

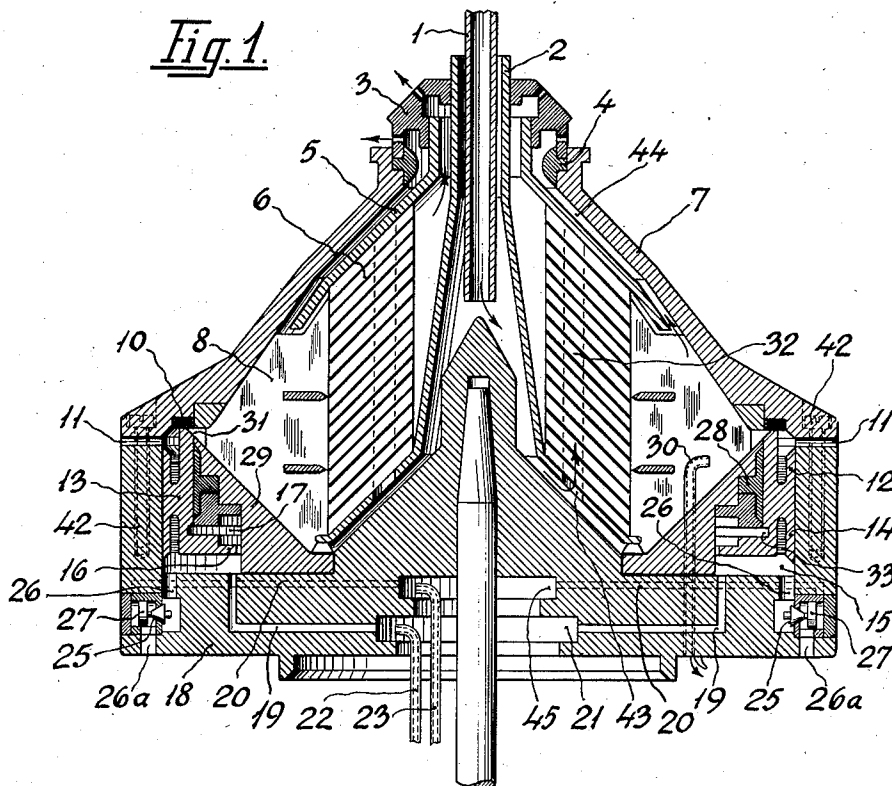
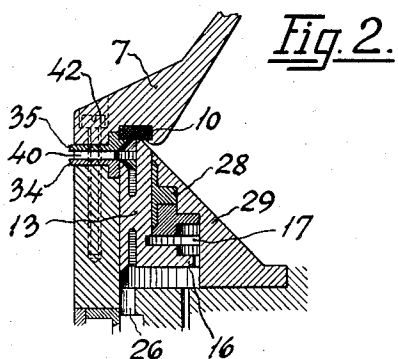
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SELF-DISCHARGING SLUDGE SEPARATOR

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SELF-DISCHARGING SLUDGE SEPARATOR

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3 Claims. (Cl. 233—20)

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The present invention relates to a self-discharging sludge separator designed to separate sludge from one or two liquids.

More particularly the invention relates to centrifugal separators of the type in which the bowl is divided into two parts which are adapted to undergo a relative axial movement at periodic intervals, to afford provision for discharge of sludge between the bowl parts. Such separators are described in my prior Patent No. 2,091,329.

In the separation of various fluids and sludge it is of importance that the slot, or the slots, at the periphery of the bowl, and through which the sludge is discharged, are opened and kept in their fully opened condition for a period sufficiently long to permit all the sludge to be discharged. The aim of the present invention is to provide means for attaining such a desired opening of the said slot or slots.

This arrangement ensures that coarse and tough sludge which otherwise will adhere to the sides of the separating drum is given a sufficient opening of the slot, and sufficiently long time to be discharged from the bowl with as little resistance as possible.

In separators of the type in question it has been aimed to achieve a rapid opening of the peripheral slots by means of a fluid and rapidly operating valves, but as the time of actual discharge is very short, certain difficulties have been experienced to open the slots to their full extent, because pressure within the separator bowl is decreased during the opening.

The present invention tends not only to provide a rapid opening of the peripheral slot or slots of the bowl, but likewise to ensure a free or full opening. This can be attained by means of an axially disposed reciprocating member for closing said slots provided with an integral circular flange between which and a part of the bowl is arranged a circular groove or space that will hold some of the fluid used for reciprocating the said member.

The fluid will remain in the circular groove on account of the centrifugal force, and will tend to actuate and force said reciprocating member into open position.

A complete understanding of the invention will be derived from the following detailed description with reference to the accompanying drawing, in which Fig. 1 shows an axial sectional view of a sludge separator according to the invention and Fig. 2 is a detail section showing a modification.

