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SELF-CLEANING CENTRIFUGAL SEPARATOR DRUM HAVING AN EXTERNAL PISTON VALVE

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FIG. 1.

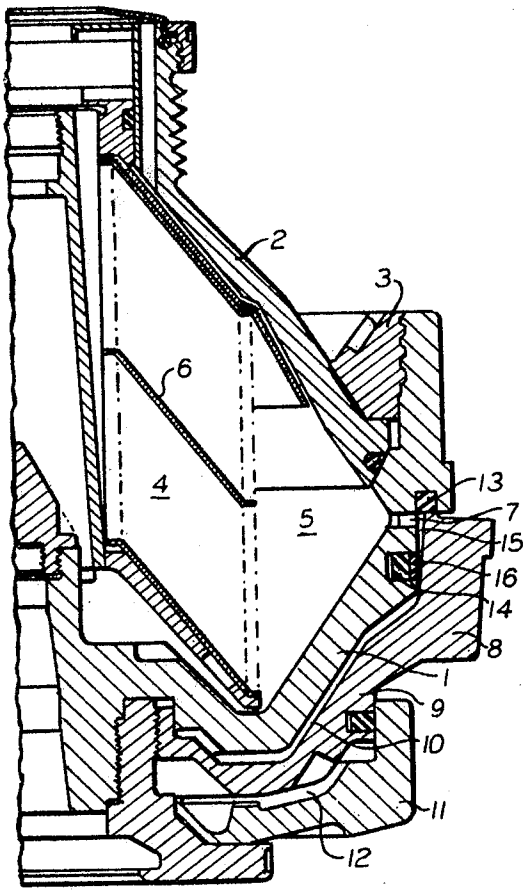
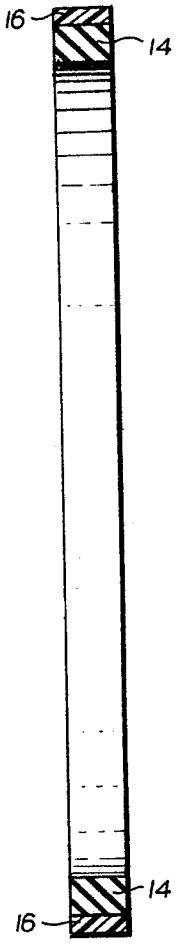


FIG. 2.



INVENTOR
PETER STEINACKER
BY Burgess, Dinklage + Sprung
ATTORNEYS.

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SELF-CLEANING CENTRIFUGAL SEPARATOR DRUM HAVING AN EXTERNAL PISTON VALVE

Peter Steinacker, Oelde I. Westphalia, Germany, assignor to Westfalia Separator A.G., Oelde, Westphalia, Germany, a corporation of Germany

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U.S. Cl. 233—20 3 Claims

ABSTRACT OF THE DISCLOSURE

Centrifugal separator having peripheral piston valve operative to open and close peripheral ejection ports by up and down movement with a sealing ring peripherally about the centrifuge drum between it and the piston wherein the sealing ring is resiliently elastic and has a relatively hard portion on the face thereof proximiate the interior surface of the piston.

The invention relates to centrifugal separator drums having ejection ports disposed in the periphery of the drum, which ports are opened and closed by the movement of a hydraulically or pneumatically operated piston valve externally enveloping the drum.

A centrifugal separator drum of this kind is known in the art and is illustrated in French Patent 777,363.

Solid-liquid or liquid-liquid centrifugal separators are well known. These types of apparatus generally comprise a drum adapted to revolve about an axis in order to separate components contained therein according to their specific weight. Such centrifuges are usually axially fed with separation taking place in the drum. The heavier component is forced outwardly toward the periphery of the drum into what is termed the sluge chamber while the lighter component is removed through a plate stack.

It is known to provide such centrifuges with peripheral ports which are intermittently operable to discharge sludge therefrom without stopping the centrifuge. In one known apparatus, a peripherally mounted, axially displaceable piston is utilized as the port opening and closing means.

The axially displaceable piston valve consists of a cylindrical part whose upper edge, in the closed position, bears against a sealing ring, and of a bottom extending radially inward which, with axially unmoveable parts, forms an opening chamber on the one side of the piston bottom and a closing chamber on the other side of the piston bottom. The introduction and discharge of a hydraulic fluid into these chambers causes the upward and downward movement of the piston valve and hence the closing and opennig of the solid-matter ejection ports.

In general, water is used as the hydraulic fluid, and the required closing and opening pressure is produced by the action of centrifugal force. It is not necessary to seal the chambers on the side facing the axis of rotation if the piston valve is hydraulically operated. On the other hand, the piston has to be sealed at its surface enveloping the drum, so that no hydraulic fluid will get into the separating chamber of the drum and no solids from the drum will get into the hydraulic fluid chamber. In this way the loss of hydraulic closing fluid is prevented and a reliable closing of the ejection ports is assured.

The cylindrical portion of the piston valve, which envelope the drum, rides, of course, with its inside surface adjacent the outside surface of the drum. A sealing ring, which seals these adjacent surfaces, lies in a groove on the drum and is urged by centrifugal force against the

inside of the piston valve. In order for such a ring to be able to be inserted into its groove it must be made of an elastic maetrial that can stretch to permit its insertion. Furthermore, a ring made of elastic material provides a better seal than one made of stiff material because it can make uniform contact at every point on account of its elasticity.

The piston valve that envelops the drum is in an area of maximum centrifugal force and has no support on its exterior. As a result, it flexes or pulls away from the periphery of the drum during operation, thereby producing a gap between the valve and the drum. This gap increases in size as the distance from the axially mounted bottom of the valve increases. When the piston valve flares out in this manner, the sealing ring emerges from its groove, and, in the upward and downward movement of the valve, is subjected to a lacerative action because of friction. This results in the fraying and crumbling of the seal. This friction on the sealing ring defeats good sealing action, while the attrition occurring between the friction surfaces impedes the up and down movements of the piston valve.

