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NONCONTACTING SEAL FOR CENTRIFUGE INLET

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Fig. 1.

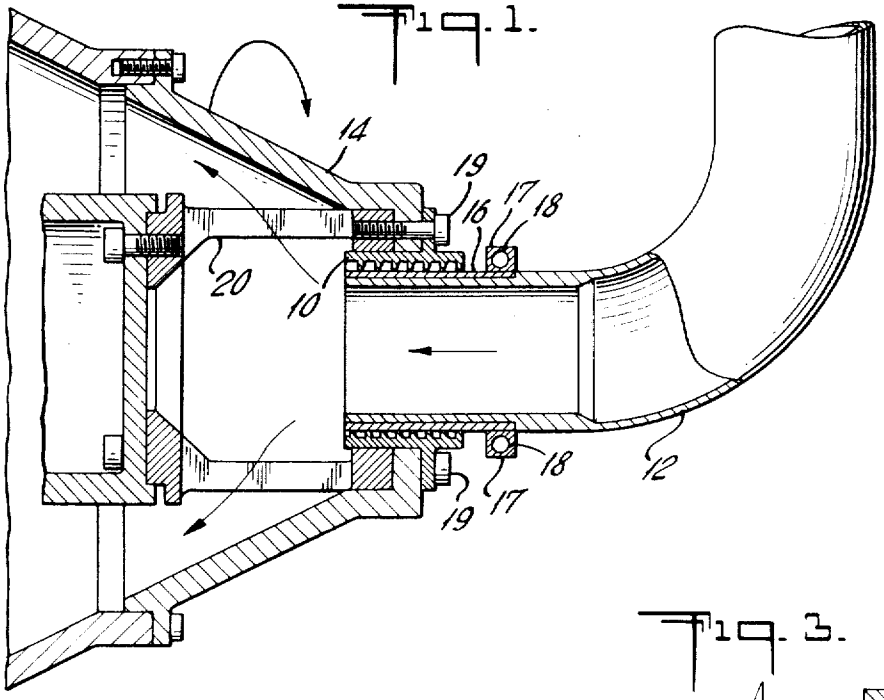


Fig. 3.

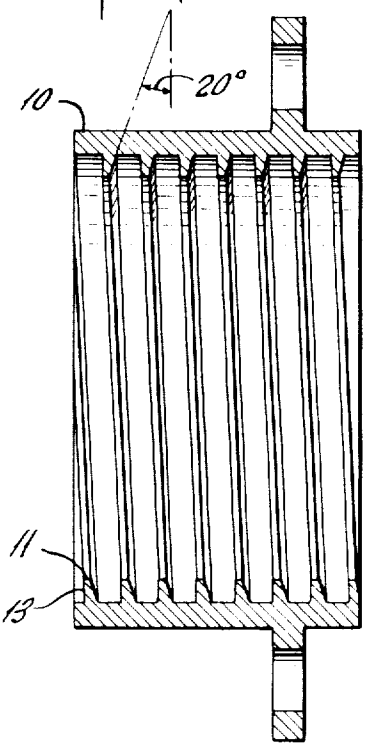
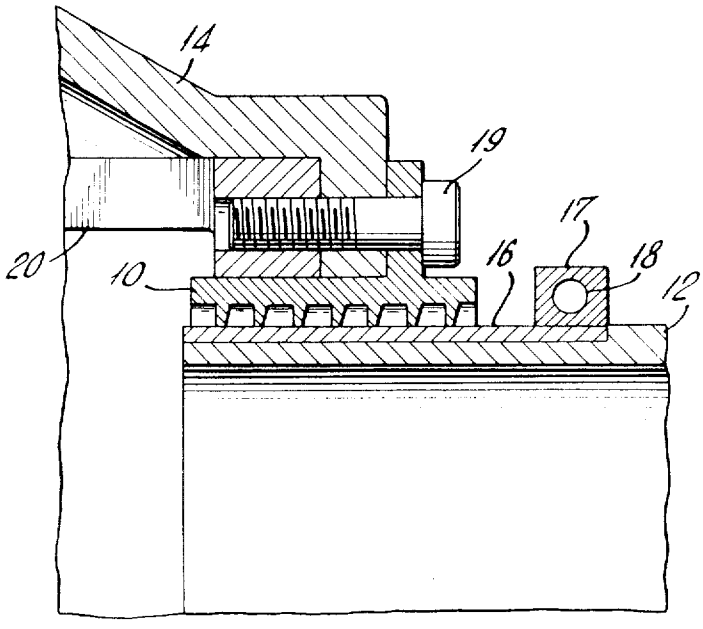


Fig. 2.