Referring to the drawing, 7 indicates the top

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part of a separator bowl which in conventional manner is screwed to the bottom parts of the bowl for instance by means of bolts 42. A centre tube 2 has attached thereto a discharge ring 3 carrying distributing discs 6, separating plates 5, and an insert 8 with wings extending into the separator bowl, serving to give the fluid to be treated the same rotational speed as the bowl parts. The fluid to be separated is charged through a pipe 1 into the centre tube 2 from the lower end of which it is conveyed into the actual separating space. The fluid passes either round the lower end of the centre tube and from outside in between the discs 6, or it is conveyed through apertures 43 in the lower end of the centre tube 2 upwardly through distributing holes 32 in the discs 6. During separation the lighter components of the fluid will move centripetally between the discs and collect in the space interior to these, and from here be discharged through the discharge ring 3, whereas the heavier components of the fluid will pass round the exterior edge of the separating plates 5 and be discharged through one or several channels or spaces 44 above the said separating plates to the discharge ring 3. These heavier fluid components pass an annular weir 4 detachably connected to the upper bowl part 7. By inserting weirs of varying diameter it is possible to regulate the separation line in the bowl between heavy and light fluid components. If the liquid only contains one kind of fluid the discharge over the weir may be closed.

During separation the solid component in the fluid, if heavier than the fluid, will collect in the space near the periphery of the bowl. The bowl has one or several slots 11 which are closed during separation of the solid components within the bowl by means of a reciprocable annular piston 13 mounted in an annular groove in the bowl which piston periodically is operated to uncover the slots, thus allowing the sludge collected in the separator bowl to be ejected by centrifugal force. This annular piston 13 reciprocates as a piston in a cylinder, being guided vertically in an annular groove or channel formed between the upright, outer, cylindrical portion of the lower part 18 of the body and an inner part 29 positioned within said lower part. It will be noted that the lower portion of this fixed inner part 29 is of reduced diameter to provide an enlarged annular chamber 15 extending inwardly from the bottom of the annular groove or channel in which the piston slides.

By means of a piston-actuating liquid con-

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veyed to the space or chamber 15 and subjected to centrifugal force, the piston is forced upwardly against a gasket 10 to seal the discharge slots 11. The outer side of the upright portion of the piston 13 may be provided with integrally formed, upper and lower, flexible and resilient lips 12 and 13 which slide on the inner face of the upright cylindrical portion of the lower part 18 and serve as packing rings. Centrifugal force will throw the lips outwardly into sealing position. The inner face of the upright portion of the piston may be sealed by a lipped resilient packing ring 28 held in position on the inner part 29 by a suitable retaining ring as shown. These packings 12, 14 and 28 are to prevent fluids from by-passing the piston. The piston-actuating liquid is sprayed from a tube or tubes 22 into a groove 21 and is by centrifugal force pressed into the bottom of the space or chamber 15 through channels 19.

During the periods in which the slots 11 are closed a tiny jet of liquid may be constantly sprayed into the groove 21 to provide hydraulic pressure in the space below the piston to ensure the slots 11 being held closed during these periods.

As above noted it is important particularly when the separator is handling matter having solids of a sticky or adhesive nature, for the slots 11 to be opened quickly and fully. To aid in accomplishing that aim, I provide for the quick escape of the liquid beneath the piston so that the pressure within the separator may act on the obtuse edge 31 of the piston 13 to move it downwardly to open the slots 11. To permit of such quick release of the liquid I provide one or more relatively large outlets or discharge passages 26, 26^a from the bottom of the chamber 15 to the exterior. These passages are controlled by valves 25 which carry pistons 27 and which are of well-known type, being centrifugally operated to closed positions and being hydraulically operated to opened positions.

When the discharge slots 11 are to be opened, the operating liquid is sprayed from a tube 23 into a groove 45. By centrifugal force the liquid passes through channels 20 to the spaces at the outer ends of the cylinders in which the pistons 27 reciprocate, the pistons being thus forced inwardly to open the valves 25. The liquid in the space or chamber 15 may then discharge through the passages 26, 26^a to release the pressure on the bottom of the piston 13, so that the pressure of the fluid and solid material in the separating section of the body on the edge 31 will cause the piston to move downwardly to open the slots 11. The control of the operating liquid may be a four-way valve, not shown.

