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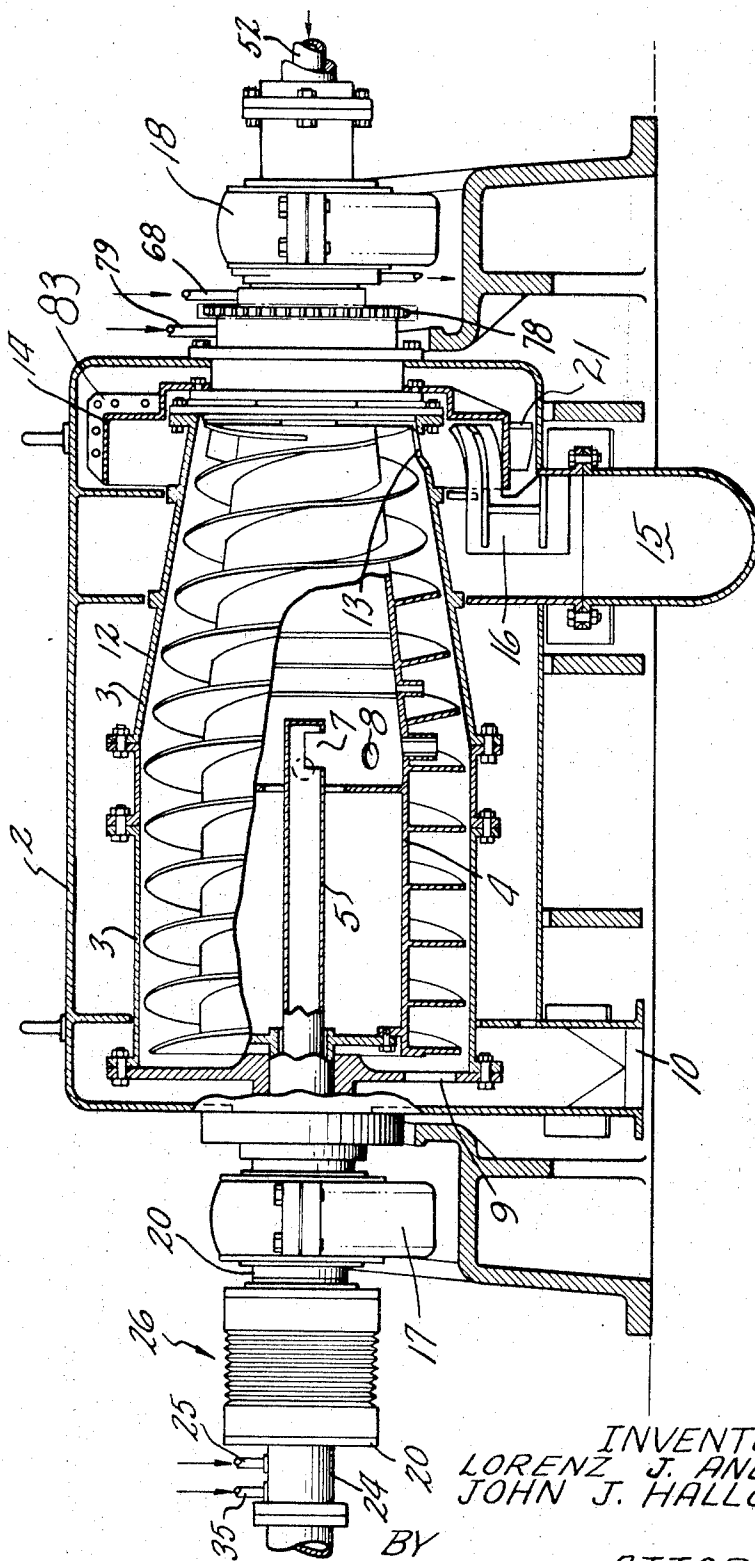
3,428,248