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NONCONTACTING SEAL FOR CENTRIFUGE INLET

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ABSTRACT OF THE DISCLOSURE

A non-contacting seal bushing has a bore machined in the form of a helical labyrinth which, when mounted on a rotating centrifuge distribution cone, prevents by-passing of feed slurry between the feed pipe and the distribution cone.

BACKGROUND OF THE INVENTION

This invention pertains to a seal developed for preventing feed slurry bypassing in a centrifuge. Centrifuges are used in many applications in chemical industry. One typical case is the use of a centrifuge for the separation of paraxylene crystals from a mixed xylene slurry. In such an application, a pusher centrifuge may be used to make a separation of paraxylene crystals. In this type of centrifuge, the feed slurry is fed into the centrifuge by means of a stationary inlet pipe which extends within a conical member that is attached to and rotates at the same speed as the centrifuge basket. The feed entering must be deposited upon the centrifuge basket as evenly as possible to assure uniform removal of mother liquor from the crystals. Toward this end, the conical member receives the feed and accelerates it as it moves from the narrowest part of the cone to the widest part of the cone, which serves as the distribution point for the feed slurry. At the outlet edge of the distribution cone, the slurry has reached nearly the same velocity as the velocity of the centrifuge basket.

The introduction of the feed slurry onto the distribution cone should be as smooth as possible. However, because the cone supporting members may interfere with the flow, it is sometimes possible for slurry to splash-back into the space formed between the inlet pipe and the cone itself. Such splash-back of slurry will then cause a bypassing of mother liquor directly onto the dry cake below, thereby creating a loss of mother liquor which would otherwise be recovered and also degrading the performance of the centrifuge since crystals leave the machine with a higher liquid content then they would otherwise have. When such a situation exists, the by-passing of slurry limits the capacity and performance of the centrifuge.

The present invention has been developed in order to overcome these difficulties which have been experienced in applications such as the above example thereby improving the capacity of the centrifuge and enhancing the quality of the resulting product crystals. Various unsuccessful attempts have been employed in the prior art in efforts to prevent such splash-back from occurring. One typical prior art construction makes use of baffies of various sorts, but such constructions have been found to be unable to prevent splash-back from being a serious hindrance to achieving expected performance from the centrifuge. Accordingly, it is a primary objective of the present invention to overcome the disadvantages of such prior art devices and to provide a novel construction that utilizes a positive seal to allow attainment of the full performance capability of the centrifuge.

BRIEF SUMMARY OF THE INVENTION

In order to prevent the splash-back of feed slurry from the inlet cone of a pusher centrifuge onto the dry cake product, there has been developed a sealing device according to the present invention. This sealing device comprises a bushing, which has been provided with a special helical thread which advances in opposition to the rotation of the centrifuge. The bushing by virtue of its helical thread acts to positively expel any liquid splash-back which may occur, acting in a manner of a rotating screw pump.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an assembly sketch illustrating the relationship of the feed inlet pipe, the rotating cone, and the helical seal bushing. FIG. 2 shows an enlarged portion of the assembly of FIG. 1. FIG. 3 shows an enlarged sectional view of the seal-bushing.

DESCRIPTION OF A PREFERRED EMBODIMENT

The cross-sectional view shown in FIG. 1 illustrates the general disposition of a seal **10** constructed in accordance with the present invention provided between a stationary inlet feed pipe **12** and a rotating cone **14**. In a typical case, the speed of rotation of the cone may be 1,000 to 1,400 revolutions per minute. In the preferred embodiment of the invention, the inlet feed pipe **12** has been provided at its outlet end with a fixed sleeve **16** for centering the feed pipe and rotating cone on the same axis. A tightening collar **17** is located at the sleeve end furthest from the termination of the pipe **12** for holding the sleeve in place and is itself secured by a bolt **18**. Due to manufacturing inaccuracies, the space left between the rotating cone **14** and the periphery of the stationary feed pipe **12** the outer diameter of the feed pipe may not be completely circular or coaxial with the cone. In order to provide a seal, the feed pipe **12**, seal bushing **10**, and feed cone **14** must be coaxial. Therefore, the sleeve **16** is made so that the axes of its outer diameter and its inner diameter are slightly displaced from each other. Thus, the sleeve **16** when placed upon the stationary feed pipe **12** as shown in FIG. 1, may be turned to account for any eccentricity until the axis of the outer surface of the sleeve **16** is concentric with the rotational axis of the feed cone **14**. Thereupon, the collar **17** is secured by bolt **18** to hold the sleeve **16** in position.