Attempts have been made to overcome this problem and to counteract the complete loss of sealing action by using a plurality of superimposed sealing rings made of the same material or by using a sealing ring having an especially great radial expansibility. These techniques, however, have not eliminated the fraying or crumbling wear on the seal.

It is therefore an object of this invention to provide a novel type of peripheral port containing centrifuge.

It is another object of this invention to provide a novel sealing arrangement for use with a piston controlled peripheral port containing centrifuge.

Other and additional objects of this invention will become apparent from a consideration of this entire specification including the drawing and claims hereof.

In accord with and fulfilling these objects, one aspect of this invention resides in a novel sealing ring for use in this type centrifuge and in such centrifuge containing such sealing ring.

The centrifuge according to this invention includes a rotatable drum of the usual construction containing peripheral sludge removing ports. An axially mounted generally cup-shaped piston extends from its axial mounting to past the peripheral ports and closely follows the outside contours of the drum. Chambers for the introduction of hydraulic fluid or pneumatic means are provided between the drum and the piston and between the piston and an outside member. These chambers are positioned near the centrifuge axis. Valve seats or seals between the piston valve and the outside of the drum are positioned on either side of the sludge removal ports. One of these is truly a valve seat which opens and closes to retain or emit sludge solids or discharge. The other seal, that is the seal positioned between the peripheral ports and the hydraulic fluid chamber, is desirably always in sealing engagement regardless of the open or closed position of the peripheral ports. It is toward this always closed seal that the invention is directed.

The invention is characterized in that the elastic sealing ring inserted into the groove on the outside of the drum has on the surface thereof proximate the piston valve, a flat ring consisting of harder material (e.g., plastic). The entire width of this additional ring, which is to be inserted in the same groove, is in contact with the piston valve and seals the actual friction surface, while the inner ring of elastic material prevents the fluid from passing through the groove from the opening chamber into the separating chamber and vice versa.

It is advisable to make the ring relatively thin, e.g., about 2 to 4 mm. in thickness, in order to enable it

to be positioned in the seating ring groove. Then only a slight expansion of the ring is necessary in order to force it over the periphery of the drum and into the groove. This expansion can be achieved, for example, by brief immersion in hot water. The shrinkage produced by cooling pulls the ring into the groove, but under the effect of the centrifugal force it emerges to such an extent as to contact the portion of the piston valve that is flaring away from it. In general, the gap between the drum and the piston valve amounts to only a few tenths of a millimeter.

Understanding of this invention will be facilitated by reference to the accompanying drawing in which:

FIG. 1 is a vertical sectional view of a centrifuge according to this invention, and

FIG. 2 is a sectional view of the sealing ring of this invention.

Referring now to this drawing, a centrifuge is shown having separating bottom chamber **1** and a drum cover **2** which are held together by a locking ring **3** and form a separating chamber **4**. Solids separated from the liquid being centrifuged collect in a sludge chamber **5** outside of a stack of insert plates **6** and are periodically ejected through ports **7** in the drum, which are opened and closed by the axially displaceable piston valve **8**. The piston valve **8** has a bottom **9** which extends inwardly forming an opening hydraulic chamber **10** with the drum bottom **1** and a closing hydraulic chamber **12** with a closing member **11**. By letting hydraulic fluid into and out of these chambers through passages which are not shown, it is possible to produce the up and down movements of the piston valve, whose upper edge abuts against a valve seat **13** in the closed position and seals the sludge chamber **5** from the outside. The cylindrical portion of the exterior of the drum bottom **1** is the portion of the drum periphery on which the piston valve **8** rides. In this portion of drum bottom **1**, an elastic sealing ring **14** is provided, as in the drums of the prior art, which is urged by the action of centrifugal force firmly against the inside of the piston valve **8** and prevents hydraulic fluid from passing over from the opening chamber **10** into the separating chamber of the drum. This sealing ring **14** also prevents solids from getting from the sludge chamber **5** into opening chamber **10**.

As represented in the drawing, the piston valve **8** flares out from the periphery of the drum during operation, so that a gap **15** develops between the two parts. The

sealing ring **14** therefore emerges partially from its groove in the drums as in the prior art.

The sealing ring **14** consists of soft material (e.g., rubber), surrounded on its exterior by a thin ring **16** made of harder material (e.g., plastic), which prevents the elastic ring **14** from emerging from the groove.

The following materials are illustrative of the elastic member of the sealing ring **14**: caoutchouc, viton, Perbunan, neoprene.

The following materials are illustrative of the relatively hard member **16** of the sealing ring **14**: polytetrafluoroethylene, polyamide, polycarbonate.

What is claimed is:

1. In a centrifuge adapted to use in sludge separation comprising a drum having peripheral sludge emission ports therein; an axially mounted and moveable piston valve member peripherally surrounding said sludge emission ports adapted to close and open such ports by axial movement; valve actuating means; valve seating means in said drum operatively associated with said piston valve; and sealing ring means between said drum and said piston valve positioned between said port and said valve actuating means; the improvement which comprises said sealing ring being composed of a resilient inner member and a relatively hard outer member wherein said outer member engages said piston valve.

2. The improved centrifuge of claim **1** wherein said valve actuating means is hydraulic and comprises an opening chamber between said piston and said drum and a closing chamber between said piston and a closing member positioned on the side of said piston away from said drum.

3. The improved centrifuge claimed in claim **1** wherein said hard outer member consists of at least one member selected from the group consisting of polytetrafluoroethylene, polyamide, polycarbonate.

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ROBERT W. JENKINS, Primary Examiner