Dec. 2, 1958 A. NYROP 2,862,659

CENTRIFUGAL SEPARATOR

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Fig. 1

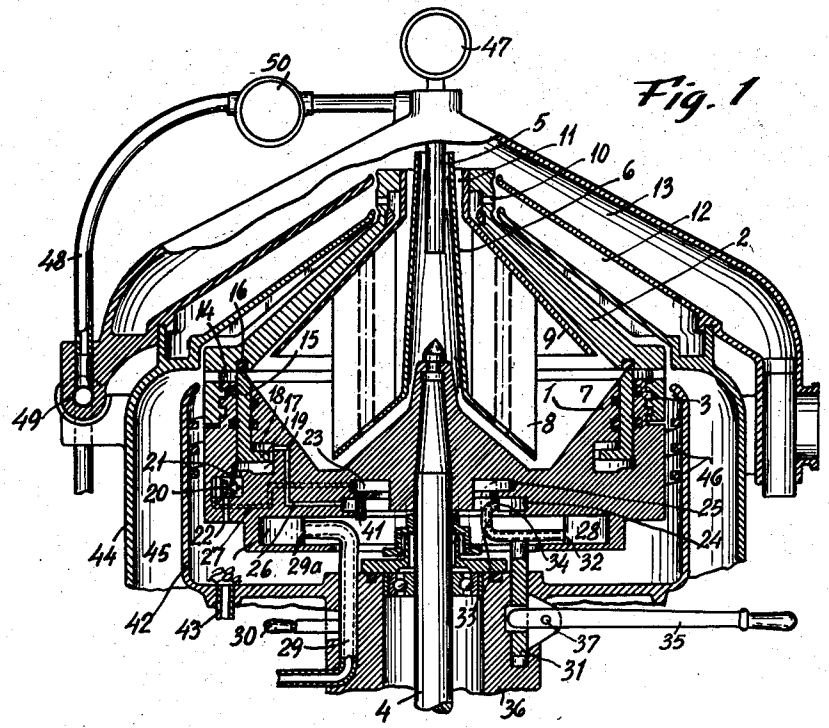


Fig. 2

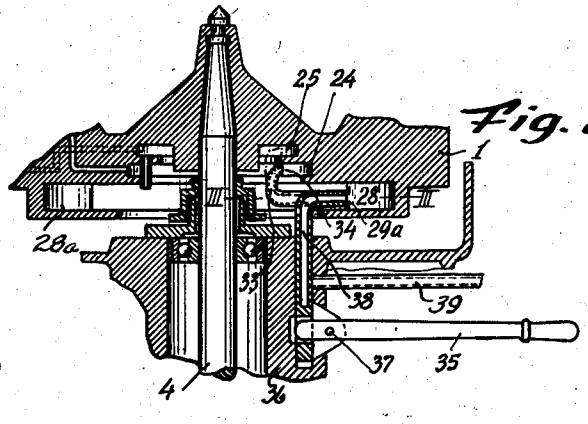


Fig. 4

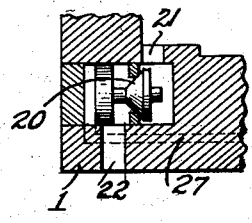
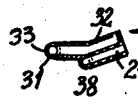


Fig. 3



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CENTRIFUGAL SEPARATOR

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4 Claims. (Cl. 233—20)

The present invention relates to improvements in centrifugal separators designed to separate sludge from liquids and discharge such sludge through slots at the periphery of the centrifugal bowl. The invention relates more particularly to a device for feeding and purifying an actuating liquid used to effect the closing and opening of such slots by means of an annular member. The term "sludge" as used herein is to be considered as designating not only impurities in liquids, but any materials including a large proportion of solids of higher specific gravity than the liquids in which they are suspended.

The improved separator is of the type of centrifugal separators in which the centrifugal bowl is mounted for rotation on a vertical axis to effect continuous discharge of liquid effluents and provided with peripherially placed sludge discharge openings for the evacuation of suspended solid material concentrated and collected within the bowl. A suitable shaped sealing piston for controlling the sludge discharge through said openings is mounted for axial reciprocation within the bowl. Said piston is actuated for intermittent displacement partly by pressure of the treated liquid in the bowl and partly by means of an actuating liquid, influenced by centrifugal force, and introduced into a spaced below the said piston through channels from a chamber with annular grooves in the body of the bowl. The actuating liquid is introduced into one of the grooves to cause the closing of the bowl slots, and introduced into the other groove to cause the opening of a valve, as later described.

The actuating liquid introduced into said space below the piston is checked by means of hydrostatic means including a valve device with the result that the actuating liquid is either retained or discharged, thereby causing displacement of the said piston to either close or open the sludge discharging openings in the bowl.

Frequently the actuating liquid is discharged from the separator as waste. In some cases water is used as the actuating liquid, but in cases where water is scarce, or it is found advantageous to use other liquids such as oil or a part of the liquid discharged from the separator, it is important that such liquids be clean and unpolluted. In some cases it is desirable to repeatedly use the same actuating liquid but during the cycle of passing through the bowl and back to the reentering means the liquid becomes polluted. Such a pollution will result in difficulties with the control of the valves and with the displacement of the piston. A constant purification of the actuating liquid is consequently important.

