April 12, 1960 J. C. F. C. RICHTER 2,932,396

APPARATUS FOR SEPARATING USED LIQUOR FROM CELLULOSIC PULP

Filed Aug. 27, 1957 3 Sheets-Sheet 1

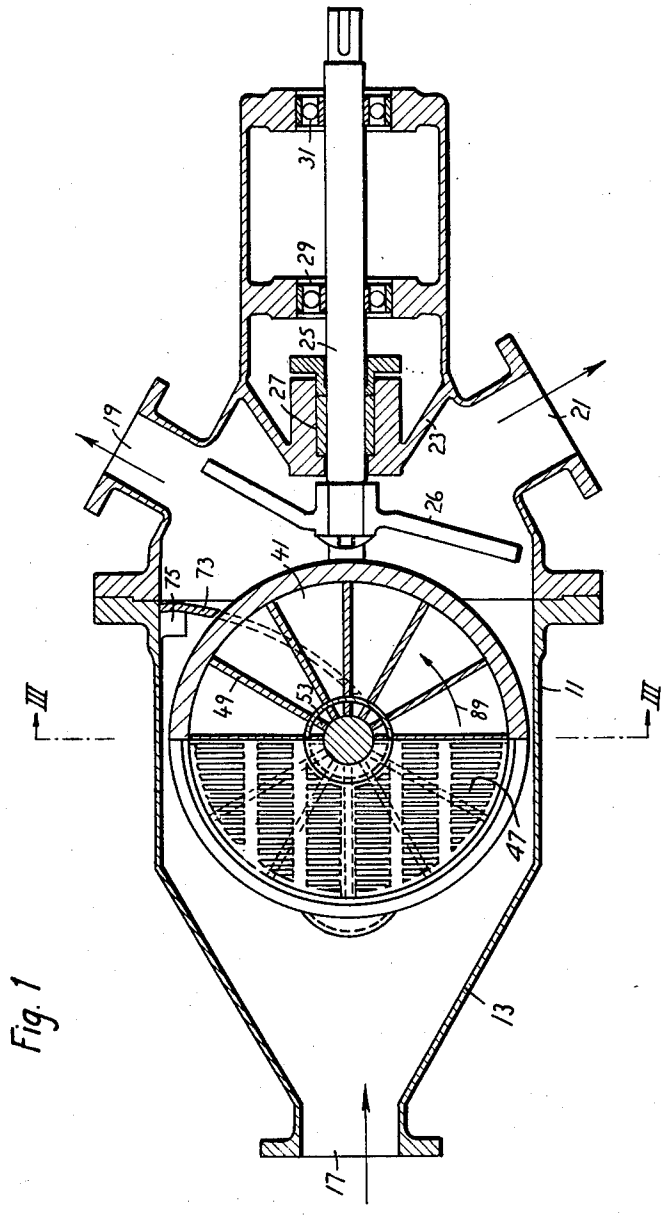


Fig. 1

INVENTOR
JOHAN C. F. C. RICHTER

