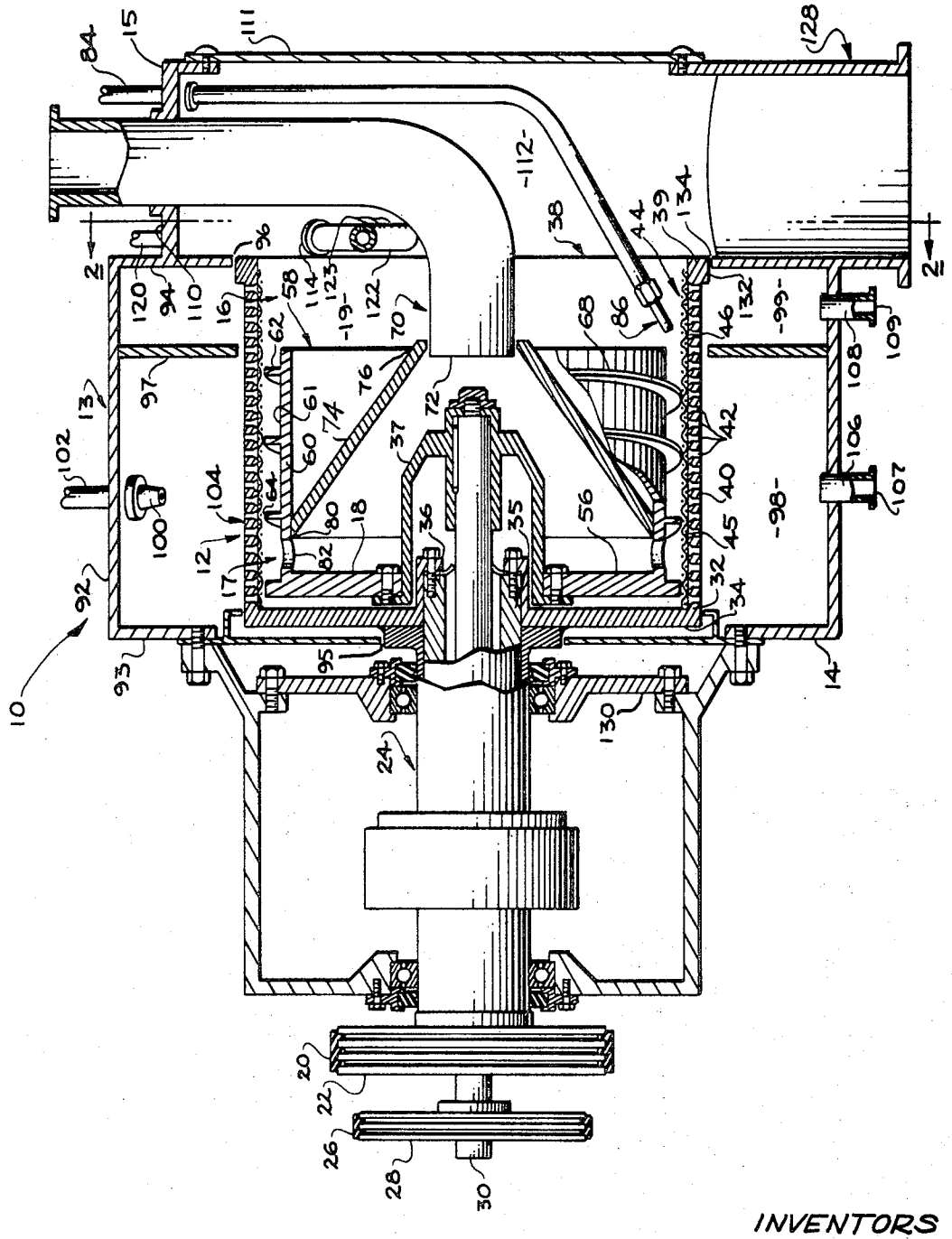
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PROCESS FOR MAINTAINING A PERFORATED BASKET CENTRIFUGE FREE OF BASKET PLUGGING

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PROCESS FOR MAINTAINING A PERFORATED BASKET CENTRIFUGE FREE OF BASKET PLUGGING

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1 Claim. (Cl. 210—78)

ABSTRACT OF THE DISCLOSURE

A method of maintaining a centrifuge basket free of plugging of the perforations therein by applying a spray of heated wash liquid to the external surface of the basket.

This application is a continuation of our prior copending application Ser. No. 510,184 filed Nov. 29, 1965 and now abandoned.