CONTINUOUS CENTRIFUGE APPARATUS

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FIG. 1



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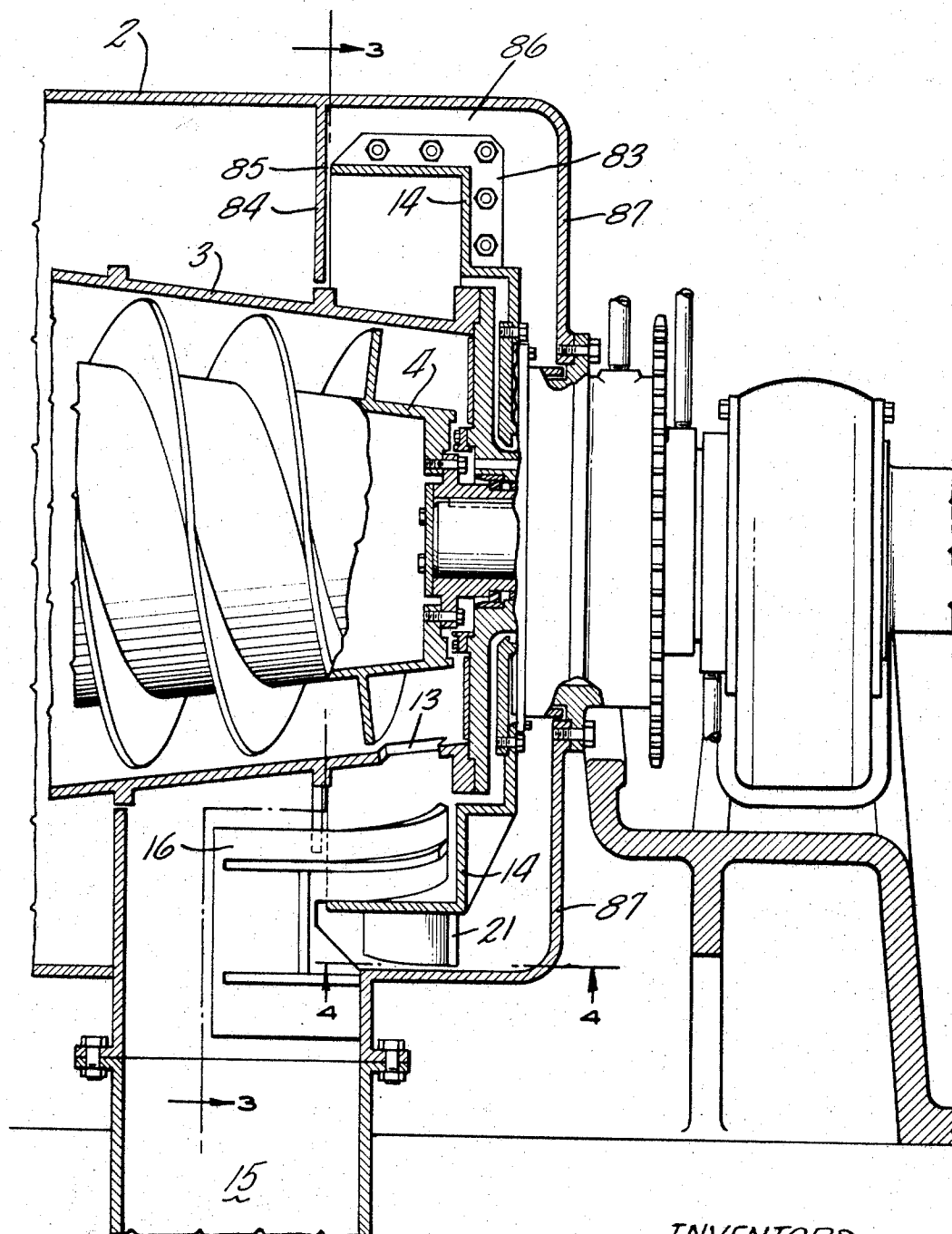
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FIG. 2



