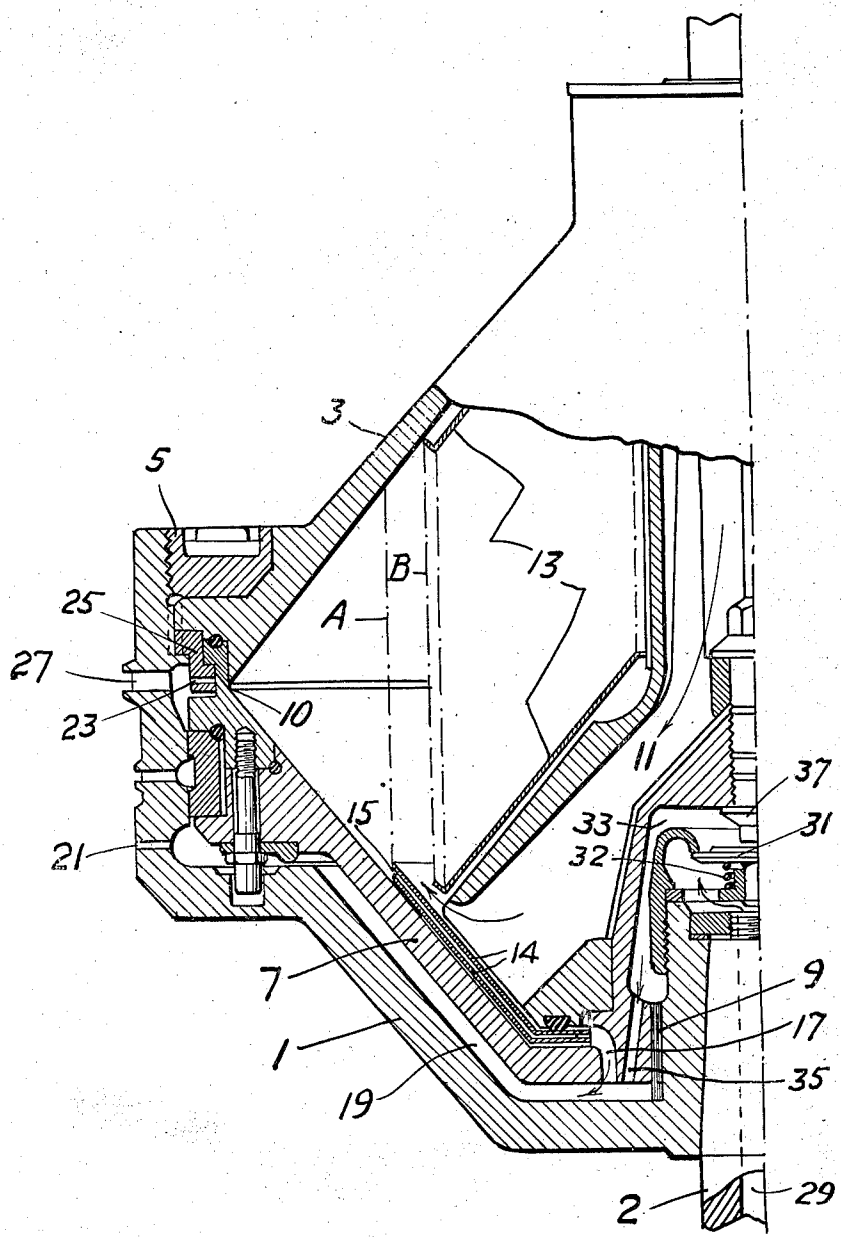
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CENTRIFUGAL SEPARATOR BOWL

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CENTRIFUGAL SEPARATOR BOWL

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This invention is directed to an improvement in a centrifugal separator bowl, more particularly of the type in which a sludge separated from the liquid undergoing treatment is discharged from the periphery of the bowl.

In treating liquids containing a high percentage of sludge, it is customary to use centrifuge bowls which are provided with discharge openings which are opened periodically for the discharge of sludge accumulated in the sludge space. Such discharge openings may either be opened at predetermined intervals, or whenever the separated liquid becomes incompletely purified.

The present invention relates to the improvement in means for automatically opening such discharge openings whenever a given amount of solids has been deposited in the sludge space of the bowl.

A preferred embodiment of the invention is shown in the accompanying drawing, in which the single figure is a vertical cross section through a centrifuge bowl in accordance with the present invention.