The present invention relates to centrifuges, and particularly to centrifuges of the type employed for the separation of solids from liquids. Still more particularly, the present invention relates to centrifuges of such type which have bowls provided with mechanical means for the advancement of separated solids to be discharged.

Centrifuges designed for liquid-solid separation may be of various shapes and mechanical designs. The centrifuge bowl may, for example, be of the basket type and may have a perforate or an imperforate wall. In many cases, the bowl may be provided with an internal scroll, or screw mechanism, which serves to advance the separated solids toward the discharge outlet of the bowl. The blade of the rotating scroll engages the separated solids and impels the latter along the interior side wall surface of the bowl and through a solids discharge outlet.

The known scroll-type centrifuges for liquid-solid separation have presented a number of problems in operation, particularly when used to separate ice from an aqueous mother liquor. Particular problems have arisen in connection with plugging of the basket perforations with small ice particles and other debris which might be included in the slurry.

It is therefore an object of the present invention to provide a process for maintaining a perforated basket centrifuge free of basket plugging during operation.

An additional object is to provide a method of cleaning the basket of a centrifuge without the need for dismantling the device.

These and other objects and advantages of the present invention will become more apparent from the following description thereof when read in conjunction with the accompanying drawing in which:

The single figure in the drawing is a side elevation, being partly in section, of a centrifuge constructed in accordance with the invention.

The above and other objects of this invention are in part accomplished by a centrifugal separator comprising; a housing, a basket disposed in said housing rotatable about an axis of rotation, the basket being provided with at least one liquid discharge outlet and one solids discharge outlet; the basket serving, upon rotation, to separate solids and liquid from a feed stream comprising a slurry of solids in liquid; means for moving solids along said basket toward said discharge outlet; means for introducing feed into the basket near the rearward end thereof; drive means for rotating said basket; and washing means

for directing a spray of wash fluid onto the external surface of the basket to keep the basket free of plugging.

Referring now to the drawing, the single figure shows a centrifuge 10 designed for the separation of solids from liquids. The centrifuge 10 is equipped with a cylindrical bowl, or basket, 12 which is rotatably mounted within a housing 14 and provides a centrifuge chamber 16. Positioned within the chamber 16 is a scroll 18. The scroll 18 is mounted coaxially with, and is rotatable with respect to, the basket 12.

The basket 12 is rotated by a belt 20 which is driven by conventional means (not shown) such as a motor. The belt 20 serves to drive a pulley 22 which is mounted on a supporting shaft structure 24 for the basket 12.

The scroll 18 is similarly rotated by a belt 26 which drives a pulley 28 mounted on supporting shaft structure 30 for the scroll 18. However, the belt 26 is driven at a speed slightly greater than that of the belt 20. The driving mechanism (not shown) for the belt 26 may be of any conventional design. For example, the belt 26 may be driven, through use of a differential gear mechanism, by the same drive means as employed for driving the belt 20.

The basket 12 is provided with a cylindrical side wall 32 and is closed at the drive end by a wall 34. An opening 35 is cut through the wall 34 for receipt therethrough of the respective inner ends 36 and 37 of the supporting shaft structures 24 and 30. At its end opposite the wall 34, the basket 12 is open as seen at 38. The side wall 32 is formed at the open end 38 with a circumferentially extending lip 39. The side wall 32 of the basket 12 is provided, over a portion 40 thereof, with perforations 42.

A cylindrical lining screen 44 lies within the chamber 16 and in contact with the side wall 32. This screen serves to retain small particles of solids within the basket 12.

The scroll 18, as shown, is of generally hollow cylindrical shape and is closed at one end by a wall 56. At its opposite end, the scroll 18 is open as seen at 58. The side wall 60 of the scroll 18 at its outer circumferential surface 61 is provided with a continuously extending helical impeller blade 62. The latter is of such pitch diameter that the distal edge 64 thereof is located closely adjacent the screen 44. The rearward end of the blade 62 is located generally in alignment with the end wall 56. The forward end 68 of the blade 62 is located adjacent the open end 58 of the scroll 18. The scroll 18 is positioned so that the wall 56 and the rearward end of the blade 62 lie closely adjacent the end wall 34 of the basket. It is preferred that the distance between the outer tip of the blades 62 and the outer surface of the side wall 60 be a constant so that a cake of solids of uniform depth is established along the length of the basket 12.