The helical seal bushing **10** is shown assembled in place on the centrifuge in an enlarged detail, see FIG. 2. It is fastened by capscrews **19** onto the rotating feed cone **14**. This secures the seal bushing **10** and centers it on the common axis of cone **14** and stationary feed pipe **12**.

In operation, the feed slurry passes downward through the feed pipe **12** making a 90° turn and entering the rotating cone **14** horizontally. The slurry enters the cone via cylindrical support frame **20** and is distributed radially outward through slots in the cone support frame **20**. Slurry received by the rotating cone **14** from the support frame **20** passes from adjacent the apex or inlet of the cone along its interior surface, being continually accelerated as the cone diameter increases, until it is deposited on the basket (not shown) of the centrifuge. Due to the turbulence at the point of injection of slurry onto the support frame **20**, splash-back can occur, passing between the rotating cone and the feedpipe. By employing the unique seal construction of the present invention, such splash-back no longer can occur.

In the FIG. 3, there is shown an enlarged cross-section of the helical seal bushing **10**. The helical seal bushing comprises a cylindrical member, the interior of which has been cut to form a helical labyrinth or thread **11** which, as shown in FIG. 2, has a vertical side **13** located

on the side of seal bushing **10** facing the interior of the cone. This side **13** is constructed so that it impels the liquid splash-back toward the interior of the cone. A left hand thread is shown to correspond to a clockwise rotation of the cone as shown, but with a counterclockwise rotation of the cone, a right hand thread would be used. The opposite side of the seal labyrinth **11** has been shown in the preferred embodiment as being inclined relative to the vertical side **12** of the cone, preferably being disposed at an angle of about 20 degrees from the vertical. However, it should be understood that the particular angle disclosed is not limiting and may be of other suitable values, depending upon the machining of the flight and the strength desired. The inside diameter of the seal bushing as defined by the inner extremity of the helical labyrinth is made slightly larger than the diameter of the sleeve **16** secured on the stationary feed pipe **18**. The pitch or number of turns per unit distance made by the helical flight may vary or may even purposely be made non-uniform, i.e. continuously varying. In the preferred embodiment a uniform labyrinth with four turns per inch is used. This requirement is dependent upon the speed of rotation of distribution cone **14** and may comprise larger or smaller number of turns per inch. For convenience of mounting, the seal bushing may be split longitudinally into mating halves.

Having described a preferred embodiment of the invention the main features of which may be extended to cover similar constructions without losing the advantages of the invention, the invention is set forth in the claims as follows.

What is claimed is:

1. A seal to prevent feed by-passing in a centrifuge of the type wherein a stationary feed pipe extends into a rotating distribution cone which comprises:

(a) a cylindrical sleeve having the axis of its internal surface eccentrically located relative to the axis of its external surface;

(b) means for fixedly mounting said sleeve around the stationary feed pipe with the axis of the external surface of said sleeve coinciding with the axis of the distribution cone;

(c) a bushing with an internal helical thread having uniform depth, said bushing having an internal diameter larger than the outer diameter of said cylindrical sleeve thereby permitting said helical bushing to freely rotate relative to said cylindrical sleeve;

(d) means for fixedly and coaxially mounting said bushing to the rotating distribution cone.

2. The seal of claim **1** wherein the helical threads of said bushing each have the side facing the direction of flow disposed at substantially right angle to the axis of said bushing and a plurality of turns per unit of distance proportional to the rotational velocity of the bushing and advancing in a direction opposite to the rotation of the inlet distribution cone, whereby liquid is expelled from the bushing onto the inlet distribution cone .

3. The seal of claim **1** wherein the helical threads of said bushing have an increasing number of turns per unit of distance toward the outer end of said bushing.

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