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CENTRIFUGE HAVING PERFORATE FRUSTO-CONICAL BASKET

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Fig. 1
PRIOR ART

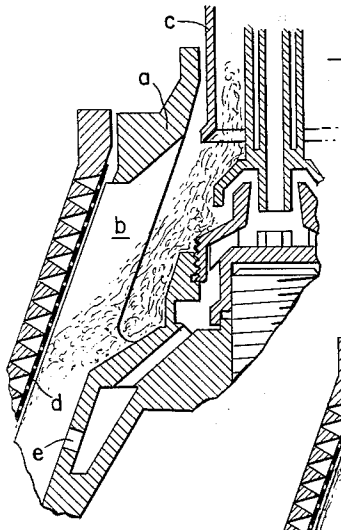


Fig. 2

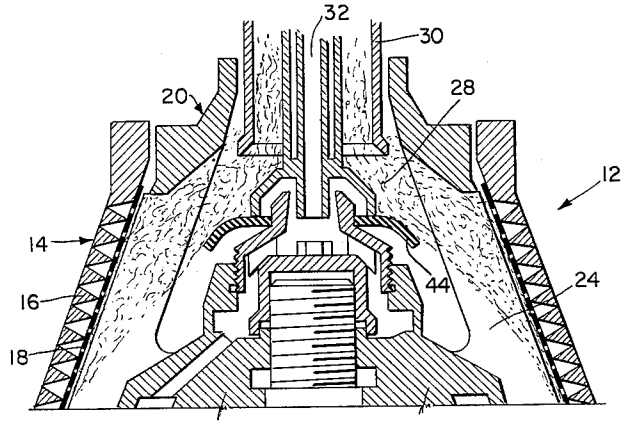


Fig. 3

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CENTRIFUGE HAVING PERFORATE FRUSTO-CONICAL BASKET

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This invention relates to a centrifuge. More specifically this invention relates to a centrifuge of the type having a perforate frusto-conical basket and containing a frusto-conical screw conveyor rotating relatively to the basket to effect a movement of solids along the wall of the basket toward discharge. Still more specifically the invention deals with such a centrifuge having improved means to guide the liquid-solids feed mixture to optimize the separating effect.

The various features of the invention will be apparent to those skilled in the art from the following discussion and the description of an apparatus embodying the invention. The description refers to the drawings in which:

FIGURE 1 is a fragmentary sectional view of a prior art machine;

FIGURE 2 is a fragmentary sectional view partly in elevation of a centrifuge embodying the invention; and

FIGURE 3 is a fragmentary view of FIGURE 1 showing the feed guide in flexed position.

In all of the figures the solid flow is indicated in phantom lines.

Centrifuges comprising a frusto-conical perforate basket containing a frusto-conical screw conveyor are well known in the prior art. In such a machine (FIGURE 1) the conveyor *a* has had a central feed opening at its smaller end, the opening providing passage outward to peripheral openings in the outer face of the conveyor between the flights *b*. The feed has been delivered into the central opening by a feed pipe *c* and has moved downwardly in the passages and eventually out to the perforate screen *d* for separation of the solids from the liquid and contact of the solids with rinse through nozzles *e*.

In the past as shown in FIGURE 1 the feed openings and passages in the conveyor have been made sufficiently ample to accommodate an occasional surge of feed mixture and to avoid upon such a surge a feed blockage or a backup of feed mixture out of the central opening and into the liquid discharge from the machine. The ampleness of these openings and passages has had the result that in normal running the feed mixture has not been deflected outward to reach the screen at its upper end and the mixture has not been exposed to the centrifugal effect for the maximum period. Further, in not reaching the screen at its smaller diameter, all of the liquids-solids mixture has had to be accelerated to the tangential velocity of the screen at the level where the mixture does reach the screen and not the lesser velocity of the smaller diameter.

It is, therefore, a feature of the invention to provide a centrifuge which makes optimum use of its screen length, at the same time precluding the blockage of the conveyor passages upon occasional surge of feed mixture.

It is a further feature of the invention to effect as much as possible of the centrifuging at the shorter radii of the centrifuge screen so that a major portion of the liquid of the mixture need not be accelerated to the greater radii, and so that the power required to drive the apparatus is reduced.

It is a further feature of the invention to increase the efficiency of the initial separation so that the bulk of the liquid is removed from the solids prior to the contact of the solids with a rinse liquid.

Other features will be apparent.

Briefly, the invention concerns a conveyor-type frusto-conical perforate basket centrifuge in which the conveyor carries a normally flat circular resilient flap disposed axially of the centrifuge, the flap being supported by its center on the conveyor. The peripheral edges of the flap are spaced above the lower wall of the opening and reach outward to adjacent the conveyor flight. The flap is adapted to urge the feed outward toward the wall of the basket at a high level and to flex during occasional feed surges to permit free passage of such surges without blocking.

Referring more specifically to the drawings, an apparatus embodying the invention is shown in FIGURE 2 and generally designated **12**. It comprises a perforate rotor **14** of frusto-conical shape. As is conventional the rotor comprises a heavy grating **16** covered on the inside by a frusto-conical screen **18** having openings pervious to the liquid but not to the solids of the mixture. Mounted for rotation on substantially the same axis and within the rotor is a conveyor **20** having a body **22**, helical flights **24** projecting from the outer surface thereof. Driving means (not shown) connected to the gear box **26**, and the gear box imparts rotary motion of different speeds to the rotor **14** and to the conveyor **20** to scroll downward feed introduced at the upper end of the centrifuge.