BY Cushman, Darby & Cushman
ATTORNEYS

April 12, 1960 J. C. F. C. RICHTER 2,932,396

APPARATUS FOR SEPARATING USED LIQUOR FROM CELLULOSIC PULP

Filed Aug. 27, 1957 3 Sheets-Sheet 2

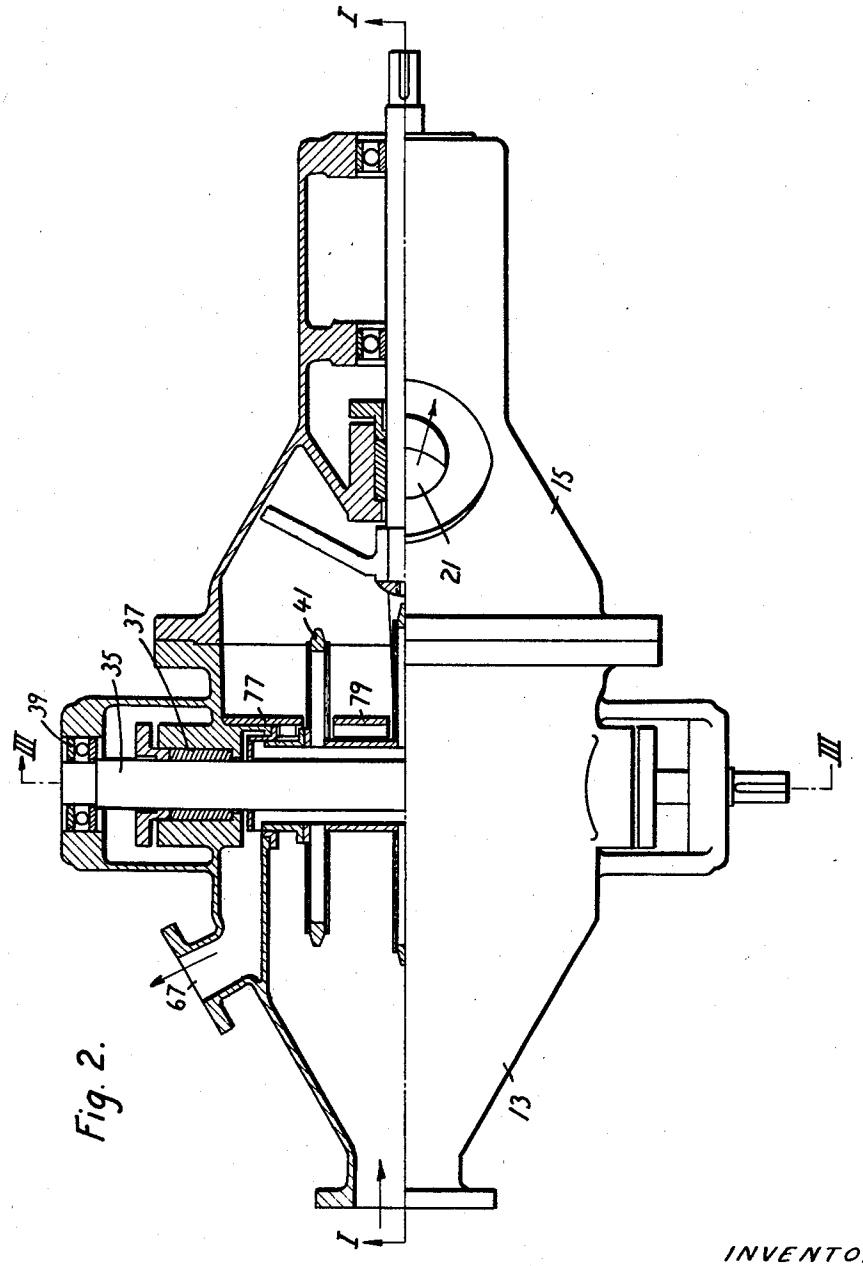


Fig. 2.