The main object of the invention is to provide a centrifugal separator of the type mentioned with special means for conveying the actuating liquid to the separator and purifying this liquid before it is put to use as the actuating liquid. The improved centrifugal separator has for this purpose an annular reservoir adapted to receive the actuating liquid and retain it for purification under the action of centrifugal force. Further, the separator has means to conduct this liquid to the reservoir and stabilize its level therein. It also has means to selectively conduct the liquid from said reservoir to either of the said annular grooves.

Further features of the invention will be apparent from the following detailed description in connection with the accompanying drawing, in which

Fig. 1 is a central axial sectional view of a separator bowl provided with a reservoir and feeding devices according to the invention;

Fig. 2 is a detail sectional view similar to a portion of Fig. 1, of a modified form of the invention, and showing a special combined device for both feeding the liquid to the reservoir and selectively conducting the purified liquid in the reservoir to the annular grooves;

Fig. 3 is a detail horizontal sectional view of the feeding device in Fig. 2 taken on the line III—III in Fig. 2, and

Fig. 4 is an enlarged detail section showing the ejecting valve means.

Referring more in detail to the drawing, the separator bowl is divided into two coaxial parts, namely, a lower part 1 and an upper part 2, which parts in known manner are interconnected by means of a threaded ring or flange 3 integral with part 2 or by an equivalent connection. The separator bowl is mounted on a shaft 4 that may be rotated at a high speed in a known manner by means of transmission members not shown in the drawing. The separator is provided with a feeding tube 5 for feeding the material to be separated into the centrifugal bowl. In the latter is a distribution tube 6 for the distribution of the material to the interior of the bowl. The distributing tube 6 carries a suitable stack of discs 8. The bowl is further provided with a skimming plate 9 by which it is possible to separate two liquid components of different gravities and a sludge component. The two liquid components may be discharged through discharge openings 10 and 11 into receptacles 12 and 13 respectively, or through known impeller devices, not included in the drawing. The sludge collected in space 7 may be discharged through discharge openings or slots 14 in the circumferential wall of the bowl.

These openings 14 are sealed or unsealed by means of an annular piston 15 mounted for reciprocal movement within an annular groove in the lower part of the bowl. The piston 15 has a flange 17 projecting into a space which, by means of the flange, is divided into two communicating chambers 18 and 19 above and below said flange respectively. In closed-bowl slot condition the piston 15 is held in sealing position by being pressed against a gasket 16 in the upper part 2 of the bowl by means of an actuating liquid influenced by centrifugal force and introduced in the spaces or chambers 18 and 19. The piston 15 is displaced to open the slots 14 partly by pressure of the liquid treated in the bowl and partly by means of an actuating liquid retained in the space 18 when the liquid in the space 19 is ejected by opening one or more ejecting valve means 20 to permit of the escape of the liquid through channels 21 and 22. The valve member or device 20, which can be of any suitable type, is held in closed position by means of centrifugal force. The lower part 1 of the bowl has in its body an annular chamber 23 divided by an inwardly projecting flange into two grooves 24 and 25. The lower groove 24 is connected by a channel 26 with the spaces 18 and 19 and serves to receive actuating liquid for the displacement of the piston 15 to its closed or sealing position. The upper groove 25 is connected by a channel 27 with a space at the valve means 20. This channel 27 serves to conduct an actuating liquid to the valve means for its displacement to open position, thereby permitting of the discharge of the actuating liquid from the space 19 and resulting in the simultaneous displacement of the piston 15 into its lower position to permit the sludge to discharge from the bowl through slots 14. Furthermore, the lower part 1 of the bowl has an annular reservoir 28, which is coaxial with and communicates with the chamber 23 and hence its grooves 24 and 25. This much larger chamber or reservoir 28 is adapted to receive and hold the actuating liquid for its purification by

the action of centrifugal force. The impurities will deposit at the circumferential wall of the reservoir **28** and are removed whenever necessary. It is advantageous to provide inwardly extending ribs or wings **28***a* in the outer zone of the reservoir **28** to bring the liquid to the same speed of rotation as the bowl. Because of centrifugal action the actuating liquid conveyed to the spaces **18**, **19** and **20** will be in a pure condition. The actuating liquid is conveyed to the reservoir **28** by means of an upright tubular member **29** provided at its top with a laterally turned end forming a paring or skimming device **29***a*. The member **29** is rotatably mounted in the separator frame **36** and can be turned round its vertical axis by means of a handle **30** fixed to it and moving in a slot in the frame. Thus it is possible to place the skimming member **29***a* in a predetermined position so that the level of the liquid in the reservoir may be kept constant. The liquid is conveyed to the reservoir under a suitable pressure and when the surface of the liquid in the reservoir reaches the skimming member **29***a*, the feed will be checked by the hydrostatic counter pressure generated in the skimming member when touching the liquid. In this manner it is possible automatically to maintain a predetermined level of the liquid in the reservoir **28**.