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FIG. 3

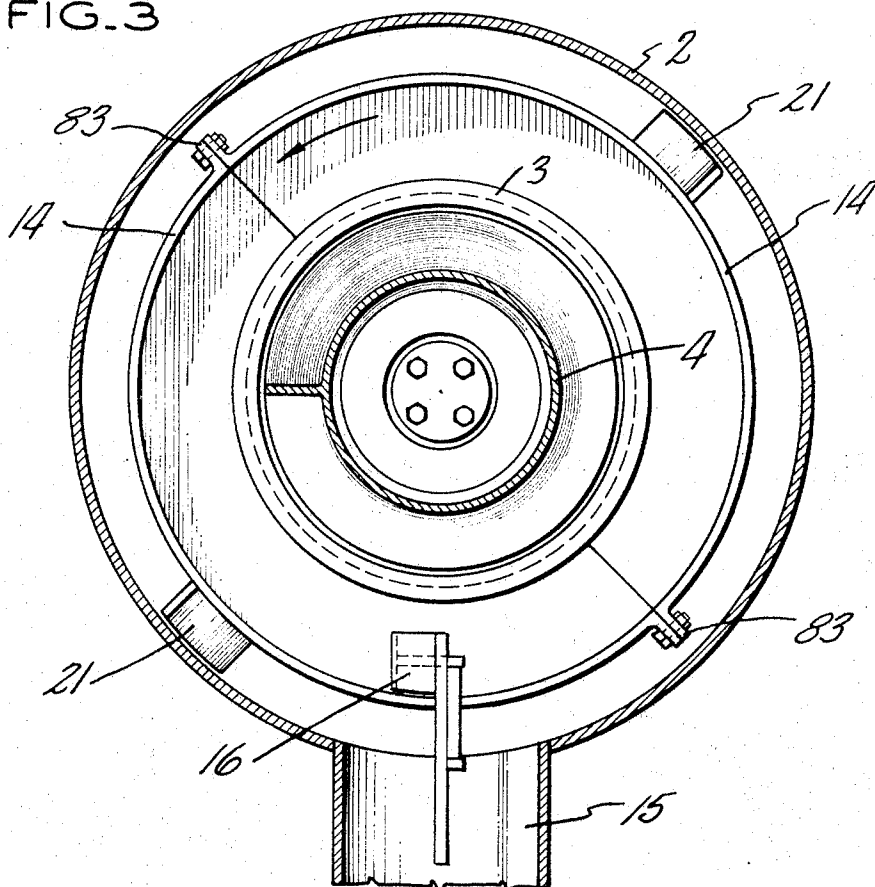


FIG. 4

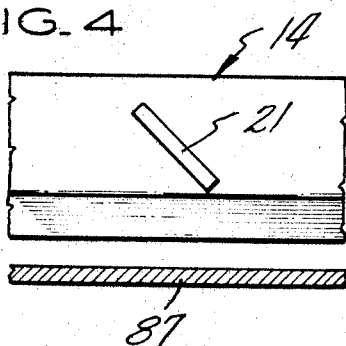
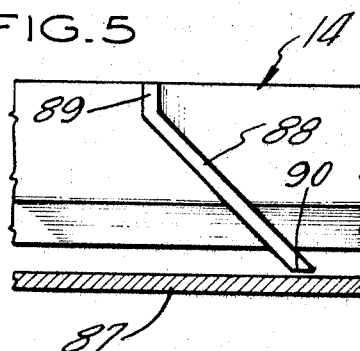


FIG. 5



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CONTINUOUS CENTRIFUGE APPARATUS

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U.S. Cl. 233-7

10 Claims

Int. Cl. B04b 1/12, 3/04, 5/00

ABSTRACT OF THE DISCLOSURE

An apparatus for a centrifuge in which dewatered coal is slung into a gutter which is rotating within the surrounding casing. A plow located on the outside diameter of the rotating gutter is in close proximity with the surrounding casing, and positioned at an angle approximately 45° from the direction of motion so that the plow will urge sludge buildup inside the casing axially to a discharge opening.

Background of the invention

In a system for handling a liquid-solid slurry and particularly in a system for handling a pumpable slurry of crushed coal and water wherein it is desired to provide a continuous and regulated supply of mechanically dewatered solids, it is necessary that the various components of the system including the mechanical dewatering device be able to operate continuously, performing its desired functions without interruption over relatively long periods of time. With a slurry such as the pumpable coal slurry which may originally have had a water concentration of 50 percent and where the mechanical dewatering reduces this concentration to approximately 20 percent, special precautions with regard to the handling of the thus concentrated slurry must be taken particularly at the outlet of the dewaterer to insure that a steady flow is maintained and that plugging or stoppage is not encountered.

U.S. Patent 3,211,369 illustrates a rotating gutter which collects the dewatered coal being spun from the centrifuge bowl and also a fixed scraper which scrapes the sludge from this rotating gutter directly into a discharge spout. The rotating gutter requires clearance from the stationary housing due to its relative motion and during operation sludge passes between the gutter and housing and tends to build up in this area. Since the sludge is not violently thrown into this area, it is generally not tightly packed and, therefore, will generally fall by gravity to a discharge opening if it is located directly below the gutter. Also any buildup that does occur will be carried around by the rotating gutter and dropped through a discharge spout so located. Even with the discharge opening mounted directly below the rotating bowl, it is possible for sludge to build up and pack between the gutter and casing. When a discharge spout is offset in the line of the gutter, sludge will pack between the gutter and casing at the lower portion; and even if carried around by the rotating gutter, will not reach the discharge opening and will, therefore, pack tightly and build up in this space. This buildup will cause friction between the gutter and housing causing abrasive wear of the gutter and increasing the power consumption of the centrifuge due to the drag.

