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(54) IMPROVEMENTS RELATING TO CENTRIFUGAL SEPARATORS

(71) We, WESTFALIA SEPARATOR AG, a German Body Corporate, of 4740 Oelde 1/ Westfalen, Postfach 2420, Germany, do hereby declare this invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a centrifugal separator drum with drain valves for the solids centrifuged out when clarifying or separating solids-containing liquids, in which, in the plane of the largest drum diameter the valves are arranged in a uniformly peripherally distributed manner, and the movable valve bodies are screened relative to the pressure of the drum charge, are closed by centrifugal force during operation, and can be opened by means of a control fluid while the drum is rotating at full speed.

Centrifugal separator drums of this type are known per se and are preferably used for liquids containing solids having a soft, yeast-like consistency, e.g. culture filtrates for obtaining antibiotics, bacterial cultures and the like whose solids proportion can vary very greatly.

A centrifugal separator drum of this type is for example known from UK Patent Specification No. 1,338,369. In this drum it is disadvantageous that the valves themselves and the feed lines for the operating liquid are arranged in the centrifugation chamber or in the solids chamber. This arrangement of the valves and lines on the one hand leads to a significant reduction of the volume of the solids chamber and on the other makes sterile operation impossible, whereas this is required or necessary in the case of a very large number of liquids.

Furthermore, in the case of leaks past sealing gaskets, the operating liquid can enter the solids chamber or get mixed with the material being centrifuged, which in most cases must be avoided.

In addition, CIP cleaning (Cleaning In Place) which has been introduced in many plants can only be performed with a limited success with this drum, because there are too

many possibilities of solid particles being deposited which are then not removed by the washing liquid.

Figure 6 of German Patent Specification No. 717,992 shows a drum in which the solids chamber is almost free from valve components. However the main disadvantage is that the valve piston, when being displaced in the opening direction, must be moved counter to the pressure of the solids deposited in the solids chamber and the liquid charge of the drum.

The opening force to be applied by the operating liquid, normally water, is in many cases not sufficient to bring the valve piston into the opening position counter to the said pressure acting in the closing direction.

As the known drums with drain valves do not fulfil the requirements which are now made on a centrifuge, often more complicated and expensive centrifuges, e.g. the self-cleaning type with sliding piston, are used for the indicated applications.

When several centrifuges are arranged in series, e.g. in the case of counter-current extraction of anti-biotics, the process becomes uneconomical.

However, it is for these and similar processes that centrifugal separation drums with drain valves are well suited, because their construction is much more simple, they have large centrifugation chamber and solids chamber volumes, and they discharge the separated solids in a satisfactory manner.

An object of the invention is to so construct a centrifugal separator drum with drain valves that the inner space of the drum is free from valve components and their feed lines and the centrifugal solids can be removed in a troublefree and complete manner from the centrifugal drum, so that sterile working and easy cleaning are possible.

According to the present invention in a centrifugal separator drum with drain valves for the solids centrifuged when clarifying or separating solids-containing liquids, in the plane of the largest drum diameter the valves are arranged in a uniformly peripherally distributed manner and the movable valve

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bodies are screened relative to the pressure of the drum charge, and the valve bodies are maintained in the closed position by centrifugal force during operation and can be urged to the open position by a control fluid when the drum is operating at full speed, the valves being arranged in the drum jacket and supply lines for the control fluid pass through the base of the drum.

The valve seat or the end face of the moveable valve body of each valve may be provided with permanently opened calibrated ducts or slots so that there is a continuous draining of part of the solids, and complete emptying is only necessary when the solids chamber is almost full, whereby the commencement of the complete discharge of solids can be brought about by means of a monitoring system e.g. using a photoelectric cell when clarified liquid becomes turbid.

As a result the intervals between emptying can become much longer, and the faults which occur in the case of simultaneous separation of liquid mixtures into their components, and which are caused by displacement of the separating zone during solids discharge, are eliminated. Valves with permanently opened calibrated ducts are particularly advantageous if the solids content of the material being centrifuged is high.