In the centrifuge bowl shown in the figure, the walls of the bowl are formed of a lower member 1 mounted upon a spindle 2, and an upper member 3 secured to the lower member by a lock ring 5. Within the bowl so formed, and closely adjacent the lower wall 1, is a member 7 which is keyed to the centrifuge bowl at 9 so as to be axially movable with respect thereto. This slide member 7 is adapted to make, in its upper position, a liquid tight seal at 10 with the upper part 3 of the centrifuge bowl, while in its lower position an annular discharge opening will be formed at 10 between the slide member 7 and the bowl wall 3. Secured to and supported by the slide member 7 in conventional manner are means forming a central inlet channel 11 for liquid to be purified, and a pile of separator discs 13.

A second group of separator discs 14 are positioned just above the slide member 7, and form with the slide member a series of channels 15 leading from the bowl proper through a passage 17 into the chamber 19 formed between the wall 1 of the centrifugal bowl and the slide member 7. The discs 14 extend to a radial distance, indicated by the line A, greater than the radial distance represented by the line B defining the outer edges of the separating discs 13.

When the centrifuge is in operation, a portion of the liquid to be purified will be purified in that portion of the bowl space occupied by the discs 14, and the purified liquid there separated will flow through the passage 17 into the chamber 19, from which it may leak through the restricted discharge openings 21. Of course, liquid will be continuously supplied to the bowl in sufficient quantity to compensate for the liquid discharging through the openings 21. Since the liquid passing into the chamber 19 will have been purified, there is no danger that the discharge openings 21 may be blocked by sludge or other impurities carried by the liquid.

So long as the chamber 19 is filled with liquid, the upward force exerted by the pressure of the liquid in chamber 19 against the slide member 7 will exceed the downward force exerted against this slide member by the main body of liquid in the centrifuge bowl, and the slide member will consequently assume its upper position in which the annular discharge opening 10 is closed. As sludge accumulates in the sludge space of the centrifuge bowl, the level of accumulated sludge will gradually move inwardly until it reaches the radial level indicated by the line A. At this level it will begin to clog the channels 15 formed between the discs 14 and so prevent the entry of liquid to the separating space occupied by these discs, and thence through the passage 17 to the chamber 19. Consequently, as liquid escapes from the chamber 19 through the discharge openings 21, the pressure within that chamber will be reduced and the slide member 7 will be forced downwardly by the pressure within the centrifuge bowl proper. The downward movement of the slide member 7 will open the annular discharge opening 10 through which a portion of the accumulated sludge will be discharged from the centrifuge bowl. The level of sludge in the centrifuge bowl will thereby recede from the level indicated by the line A, and liquid will once more flow through the channels 15 between the discs 14, and thence into the chamber 19. As soon as the upward forces exerted by the liquid within the chamber 19 exceed the downward forces exerted by the main body of liquid in the centrifuge bowl, the slide member 7 will be moved upwardly to close the discharge opening 10.

In accordance with the present invention, the extent of the annular discharge opening 10 formed by the downward movement of the slide member 7 is so controlled as to prevent all of the sludge contained in the sludge space of the bowl from flowing out before the opening is closed again. It is therefore not necessary, in accordance with the present invention, to interrupt the supply of liquid to be separated. Unless a very coarse sludge is contained in the

sludge space, it will be desirable, in accordance with the present invention, to further throttle the discharge of sludge, when the annular discharge opening 10 is opened, by surrounding this discharge opening with a ring 25 containing a plurality of throttled openings 23. Both the discharge opening 10 and the openings 23 are in line with openings 27 formed in the outer wall of the bowl.

It is, of course, also possible to arrange the throttled openings 23 inside the annular opening 10 instead of outside. In either case, in order that the opening shall have the desired effect, the play between the slide member 7 and the fixed wall 3 of the bowl must be very small, so that only a very small part of the sludge can be discharged from the bowl. In the structure shown a recess will be formed just inside the throttled openings 23 when the slide member 7 moves downwardly, and in this recess the sludge which flows through the annular opening so formed may collect.

In order to enable the efficient and economic operation of the centrifuge when the bowl is being filled in starting up, it is necessary to supply liquid to the chamber 19 from some source other than the channels 15 and passage 17, so that the bowl may be kept closed while it is being filled.

Such supply of liquid may be obtained, for example, by feeding liquid directly from the inlet passage 11 to the chamber 19. This, however, is not particularly desirable, since such liquid will not be purified and sludge will enter the chamber 19.