Summary of the invention

This invention contemplates a plow arrangement on a continuous centrifuge. The centrifuge is the type which has a gutter rotating within a surrounding housing with the gutter collecting the centrifuge discharge. The plow is located on the outside diameter of the rotating bowl in such a manner as to scrape sludge buildup between the rotating bowl and housing toward a discharge opening

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thereby maintaining this space free so as to minimize power consumption requirements of the centrifuge and to avoid wear on the outside of the gutter.

This invention not only improves the operation of a centrifuge when the solids discharge is located directly below the rotating gutter but permits freedom in the location of the discharge spout while still preventing a buildup of sludge between the gutter and housing. This freedom permits locating the discharge so that the main solids discharge from the centrifuge passes to the center of the pipe thereby minimizing wear of the pipe and simplifying introduction of the solids to equipment below. Where bearing and sealing complications require that the rotating gutter be located a substantial distance from the end of the centrifuge housing, the discharge pipe may still be located to receive the discharge from the gutter even though the discharge may not be co-extensive with the entire depth of the gutter.

Brief description of the drawings

FIGURE 1 is a sectional side elevation of a general arrangement of a centrifuge;

FIGURE 2 is a detailed sectional side elevation of the portion of the centrifuge showing the rotating gutter and the plow;

FIGURE 3 is a sectional front elevation illustrating the location of the plow on the rotating gutter;

FIGURE 4 is a view of one form of plow; and

FIGURE 5 is a view of an alternate form of the plow.

Description of the preferred embodiment

Referring to FIGURE 1, stationary housing 2 is designed to contain the pressure under which the centrifuge must operate and contains within it a rotating bowl 3 which rotates at 1000 r.p.m. and a rotating conveyor 4 which rotates in the same direction at 1010 r.p.m. The slurry mixture of coal and water is fed longitudinally along the axis of the centrifuge through the slurry feed tube 5.

This slurry passes through an opening 7 at the end of the feed tube and flows through openings 8 in the conveyor. The mixture then is held by centrifugal action against the inside perimeter or bore of the bowl 3. The water flows longitudinally to the left passing through a hole 9 in the end of the bowl and thence through the water outlet to discharge. The separated coal is moved along the beach 12 of the bowl 3 by the relative motion between the screw thread of the conveyor and the bowl. The coal is discharged through the opening 13 at the solids discharge end of the bowl where it is thrown against the gutter 14. The rotating gutter 14 moving at only 10 r.p.m. continuously passes the fixed scraper 16 which scrapes the coal sludge from the gutter. These solids are then passed downwardly through the solids discharge line 15 and directly into a pulverizer (not shown).

The rotating gutter 14 is made of two sections which are bolted together at flange 83. Splash plate 84 is securely fastened to the casing 2 and located so that it passes very close to the bowl 3. The dewatered coal is slung outwardly through opening 13 and collected in the rotating gutter 14. Some spray, however, carries portions of this sludge through opening 85 into the annular space 86. This sludge will build up in the annular space mainly at the bottom where it is deposited by gravity. The flanges would rub against the sludge buildup thereby creating increased power requirements and resulting in wear of these flanges. Even if the flanges were not used, the outside edge of the gutter itself would rub and wear.

Plow 21 is securely fastened to the outside of the rotating gutter 14 at each of two locations 180° apart. This plow is located with only a small clearance between it and the casing 2 so that as the gutter rotates, the plow will

scrape the surface of the casing. This plow should not be perpendicular with the direction of movement as the flanges will generally be but should be located at a small angle from the direction of the movement preferably not exceeding 45°. With the plow so located, the sludge is urged inwardly towards discharge line 15 so that it passes out of the annular space 86 and out of the centrifuge itself.