The conveyor is formed at its smaller end with an opening **28** which receives the standard feed tube **30** having a central rinse tube assembly **32**. The opening **28** extends through to the outside of the conveyor between the flights. As shown the opening **28** is made ample to accommodate large surges of feed.

The upper end of the central part of the conveyor body **22** is covered by a central cap **38** having an axial bore adapted to receive rinse liquid from the assembly **32**. The rinse liquid is channeled down inside the conveyor to the rinse nozzles **40** intermediate the flights.

Referring more specifically to the area of the opening **28** the cap **38** is preferably formed with a reduced upper end to present a sloping shoulder **42**. Resting on this shoulder is a normally flat circular resilient flap **44** formed with the central opening receiving the upper end of the cap. In practice the shape of the upper end of the cap and the opening in the flap may be hexagonal or some other irregular configuration so that the flap is keyed to rotate with the conveyor. The circular periphery of the flap reaches outward in the opening **28** to adjacent the upper end of the flights, preferably touching their inner edges. As shown the rinse feed assembly **32** has a downward stationary annular flange **46** which holds the central portion of the flap down against the cap **38**.

Referring to FIGURE 2, the feed mixture delivered into the opening **28** by the tube **30** moves downward and engages the flap **44**. The flap deflects the feed outward to the screen adjacent its upper end.

Since the level of contact of the feed with the frusto-conical screen is appreciably higher than in the prior art devices (FIGURE 1) there is improved separation and reduced power requirements.

The drying of valuable solids at the upper portion of the screen is especially appreciated in those machines in which a rinse, such as at **40** is employed. In such machines it is important to have the solids as dry of liquid as possible before the contact of the rinse. This is because the greatest benefit obtains from a given quantity of rinse if the solids are relatively dry. The drying is also important because the liquid thrown off the solids above the rinse level and the liquid thrown off below the rinse are often collected separately by a compartmented cover

(not shown). Since the separated liquid may be valuable it is important that as much as possible be not diluted with rinse liquid.

Referring back to FIGURE 1, at the level of the rinse *e* the solids still contain much liquid. In the FIGURE 2 embodiment of the invention most of the liquid has been separated before the solids reach the level of the rinse nozzles **40**. For instance, in actual experiment with a relatively thin slurry it has been found that as much as 50–100% liquid has remained on the solids by the time they reach the rinse level of the prior art machine while with the same machine modified to embody the invention the liquid content may be down to 5–15% at the rinse position. With thicker slurries, liquid content has measured 5–15% at this position in the prior art machines and 3–6% with the same machine modified to embody the machine of the invention.

FIGURE 3 illustrates the non-blocking feature of a machine embodying the invention. On a momentary surge of feed mixture the flap **44** will flex downward to permit an increase in flow through the opening **28**. After passage of the surge the flap will return to its relatively flat disposition.

The flap **44** may be selected from any of the resilient and flexible natural or synthetic plastics, including rubber. A satisfactory flap has been formed of ⅛" thick 90 durometer buna "N" rubber. Alternatively, the flap may be formed of a thin stock of a resilient metal such as stainless steel.

It will be apparent to those skilled in the art that an apparatus embodying the invention will have the advantage of obtaining full benefit of its screen height and at the same time be able to accommodate momentary surges of feed mixture. The result is greater exposure of the mixture to a centrifugal field and at the same time avoidance of the necessity of accelerating feed liquid to a large diameter, much of the liquid being thrown off the rotor at a smaller diameter. The benefits are improved separation with a drier solid discharge and reduced power requirements. Special benefits inure in applications in which a rinse is used because (1) the rinse is more effective on dryer solids, and (2) more valuable separated liquid undiluted with rinse liquid may be collected prior to the rinse.

Having particularly described the invention, it is to be understood that this is by way of illustration, and that changes, omissions, additions, substitutions, and/or other modifications may be made without departing from the spirit thereof. Accordingly it is intended that the patent shall cover, by suitable expression in the claims, the various features of patentable novelty that reside in the invention.

I claim:

1. In a centrifuge comprising a frusto-conical perforate basket and a frusto-conical conveyor having at least one flight thereon and disposed within the basket, means for driving the basket and the conveyor at different speeds to effect a scrolling of material toward the larger end of the basket, the conveyor having at its smaller end a central opening defined in part by a lower wall in the smaller end of the conveyor and adapted to receive a feed mixture, the opening communicating to the outer face of the conveyor, the improvement of a normally flat resilient circular flap disposed axially of the conveyor in the opening and supported at its center on the conveyor, the periphery of the flap being spaced above the lower wall of the opening and extending outward to adjacent the flight, the flap adapted to urge feed mixture outward toward the smaller radial portion of the perforate basket and to yield and flex downwardly a substantial distance at its periphery during occasional surges of feed to avoid feed blockage and after such surges return to its normal posture.

2. The improvement of claim **1** wherein the flap is of 90 durometer buna "N" rubber.

3. The improvement of claim **1** wherein the flap is of thin resilient metal.

4. A centrifuge comprising a frusto-conical perforate basket and a frusto-conical screw-type conveyor disposed within the basket, means for driving the basket and the conveyor at different speeds to effect a scrolling of material toward the larger end of the basket, the conveyor having at its smaller end a central opening adapted to receive a feed mixture, the opening communicating to the outer face of the conveyor, a normally flat resilient flap mounted on the conveyor adjacent the axis thereof in the opening and adapted to deflect the feed outward and to flex a substantial distance at its periphery in the direction of the feed flow upon a momentary surge of feed to avoid feed blockage and to return to its normally flat posture after such surge.

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