INVENTOR
JOHAN C. F. C. RICHTER

BY Cushman, Darby & Cushman
ATTORNEYS

April 12, 1960 J. C. F. C. RICHTER 2,932,396

APPARATUS FOR SEPARATING USED LIQUOR FROM CELLULOSIC PULP

Filed Aug. 27, 1957 3 Sheets-Sheet 3

Fig. 3

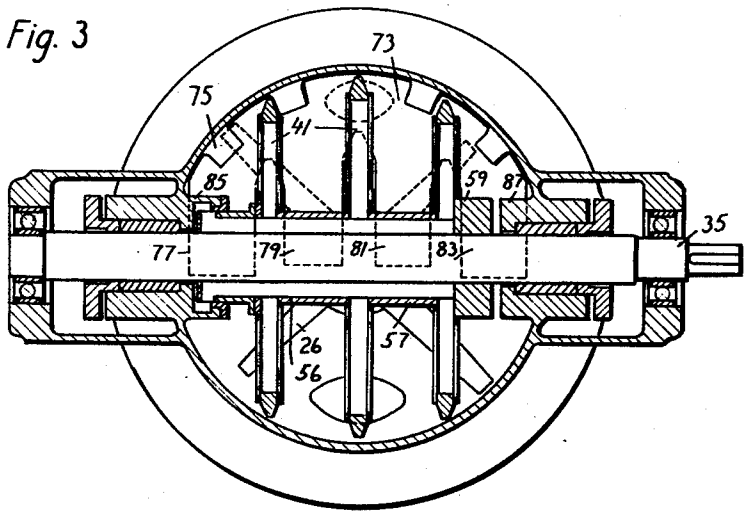


Fig. 5

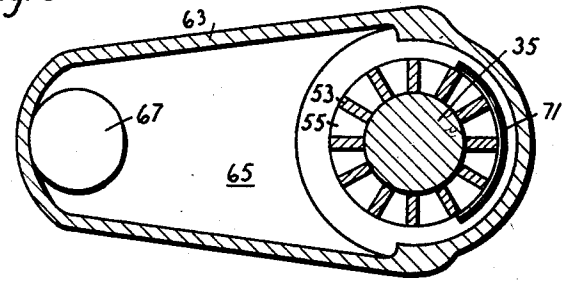
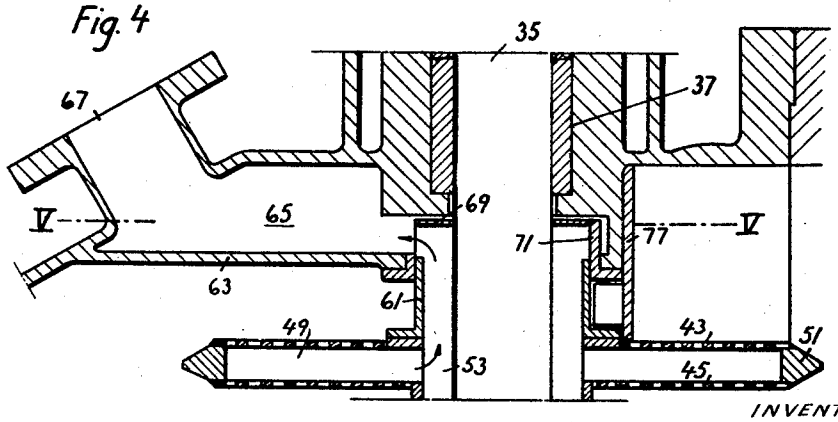


Fig. 4



INVENTOR

JOHAN C. F. C. RICHTER

BY Cushman, Darby & Cushman

ATTORNEYS

United States Patent Office 2,932,396
Patented Apr. 12, 1960

2,932,396

APPARATUS FOR SEPARATING USED LIQUOR FROM CELLULOSIC PULP

Johan C. F. C. Richter, Karlstad, Sweden, assignor to Aktiebolaget Kamyr, Karlstad, Sweden, a company of Sweden

Application August 27, 1957, Serial No. 680,483

Claims priority, application Sweden August 30, 1956

7 Claims. (Cl. 210—152)

The present invention relates to an apparatus for separating used liquor from cellulosic pulp and, more particularly, to an apparatus for separating used liquor from cellulosic pulp when the liquor and pulp are being fed at high pressure and high temperatures from a digester apparatus or any pressure vessel.

An object of the present invention is to provide an apparatus which utilizes the high pressure of the pulp in order to obtain a large pressure drop across the straining surface.

Another object of the present invention is to provide an apparatus which utilizes the high temperature of the pulp to maintain the liquor in the pulp highly fluent so that it may be easily separated off in the strainer.

Still another object of the present invention is to provide an apparatus whereby liquor may be easily and efficiently separated from cellulosic pulp, the apparatus being so constructed as to utilize the high pressure and high temperature of the pulp as it is being fed from a digester or other pressure vessel.

Heretofore separation of used liquor from cellulosic pulp has been accomplished by feeding the viscous pulp to a cylindrical sieve. A concentric feeding screw mounted within the sieve was adapted to convey the viscous pulp axially through the sieve. Such known separators are limited in size for providing efficient separation in that if the size of the apparatus is such that the liquor must pass through too much pulp before reaching the straining surface, then inefficient separation occurs. In other words, if the distance which the liquor must pass through the pulp to reach the straining surface is too great the pulp will have passed through the apparatus without the liquor being expressed. To overcome this, the flow of pulp through the apparatus is slowed but as is obvious such apparatus becomes inefficient as the slowing down of the flow of pulp decreases the output.