The invention may be performed in various ways, and one specific embodiment will now be described by way of example in which:—

Figure 1 a longitudinal section through the lefthand half of a separating drum according to the invention.

Figure 2 an enlarged section through the closed valve.

Figure 3 an enlarged section through the open valve, and

Figure 4 an enlarged section through another valve with additional calibrated ducts or slots in the valve piston or in the valve cone.

With reference to Figure 1 the solids-containing liquid mixture to be separated is passed centrally through an inlet tube 1 into a distributor chamber 2, flows through rising ducts 3 of a disc set 4, whereby the lower density liquid component flows inwards through the disc set and is discharged through duct 5 which can issue into a paring chamber. The separated denser liquid flows through the disc set radially towards the drum periphery, is diverted around a separating disc 6 and discharged through ducts 7. A line 8 marks the separating zone between the specifically lighter and heavier components. The solid matter which is also centrifuged outwards is collected in solids chamber 9. The drain valves 11 are uniformly distributed over the periphery of drum jacket 10. In base 10a of the drum are provided the ducts 12 for supplying the operating liquid. The opening of valves 11 takes place through supplying an operating liquid through a feed line 13 located

outside the drum. The draining of the operating liquid from the valves 11 takes place after blocking the supply, through emptying ducts 14, which are provided with a constriction 15. The solids are discharged into the sludge collector 16 by the valves. The drum is closed by a lid 17, which is fastened firmly to the drum jacket 10 by means of a lock ring 18.

Figure 2 shows an enlarged section through a closed drain valve 11 and Figure 3 through the open drain valve 11, which comprises valve housing 19, valve body 20, valve seat 21 guide piece 22, and various seals. The valve housing 19 contains emptying ducts 23, for the solids and an annular duct 24 with bores 25 for the operating liquid, the bores being connected to an annular duct 26. Annular duct 24 is also connected with one of the supply ducts 12 for the operating liquid and one of the emptying ducts 14. The valve seat 21 contains a duct 27 by means of which the solids are ejected when the valve is open. Duct 28 in valve body 20 is a vent duct.

The valve functions in the following manner:

During operation, under the action of centrifugal force valve body 20 with its conical end face 29 movable and sealingly guided in guide piece 22 and valve housing 19, seals the emptying duct 27 in the valve seat 21 and consequently prevents the escape of solids from chamber 9.

When the solids chamber 9 is to be emptied, operating liquid is passed through the feed line 13 into ducts 12 of drum base 10a. It passes from annular duct 24 of valve housing 19 via bores 25 into the annular duct 26 where a liquid pressure builds up which, counter to the centrifugal force, moves valve body 20 radially towards the drum axis and, as shown in Figure 3 releases gap 30 between the conical end face 29 of valve body 20 and valve seat 21, so that solids are ejected from the drum through the ducts 23, annular gap 30 and duct 27. After shutting off the feed line 13, the operating liquid escapes through the emptying duct 14, whose outlet has a constriction 15 which is to permit a pressure build-up in the annular duct 26 during operating liquid supply. While the operating liquid contained in annular duct 26 escapes, the valve body 20 is displaced towards the valve seat 21, thus closing the emptying duct 27.

Figure 4 shows a section through another type of valve 11 for the additional continuous draining of a certain quantity of solids during operation. To this end, either calibrated ducts or slots 31 are provided in the valve seat 21 or calibrated ducts or slots 32 are provided on the end face of the valve body 20, so that a certain amount of solids is continually drained off from the solids chamber 9 through bores 23, the said cali-

brated ducts, and duct 27. At predetermined intervals, a complete emptying or an additional partial emptying of the solids chamber can be performed by a more or less brief opening of the valve.