The scroll 18 is of abbreviated length as compared to the length of the chamber 16. Thus, the open end 58 of the scroll 18 is spaced from the open end 38 of the basket 12. At the same time, the forward end 68 of the blades 62 is spaced from the lip 39 of the side wall 32 of basket 12. It will thus be seen that only the rearward portion 17 of the chamber 16, located adjacent to the end wall 34, is occupied by the scroll 18. The latter does not extend through the remaining portion 19 of chamber 16 located adjacent to the open end 38 of basket 12. The blade 62 overlies only that portion 45 of the screen 44 which is coextensive with the chamber portion 17. The remaining screen portion 46, lying adjacent the lip 39, provides a washing zone for separated solids, as will be made clear hereinbelow.

A feed conduit 70 extends through the open end 38 of the basket 12. At its inner end 72, the conduit 70 extends through the open end 58 of the scroll 18.

A conically-shaped baffle member 74 is mounted within the scroll 18. The baffle member 74, as its inner or con-

stricted end 76, is located at the open end 58 of the scroll 18 and there receives the inner end 72 of the feed conduit 70. At its outer, or flared, end 80, the baffle member 74 is secured in conventional manner to the scroll side wall 60 and at a short distance from the end wall 56. A number of discharge ports 82 are spaced about the scroll wall 60. The discharge ports 82 are each located between end wall 56 of the scroll 18 and the flared end 80 of the baffle member 74.

A conduit 84 for conducting wash liquid extends through the open end 38 of the basket 12 and into the chamber 16. The conduit 84 at its inner end is provided with a nozzle 86. The nozzle 86 is positioned so as to close to the upper surface of the cake of solids advanced across the portion 46 of the screen 44.

The housing 14 is made up of two sections, 13 and 15. The first housing section 13 generally serves to enclose the basket 12. The housing section 13 is formed of a circumferentially-extending wall 92 and two oppositely-positioned side walls 93 and 94. The latter two walls each extend generally radially with respect to the axis of the housing 13. The side wall 93 is provided with a central circular opening 95 which is designed to permit the passage therethrough of the shaft structure 24 of the basket 12 and the shaft structure 30 of the scroll 18. The wall 94 is provided with a circular opening 96, within which the lip 39 of the basket 12 is situated.

The housing section 13 is divided by a radially-extending divider plate 97 into two chambers, 98 and 99. The chamber 98 is situated to receive liquid which has been separated from solids in the operation of the contrifuge 10. Such separated liquid is received from the chamber portion 17 and through the screen portion 45 and adjacently located perforations 42 in the basket side wall 32.

An outpet pipe 106 serves to conduct the separated liquid from the chamber 98. The outlet pipe 106 extends horizontally from a lower portion of the chamber 98 and terminates in a downwardly-directed discharge end 107.

The chamber 99 is situated to receive wash liquor which has been formed by washing of the separated solids by wash liquid from the nozzle 86. Such wash liquor is received from the chamber portion 19 through the screen portion 46 and adjacently located perforations 42. A horizontal outlet pipe 108, having a downwardly-directed outer end 109, extends from a bottom portion of the chamber 99 for the discharge of the wash liquor.

The housing section 15 is formed by the wall 94, a circumferentially-extending wall 110, and an outer end wall 111. The section 15 provides therewithin a generally cylindrical chamber 112 situated to receive washed solids which pass from the chamber 19. Mounted on an upper portion of the wall 110 and located at opposite sides of the chamber 112 are two water inlet couplings 114 connected to water inlet conduits 120. A spray pipe 122, having perforations 123 in the wall thereof, is connected at its opposite ends to the couplings 114. The spray pipe 122 serves to spray liquid, such as water, onto the solids received in the chamber 112. Such liquid carries the solids from the chamber 112 and through a discharge outlet 128.

The housing 14 is designed to permit rotation therewithin of the basket 12. Thus, a small clearance is provided between the shaft structure 24 for the basket 12 and the circumferential surface 130 defining the opening 95 in the side wall 93 of the housing 14. A small clearance is likewise provided between the outer circumferential surface 132 of the lip 39 and the circumferential surface 134 defining the opening 96 in the side wall 94 of the housing 14.

In the operation of the centrifuge 10, feed slurry constituted of a mixture of solids and liquid to be separated is fed through the feed conduit 70 and from the inner end 72 thereof into the scroll 18. The feed slurry proceeds along the inner surface of the baffle member 74 through the discharge ports 82 and onto the screen portion 45. Here, solids and liquid are separated by the centrifugal forces. The separated liquid passes through the screen portion 45, through the adjacent wall perforations 42, and into the chamber 98. Such separated liquid is then withdrawn from the chamber 98 through the discharge pipe 106. The separated solids, possible retaining some adherent liquid, remain on the screen portion 45.