The present invention eliminates the aforesaid disadvantages in that an apparatus is provided with straining surfaces formed as rotary disc members positioned parallel to the pulp flow, the disc members being spaced transverse of the pulp flow so that the pulp flow must pass between adjacent disc members. The apparatus includes a pressure-resistant shell having an inlet adapted to be connected to a digester or any other pressure vessel and an outlet for thickened pulp. An additional outlet is provided in the shell, the second outlet being in communication with the disc members, which as mentioned above, have straining surfaces for straining off the used liquor. A more detailed description of the construction of the pressure-resistant shell, the disc members, and the flow of pulp and liquor through the apparatus will follow later in the specification.

The above objects, as well as additional objects, will appear more fully in the following specification, claims and drawings, in which a preferred embodiment of the invention is disclosed.

Figure 1 is a side elevational view of the apparatus of the present invention, the view being partly in section.

Figure 2 is a top plan view of the apparatus shown in Figure 1, parts of the apparatus being shown in section.

Figure 3 is a cross-sectional view of the apparatus taken along the line III—III in Figures 1 or 2.

Figure 4 is an enlarged fragmentary sectional view of the apparatus showing in detail the construction of one of the disc members, and

Figure 5 is a sectional view taken on the line V—V of Figure 4.

Referring now to the drawings, wherein like characters or reference numerals represent like or similar parts, the preferred embodiment of the invention includes a pressure-resistant shell formed by a central cylindrical part **11** and adjoining tapered or conical end parts **13** and **15**. The conical end part **13** has a center inlet **17** which is adapted to be connected to the discharge end of a cellulose digester either directly or by an interposed pressure vessel of a type known in the art. The opposite conical end part **15** of the pressure-resistant shell is attached to the center part **11** by a flange connection and is provided with an outlet **19** on its conical surface. The outlet **19** is adapted to be connected to a sluicing or throttling device of a type known in the art, by which pulp, under digester pressure, or essentially digester pressure, is continuously or in small batches delivered into a blow tank or similar apparatus having a considerably reduced pressure, the pressure sometimes even being atmospheric. A reserve outlet **21** may be provided on the surface of conical part **15** opposite the outlet **19** so that the apparatus of the present invention is capable of being used with one or more sluicing or throttling devices. In other words, by providing the additional outlet **21** the apparatus of the present invention can be quickly changed from one sluicing or throttling device to another sluicing or throttling device.

Conical end part **15** of the shell is provided with an end wall **23**. A shaft **25** extends through the end wall **23** and is coaxial to the longitudinal axis of the shell. Shaft **25** is sealed against the end wall **23** by means of a stuffing box **27** and is rotatably journaled in bearings **29** and **31** carried in an extension of the conical part **15**, as shown in Figure 1. An agitating member **26**, carried on the inner end of shaft **25**, is adapted to be rotated by the shaft at a suitable speed so that thickened pulp being delivered to either of the outlets **19** or **21** is broken up and discharged through the outlets. The agitating member **26** prevents the thickened pulp from building up bridges or plugs that would block the outlets **19** or **21**.

A shaft **35** extending diametrically across the cylindrical center part **11** of the shell at right angles to the longitudinal axis thereof is sealed at each end by stuffing boxes **37** and is journaled in bearings **39** carried on the outside of the shell. Suitable driving means is provided for connection to one end of the shaft so that the shaft may be rotated. Shaft **35** carries a plurality of spaced sieve disc members **41**, the disc members being parallel to each other and located in planes at right angles to the shaft. Only three disc members **41** are shown in the preferred arrangement of the invention but it is to be understood that any number of disc members may be utilized, the number being increased with the increase in size and cross-section of the shell.