Bearing complications in a large centrifuge and strength requirements for the gutter 14 may make it essential that the rotating gutter 14 be located some distance away from the end plate 87 of the casing 2. The discharge line 15 should be located so that the main solids discharge from the gutter 14 pass directly into the center of the discharge line so as to avoid wear in the discharge pipe and to facilitate the introduction of the solids into a subsequent piece of equipment. The use of plow 21 to urge the sludge buildup from annular space 86 toward the discharge line facilitates the location of the discharge line permitting increased freedom in its location for any purposes desired.

FIGURE 4 illustrates the simple plow which extends neither to the end plate 87 nor to the inboard side of the rotating gutter 14. For centrifuging of most slurry compositions this should be sufficient since the splashing should not reach back near end plate 87 and solids buildup in the area of splash plate 84 would not occur at the top and sides of the centrifuge due to the low velocities precluding sticking and gravity tending to carry off sludge to the bottom. Sludge near the splash plate 84, therefore, would drop directly into discharge line 15.

Should, however, the spray being carried into annular space 86 be of such a nature that it sticks throughout the periphery of the casing and carries back to an area near the end plate 87, a plow 88 shaped as illustrated in FIGURE 5 may be used. This plow is extended in the outboard direction so as to pass very close to end plate 87 and has a flat portion 89 perpendicular to the direction of movement immediately adjacent splash plate 84. This permits the sludge in that area to be carried around radially and discharged into the spout without any tendency to wedge the sludge between the rotating gutter 14 and the splash plate 84. The leading edge 90 is beveled.

While we have illustrated and described a preferred embodiment of our invention it is to be understood that such is merely illustrative and not restrictive and that variations and modifications may be made therein without departing from the spirit and scope of the invention. We therefore do not wish to be limited to the precise details set forth but desire to avail ourselves of such changes as fall within the purview of our invention.

What is claimed is:

1. A centrifuge for the mechanical separation of fluid and solids; including a bowl having a horizontal axis; means for rotating said bowl around its axis; means for supplying a fluid-solid slurry into said bowl; said bowl having a solids concentrate outlet adjacent one end from which solids concentrate is directed radially outward; an annular gutter surrounding and concentric with said bowl at the location of said concentrate outlet, for collecting the solids concentrate discharged from said bowl; means for rotating said gutter concentrically with said bowl at a speed less than that of said bowl; a stationary housing surrounding said annular gutter; a solids discharge pipe below said gutter and in communication with said gutter

to receive the solids concentrate leaving said gutter; a plow fastened to the outside diameter of said annular gutter presenting a surface of substantially less than 90° from the direction of motion, with the slope presented being in such a direction as to urge solids which may be bound to the housing toward the centerline of said solids discharge pipe.

2. An apparatus as in claim 1 having also a stationary scraper located at the bottom of said annular gutter and in closely spaced relationship with the inside diameter of said annular gutter, said scraper having a scraping end within said gutter and a discharge end outside of said gutter; and said solids discharge pipe being located directly beneath the discharge end of said scraper.

3. An apparatus as in claim 2 wherein said discharge line is located so that the discharge from said scraper falls directly into the center portion of said discharge pipe.

4. An apparatus as in claim 1 wherein said discharge pipe has at least a portion of its inside opening co-extensive with only a portion of said annular gutter; and said plow being co-extensive with the remainder of said annular gutter.

5. An apparatus as in claim 1 having also an annular splash plate between said bowl and said casing substantially sealing the area between the bowl and the casing from longitudinal flow of concentrate and located in close proximity with said annular gutter to restrict the radial flow of said concentrate past said annular gutter; said splash plate being axially located so that its plate passes through a portion of the internal opening of said discharge pipe.

6. An apparatus as in claim 5 wherein said plow exists only in that portion of said annular gutter which is not co-extensive with the internal opening of said discharge pipe.

7. An apparatus as in claim 5 wherein said plow has a portion thereof co-extensive with the internal opening of said discharge pipe, and with this portion being perpendicular to the direction of motion of said annular gutter; the remainder of said plow only presenting said surface at less than 90° from the direction of motion.

8. An apparatus as in claim 5 having also an end plate fastened to said stationary housing and sealing said housing from axial flow of concentrate therethrough; said end plate being located on the opposite side of said gutter from said splash plate; said plow extending beyond said annular gutter to a location in close proximity with said end plate.

9. An apparatus as in claim 1 wherein said plow presents a surface of less than 46° from the direction of motion.

10. An apparatus as in claim 1 wherein the leading edge of said plow is beveled so that no portion of said plow presents any surface urging solids which may be bound to the housing away from the centerline of said discharge pipe.

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