In accordance with the present invention, it is therefore preferred to provide a separate supply of purified liquid for filling the chamber 19, and thus holding the bowl closed while the bowl is being filled with liquid to be purified. Such separate supply of liquid may be conveniently admitted through a channel 29 in the spindle 2 on the separator bowl. The channel 29 may communicate, in conventional manner, with a fixed stationary pipe, the connection being suitably packed so the liquid may be supplied through the channel 29 under pressure. Liquid from the channel 29 will pass to the chamber 19 through passageway 33, controlled by valve 31, and channel 35. Valve 31 is normally held against its seat by a spring 32, and thus closes communication between the channel 29 and the chamber 19 when the slide member 7 is in its upper position. When the slide member 7, however, is in its lower position, valve 31 is opened by the head of screw 37, thus permitting liquid under pressure to enter the chamber 19 from the channel 29, so as to raise the slide 7 and close the discharge opening 10.

If the supply of liquid under pressure to the channel 29 is maintained not only during the filling operation but also during the operation of the centrifuge, it is possible to control the time during which sludge may discharge through the discharge opening 10. This control may be accomplished by regulating the pressure of the liquid within the channel 29 or by adjusting the screw 37.

In the arrangement shown in the drawing, the slide member 7 carrying the separating discs 13, etc., is made movable. It is also possible to unite the upper and lower part of the centrifuge bowl, for instance at the center, the said parts thereby being so shaped that openings for the discharge of the sludge are formed at the outer periphery. Such openings may be kept closed by a slide which is forced upwardly by the pressure of liquid beneath it and which may be operated in the same manner as the slide 7.

When the slide member 7 is wholly operated from the liquid in the separating chamber, i. e., no liquid is admitted from channel 29, it is necessary that the liquid flow into the chamber 19 at a suitable distance from the rotation axis of the bowl, and at a suitable point relative to the liquid discharge from the separating chamber of the bowl, in order to enable the bowl to be modified for different conditions of work. The channel 17 may be arranged in a turntable screw provided with an eccentric opening or with exchangeable regulating discs.

Instead of discharging the sludge from the bowl through the openings 27, it may be advantageous to reconduct it in some way toward the center through channels located outside or in the walls of the bowl. In so doing, a resistance will, of course, be generated, so that the requirements put on the throttled openings 23 will be reduced.

What we claim is:

1. A centrifuge bowl having a separating space and a restricted discharge through the periphery for sludge, a member movable within said bowl to open and close said discharge, means forming with said member a chamber, said member being operated by liquid pressure within said chamber, a restricted outlet from said chamber to the exterior of said centrifuge bowl, and a channel connecting said chamber with the sludge space of said bowl, the means forming with said movable member the said chamber being a wall of the bowl and the said movable member being a plate slidable parallel with the axis of the bowl and the area of which exposed to the pressure within said chamber is greater than the area exposed to the pressure of the liquid in the separating space of the bowl.

2. A centrifugal bowl having a restricted outlet through the periphery for separated sludge, a member movable parallel with the axis of the bowl in opposite directions to open and close said outlet and having on one face an area exposed to pressure within the separating space of the bowl, means forming with said member a chamber, said member on its other face being exposed to pressure within said chamber, the means forming with said member the said chamber being a wall of the bowl the face of the member exposed to pressure in the chamber being of greater diameter and of greater area than the area of the face of the member exposed to pressure in the separating space, said chamber having a restricted outlet for separated liquid to the exterior of the bowl, a channel connecting said chamber with the sludge space of the bowl at a shorter distance than said sludge outlet from the bowl's axis and through which separated liquid is adapted to intermittently flow into said chamber to thereby intermittently subject the second named face of said member to pressure, said member being thereby movable parallel with the axis of the bowl in opposite directions to open and close the sludge outlet as above specified.

3. In a centrifugal bowl, having a discharge for sludge therefrom, an annular member movable back and forth in the direction of the bowl's axis to close and open said discharge and enclosing between it and one end of the bowl the bowl's separating space and enclosing between it and the other end of the bowl a liquid pressure chamber, there being a restricted outlet from said chamber

to the exterior of the bowl and a channel connecting the sludge space of the bowl with said chamber, the maximum diameter of the wall of said member exposed to pressure within said chamber exceeding the diameter of the entrance to said discharge and thus exceeding the diameter of its wall exposed to the pressure within said separating space, the area of said member exposed to pressure within said chamber exceeding the area exposed to the pressure of the liquid in the separating space of the bowl, so that during flow of liquid through said channel into said chamber the liquid pressure in said chamber will exceed the liquid pressure in said separating space and be effective to move and hold said member toward the first named end of the bowl and thus maintain said sludge discharge closed, while accumulation of sludge adequate to substantially close the flow of liquid through said channel will, due to the escape of liquid from said chamber through said restricted opening and consequent drop in liquid pressure therein, render the pressure in the separating space of the bowl effective to move said member toward the second named end of the bowl and thus open the sludge discharge.