As previously indicated, the scroll 18 is rotated during the centrifuge operation at a speed somewhat faster than that of the basket 12. The rotating helical blade 62 engages the solids which remain on the screen portion 45 after the separation of the liquid. The blade 62 impels such solids along the screen portion 45 and onto the screen portion 46. As the solids pass along the screen portion 46, wash liquid is directed onto such solids through the conduit 84 and the nozzle 86 at the lower end thereof. The solids are thus washed for the removal therefrom of any adherent liquid. The wash liquor passes through the screen portion 46, through the adjacent wall perforations 42, and into the chamber 99. From the chamber 99, the wash liquor is withdrawn through the discharge pipe 108.

The washed solids pass from the screen portion 46 over the lip 39 and into the chamber 112. From the chamber 112, the solids are discharged through the outlet 128. Such discharge is aided by liquid from the spray pipe 122.

The basket 12 is preferably rotated at a speed that will provide a force of 1,000–1,500 g's. The scroll 18 is, as has been indicated, rotated at a speed slightly greater than that of the basket 12. The preferred speed difference is about 2 to 10 r.p.m. As a result of the speed of rotation of the basket, adequate dewatering of the solids is assured. At the same time, the rotation of the scroll 18 relative to the basket 12 provides for advancement of the separated solids by the blade 62 along the screen portions 45 and 46 and over the lip 39.

The length of the screen portion 46 is preferably about one-half that of the screen portion 45. However, in the case of separation in which the viscosity of the adherent liquid is unusually low, a washing zone which is about one-half the length of the basket 12 may be desired. The total quantity of wash liquid employed may be varied, depending upon the extent of washing desired. In some separation procedures, and as already indicated with regard to the separation of ice from brine, a melted form of the solids being washed may be employed as the wash liquid. In other procedures, it may be preferred to employ some other type of wash liquid such as, e.g., a suitable solvent.

When the centrifuge is employed to separate ice crystals from a mother liquor, such as, for example, concentrated coffee extract, small particles of ice or other finely divided solids tend to plug the basket perforations 42 and the openings in the screen 44. According to this invention, such plugging can be prevented by spraying a fluid on the external surface 104 of the basket 12. Located in the chamber 98 and mounted on the circumferential wall portion 92 of the housing section 13 are a plurality of circumferentially spaced spray nozzles 100 (one being shown). Each nozzle 100 is connected through a conduit 102 to a distributor head (not shown). The nozzles 100 are positioned to direct wash fluid, such as water, onto the exterior surface 104 of the basket wall 32. Such wash fluid serves to maintain the perforations 42 clear for free flow therethrough of the liquid separated from the solids. The wash nozzles 100 may be operative intermittently and as required to keep the perforations 42 clear of debris. Continuous use of the nozzles 100 serves to dilute the mother liquor and may be undesirable when the mother liquor is the desired product.

The wash fluid directed through the nozzle 100 may serve to provide either mechanical cleaning of the screen and basket, or may serve to heat the basket and screen and thus melt any ice which may tend to cause the plug-

ging. Thus, the wash fluid may be mother liquor, dilute mother liquor, warm or hot water or steam. The location of the nozzles **100** is such that a portion, or all, of the basket **12** is covered by the spray. The cleaning or unplugging operation can be conducted while the centrifuge is in actual operation (that is, separating solids from liquids) or the cleaning operation may be conducted while no feed slurry is flowing therethrough by rotating the basket and spraying fluid from the nozzle **100** onto the basket **12**. In this manner, the basket **12** and screen **44** may be cleaned without removal from the housing **14** and the cleaning operation will not dilute mother liquor in the chamber **98**.

In accordance with the present invention, a number of modifications may be effected with respect to the structure and operation of the centrifuge **10**. Thus, the basket **12** and the scroll **18** may be designed of a shape other than cylindrical, e.g., conical. Also, the basket **12** may be formed with a solid, rather than perforated side wall **32**. In this case, suitable ports, as are well known in the art, would be provided for the passage of the mother liquor from the chamber **16**.

Although the invention has been described with reference to particular embodiments thereof, it is to be understood that various changes may be made without departing from the spirit of the invention as defined by the scope of the appended claim.

We claim:

1. A method of centrifuging ice from an aqueous liquid comprising:

(a) rotating a mixture of ice and liquid in a perforated centrifuge basket;

(b) directing a spray of heated wash liquid onto the external surface of said basket at a temperature substantially higher than the basket to keep the basket perforations free of ice plugging and to wash the ice substantially free from the aqueous liquid; and

(c) separating and recovering the washed ice from the liquid.

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