As the pressure in the separating compartment on the edge 31 of the piston decreases as soon as the slots 11 open, the displacement of and the maintenance of the piston 13 in its open position will be uncertain even when the displacement or opening movement is rapid. To remedy this, the annular groove or channel in which the piston 13 slides has the above mentioned enlarged chamber 15 extending inwardly at the bottom of the guiding channel, and the piston is provided with a preferably integral and relatively wide radial flange 16 projecting inwardly from its lower end into said enlarged chamber to divide this chamber into a lower space below the flange and an annular, groove-like upper space 17 above the flange. This wide

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annular flange 16 has its inner edge slightly spaced from the inner wall of the chamber so that there is an open but restricted communication between the lower and upper spaces. Hence the working liquid entering the lower portion of the chamber through the passage or passages 19 will also enter the groove-like upper space 17, and there will be a tendency of the liquid above the flange to be retained in the space 17 when the liquid below the flange is permitted for rapidly discharge upon the opening of the valves 25. This liquid will, on account of centrifugal force, remain in the upper space 17, and it will consequently exercise a strong hydrostatic pressure tending to force the annular piston downwardly to open position and keep it there until liquid is again admitted to the chamber through the passages 19 for the reverse action. It will be noted that the area of the flange 16 in contact with the lower space is greater than that in contact with the upper space. I have found that this action of the substantial body of liquid retained by centrifugal force in the upper space 17, not only aids the quick opening of the piston to its fully opened position but tends to hold the piston in such fully open position so that even very tough, sticky and coarse solid matter will be satisfactorily ejected through the slots 11.

The groove-like upper space 17 is preferably made of angular shape in cross-section, being narrow vertically at its largest diameter and wider vertically at its smallest diameter. This may be done by forming the upper face of the flange 16 at its inner edge with an annular recess and forming a similar opposed recess in the portion of the inner part 29 forming the top of the enlarged chamber, as clearly shown in the drawings. By thus widening the inner portion of the space 17 a vertically thick body of liquid in the groove-like space is attained, and consequently there will be a greater downward pressure on the flange 16 when liquid is quickly discharged from the space beneath the flange. As the piston lowers, the upper space 17 widens vertically and hence the wider inner portion will act as a reservoir for the narrower outer portion, and a considerable amount of the liquid will be retained by centrifugal force above the flange 16.

I also preferably form in the piston 13 an inwardly-open, annular groove 33 which opens into the reduced or narrower outer portion of the upper space 17. This groove 33 forms a collecting pocket for any solid particles or impurities in the piston-actuating liquid. Such impurities will consequently not constitute any hindrance to the reciprocation of the piston 13. Discharge pipes or members 30 for continuous discharge of semi-solid sludge may be arranged in the separator bowl.

As shown in Fig. 2 interchangeable parts 34 and 35 for replacement together with members 40 when worn, may be provided in the peripheral slots 11.

All the functions for supplying piston actuating liquid and valve manoeuvring liquid may be operated manually, or be arranged for automatic operation.

It will readily be understood that the construction can be modified in various manners within the scope of the invention as defined in the following claims.

I claim:

1. A centrifugal separator, including a bowl

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adapted to be rotated to effect continuous discharge of liquid effluents and the concentration of suspended solid material within the bowl, and provided with peripheral slots for the intermittent discharge of concentrated solid material, said bowl having a body with outer and inner portions between which is an annular piston-receiving channel and an enlarged, annular chamber which extends inwardly at the bottom of said channel, an annular discharge-controlling piston mounted in said channel for reciprocation therein against and away from a sealing surface to control the discharge of concentrated solid material from said peripheral slots, said piston being provided with a radial flange extending inwardly from its lower portion and into said chamber to divide the latter into a lower space below said flange and an upper, annular groove-like space above said flange, said upper and lower spaces being in open communication with each other around the inner edge of said flange and both being adapted to receive a piston-actuating liquid, the area of the flange in contact with the lower space being greater than that in contact with the upper space, means for admitting a piston-actuating liquid into said lower space to act on the bottom of said flange to move said piston upwardly to sealing position and to enter said upper space around the inner edge of said flange, valve-controlled, quick-escape, liquid passages leading from said lower space to permit the quick discharge of liquid beneath the flange during motion of the piston downwardly to discharge position for concentrated solids, and valves for controlling said discharge passages, said valves being centrifugally actuated to closed positions and hydraulically op-

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erated to open positions, said upper groove-like space being so proportioned and arranged that when said valves are hydraulically operated to permit of the quick escape of liquid beneath the flange, a substantial body of liquid will be retained by centrifugal force in the space above said flange and will exert a hydrostatic pressure tending to force said flange downwardly to assist in the quick and full opening of said piston.

2. The structure of claim 1 in which said upper groove-like annular space has an angular cross-section, being narrow in a vertical direction at its larger diameter and wide in a vertical direction at its smaller diameter.

3. The structure of claim 1 in which said piston is formed with an inwardly open annular groove to collect impurities in the piston-actuating fluid, said groove opening into said groove-like upper space at its largest diameter.

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The following references are of record in the file of this patent:

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