4. A centrifugal separator for separating sludge from liquid, comprising a centrifugal bowl having openings for discharge of sludge and for discharge of purified liquid respectively, a slide member within the bowl and forming one wall of the bowl's separating space and movable axially to open and close communication between the peripheral part of the sludge space of the said separating space and said sludge discharge, said slide member forming between it and a part of the bowl wall a chamber, the area of the wall of said slide member exposed to pressure within said chamber being greater than the area of the wall of said slide member exposed to pressure within the separating space of the bowl, said chamber having a restricted outlet, a channel connecting said chamber with the inner part of the said sludge space and adapted to purify liquid in its passage therethrough and convey it to said chamber and thereby exert a liquid pressure therein effective to move said slide member into position to close the sludge discharge, said channel adapted to be closed by accumulation of sludge in said sludge space to thereby shut off inflow of liquid to said chamber, thereby reducing the pressure therein and rendering the pressure of liquid in the separating space effective to move said slide member into position to open said sludge discharge until after sufficient sludge is discharged to allow resumption of flow of purified liquid through said channel into said chamber.

5. In a centrifuge bowl having a separating space and a discharge for sludge therefrom, a single member having an area exposed to the pressure within said separating space and which is movable within said bowl to open and close said discharge, means forming with said member a chamber, said member being operated by liquid pressure within said chamber and having an area exposed to pressure within said chamber which is greater than the area exposed to pressure within said separating space, a restricted discharge opening from said chamber to the exterior of said centrifuge bowl, a channel connecting said chamber with the sludge space of said bowl, and means forming a separate conduit leading to said chamber from outside said centrifuge bowl for the admission of operating liquid to said chamber.

6. In a centrifuge bowl having a separating space and a discharge for sludge therefrom, a single member having an area exposed to the pressure within said separating space and which is movable within said bowl to open and close said discharge, means forming with said member a chamber, said member being operated by liquid pressure within said chamber and having an area exposed to pressure within said chamber which is greater than the area exposed to pressure within said separating space, a restricted discharge opening from said chamber to the exterior of said centrifuge bowl, a channel connecting said chamber with the sludge space of said bowl, means forming a separate conduit leading to said chamber from outside said centrifuge bowl for the admission of operating liquid to said chamber, a valve controlling said last named conduit, and means for operating said valve in response to movements of said movable member.

7. A centrifugal bowl having a separating space and a restricted outlet through the periphery for sludge, a single member movable within said bowl to open and close said sludge discharge, means forming with said member a chamber, said member having a larger area exposed to pressure within the chamber and a smaller member exposed to pressure within said separating space said chamber having a restricted peripheral outlet, discs within the bowl providing a channel through which separated sludge-free liquid flows inward toward the axis of the bowl and thence into said chamber and thereby creates a liquid pressure therein adequate to move and hold said member into position to close the sludge discharge, accumulations of sludge being adapted to close the outer ends of the discs against free flow of liquid through said channel, thereby so reducing the liquid pressure in said chamber that the pressure of liquid in the separating space of the bowl will move said member into position to open the sludge discharge.

8. In a centrifugal bowl, a member axially movable back and forth within the bowl and forming between it and one end of the bowl a separating space and forming between it and the other end of the bowl a narrow chamber adapted to receive separated liquid as hereinafter specified, said bowl having a peripheral restricted sludge outlet from said separating space, said axially movable member being adapted in its back and forth movement to open and close said sludge outlet and having one face of relatively small area exposed to pressure in the separating space and another face of relatively large area exposed to pressure in said chamber, a channel through which separated liquid can flow from the separating space to said chamber when there is relatively little separated sludge in the separating space and closable by accumulation of a predetermined thickness of separated sludge in the separating space to thereby stop said flow, there being in said chamber a restricted opening for discharge of liquid flowing thereinto; whereby the excess pressure in said chamber, when separated liquid is flowing thereinto, moves said member into position to close said sludge outlet and whereby the pressure in the separating space, after admission of separated liquid into said chamber is stopped by accumulation of sludge, moves said member into position to open said sludge outlet.

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