WHAT WE CLAIM IS:—

1. A centrifugal separator drum with drain valves for the solids centrifuged when clarifying or separating solids-containing liquids, wherein in the plane of the largest drum diameter the valves are arranged in a uniformly peripherally distributed manner and the movable valve bodies are screened relative to the pressure of the drum charge, and wherein the valve bodies are maintained in the closed position by centrifugal force during operation and can be urged to the opened position by a

control fluid when the drum is operating at speed, the valves being arranged in the drum jacket and supply lines for the control fluid passing through the base of the drum.

2. A centrifugal separator drum according to claim 1, wherein the valve seat or the end face of the movable valve body of each valve is provided with permanently opened calibrated ducts or slots.

3. A centrifugal separator drum substantially as described hereinbefore with reference to the drawings.

For the Applicants:  
G. F. REDFERN & CO.,  
High Holborn House,  
52-54 High Holborn,  
London WC1V 6RL.

FIG. 1

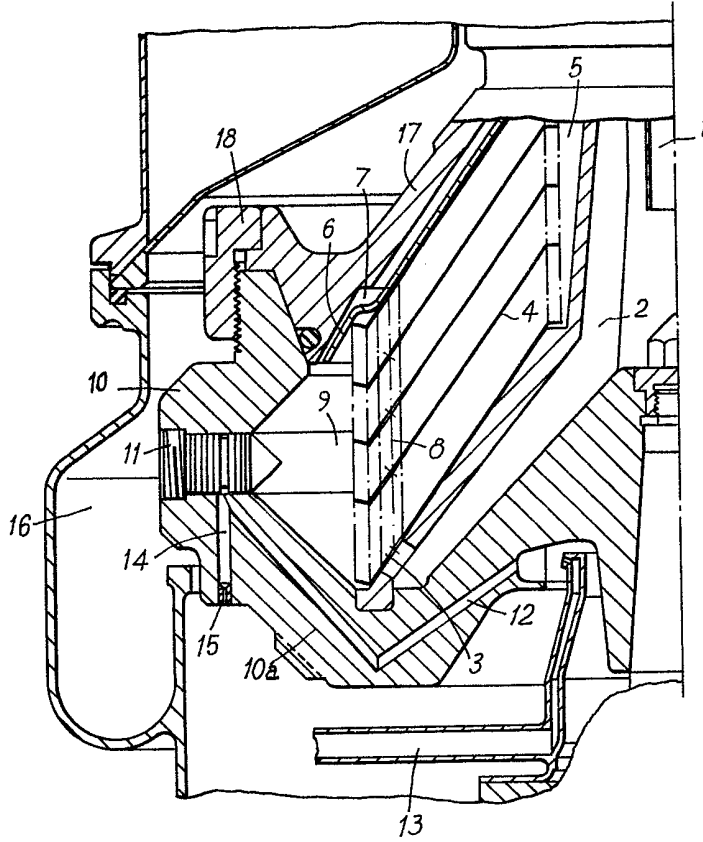


FIG.2

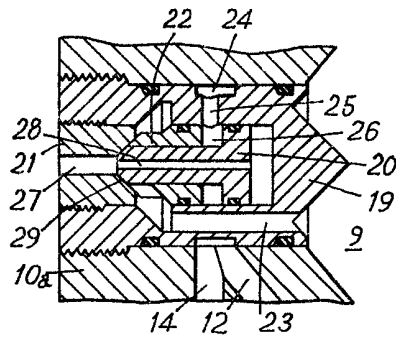


FIG.3

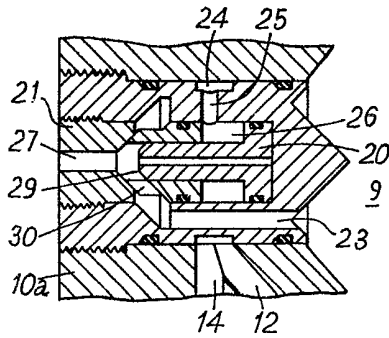


FIG.4