The actuating liquid is conveyed from the reservoir **28** to the annular grooves **24** and **25** by means of a conveying device. This device is mounted for vertical movement in the separator frame **36** and consists of a vertical spindle **31** with a paring or skimming device at its upper end disposed in the reservoir. The spindle is mounted to reciprocate and the skimming and feeding device comprises a tubular element **33** fixed between its ends to the top of the spindle and having an open inlet end **32** and an upwardly turned discharge end **33** terminating in an open outwardly directed extremity **34**. The inlet end extends radially outward and the upright discharge end **34** is of such height that by vertically adjusting the spindle the extremity **34** may be positioned to direct the liquid into either of the grooves **24** or **25**. During the rotation of the bowl the skimming end **32** will skim the liquid from the surface of the body of liquid in the reservoir and convey it either to the groove **24** or to the groove **25**. When the outlet **34** is placed to feed into the groove **24**, the actuating liquid will from this groove be conveyed through the channel **26** to the spaces **18**, **19** and consequently force the piston **15** to its bowl closing position. When the outlet **34** is moved to feed into groove **25**, the actuating liquid will from this groove be conveyed through the channel **27** to a space at the valve member **20** and force this valve member into open position with the result, that the actuating liquid in the space **19** below the flange **17** will be discharged from the passage **22**. The hydrostatic pressure of the treated liquid in the interior **7** of the bowl and in the liquid in the space **18** above the flange **17** will force the piston **15** downward and thereby open the sludge discharge slots **14**. The device with the member **31**, **32**, **33** and **34** may be moved to action either mechanically or manually as by means of a handle **35**, which is jointed to the spindle **31** and is able to turn around an axis **37** in the separator frame **36**. The handle **35** can be locked in a known manner.

To simplify the construction the liquid feed to the reservoir and the selective discharge of liquid from the latter to the grooves may be combined as shown in Figs. 2 and 3. In such a construction the spindle has a bore **38** in its upper part, which can guide liquid from an inlet **39** to the skimming element **29***a*. The means for conducting liquid from the reservoir to the grooves may be mounted on one side of the member **29***a* as seen in Fig. 3. The annular grooves **24** and **25** are coaxial with the reservoir **28** and their dams have such a diameter that a surplus of liquid from the grooves **24** and **25** will stream back to the reservoir **28**, thereby avoiding loss of liquid. With a special construction the groove **25** may be provided with overflow tubes **41** by which the level of the liquid in the groove is checked.

To collect the actuating liquid, which is discharged from the space **19** through the valve means **20**, the centrifugal bowl is surrounded with a receptacle **42** carried by the frame **36**. The receptacle **42** has a discharge tube **43**, which in certain cases may be connected with the feed pipe or member **29** through a suitable pumping means so that the discharged actuating liquid may be conveyed back to the reservoir **28**. Surrounding the receptacle **42** there is a wall **44** to form a compartment **45** to collect the sludge which is discharged from the interior **7** of the centrifugal bowl through the slots **14**. In the space between the wall of the receptacle **42** and the exterior of the centrifugal bowl there are arranged annular rib-like members **46** to prevent sludge from entering the receptacle **42**.

The feeding tube **6** is provided with a thermometer **47** to show the temperature of the liquid supplied through a tube **48** to the feed tube **6**. A flow control meter **59** may be in the feed tube **48**.

The part of the separator forming the receptacles **12** and **13** is hingedly connected with the frame by a hinge **49**.

I declare that what I claim is:

1. In a centrifugal separator, the combination of a centrifugal bowl mounted for rotation on a vertical axis to effect continuous discharge of liquid effluents and provided with peripheral sludge discharge openings for suspended solid material collected within the bowl, a sealing piston for controlling the sludge discharge through said openings and mounted for axial reciprocation within the bowl, said piston being actuated to intermittent displacement partly by pressure of the treated liquid and partly by means of an actuating liquid influenced by centrifugal force and conducted by means of a channel from an annular groove in the body of the bowl to a space below said piston, said space being connected with a discharge arrangement for the actuating liquid, this discharge arrangement comprising a valve means and hydrostatic means for displacement of the valve means to an open position to permit the discharge of the actuating liquid and the simultaneous resulting movement of said piston to its open sludge-discharging position, said hydrostatic means in the body of the said bowl comprising a second annular groove for intermittent reception of actuating liquid and communicating with said valve means, an annular reservoir adapted to receive and hold the actuating liquid for purification by centrifugal force, means to conduct actuating liquid to said reservoir and means to conduct actuating liquid from said reservoir to either of said annular grooves to cause the actions described.

2. In the structure of a centrifugal separator as described in claim 1 in which said annular grooves in the body of the bowl have means to conduct surplus of actuating liquid back to said reservoir.

3. In the structure of a centrifugal separator as described in claim 1 in which said means to conduct actuating liquid from said reservoir to said annular grooves comprises a reciprocating device which can conduct the actuating liquid alternately from said reservoir to either of said grooves to effect opening or closing the sludge discharge openings in the bowl.

4. In the structure of a centrifugal separator as described in claim 1 in which said means for conducting actuating liquid to said reservoir includes an adjustable device capable of adjusting the surface level of the actuating liquid in the reservoir to a predetermined level.

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