As shown in Figures 1 and 3, the disc members **41** have their peripheral edges positioned adjacent or close to the interior wall of the shell, the distance that each disc member is spaced from the wall of the shell being substantially equal Consequently, the disc members **41** are of different diameters depending upon their distance

from the longitudinal center line of the shell. As shown in Figure 3, the disc members **41** are so arranged along the shaft **35** that the flow of pulp from the inlet **17** toward the outlets **19** or **21** is evenly distributed between adjacent disc members or on the outside of the outermost disc members. By providing disc members arranged in this manner, the pulp particles within the flow of pulp through the apparatus are never more than half the distance away from the planar surface of the disc members **41** and therefore, all particles of pulp are insured of passing rather close to the sieve surfaces of the disc members before reaching the thickened pulp outlets **19** and **21**. By having disc members **41** so arranged, the liquor in the pulp does not have to flow through too much of the pulp to reach the sieve surfaces of the disc members when it is being separated from the pulp and, thus, more efficient separation of used liquor and pulp results.

Each of the disc members **41** comprise two substantially planar circular sieve plates **43** and **45**. The plates **43** and **45** may be perforated, as shown in Figure 1, by providing a plurality of narrow slits **47** therein, arranged in parallel rows close together or the plates may be provided with other shaped apertures. The sieve plates **43** and **45** are spaced apart a small distance by means of radially arranged spacer elements **49** and by a ring **51** surrounding the periphery of the disc members. The plates **43** and **45** are welded to the ring so that the ring closes the space between the plates at their periphery and, thus, prevents the escape of liquor from between the plates **43** and **45** outwardly of the disc members. A plurality of ribs **53** extending radially from and longitudinally along the drive shaft **35** define axially passages **55** between themselves. The sieve disc members **41** are centrally apertured, as shown in Figure 4 and are threaded upon the ribs **53**, the edges of plates **43** and **45** adjacent the apertures being welded to spacer sleeves **56** and **57** also carried on ribs **53**. As shown in Figure 3, a ring **59**, provided on shaft **35** abuts and is attached to the right-hand disc member **41** and thereby forms on enclosure for the passages **55** defined by the ribs **53**. Ribs **53** are placed opposite the radial spacers **49** between the plates **43** and **45** when the disc members are assembled on the shaft **35**. Each passage **55**, formed longitudinally along the shaft **35**, communicates with an equally located sector of the interior of all of the disc members **41** but is closed off from adjacent sectors.

As shown in Figure 4, a sleeve element **61** encloses the periphery of the passages **55** defined by the ribs **53**, the sleeve being positioned adjacent the disc member **41** which is opposite the disc member bearing against the ring **59**. Sleeve **61**, as well as the ribs **53**, extend through a stationary wall **63** in the shell, the stationary wall **63** defining a space or passageway **65** into which the passages **55** open outwardly. The shell is provided with a liquor discharge outlet **67** that is in communication with the passageway **65**, the outlet **67** being adapted to be connected to a collecting tank or the like, in which atmospheric pressure or a low pressure, is maintained. By providing a large pressure drop between the sides of the sieve plates **43** and **45**, liquor in the pulp passing between the disc members **41** is pressed through the slits **47** into the sector-shaped spaces between the sieve plates **43** and **45**. The liquor flows inwardly toward the center of the disc members **41** and follows the path of the arrows shown in Figure 4 in that it is discharged to the passages **55** and flows longitudinally along the shaft to where it is radially discharged into the space or passageway **65**. From the passageway **65**, the liquor is discharged through the outlet **67**. A plate **69** bearing against the ends of the ribs **53** provides a radial outlet or orifice for the passages **55** between the sleeve **61** and the plate **69**. An arcuate-shaped blind or cover fixed to the shell is adapted to cover a plurality of the orifices at the end of the passages **55**. During rotation of the disc members **41**, the orifices move past the cover and are successively closed whereby pressure can build up within the disc members **41** so that the pressure between the plates **43** and **45** is substantially the same as the pressure of the pulp passing through the shell. By providing the arcuate-shaped blind or cover **71** to build up the pressure within the disc members **41** during a portion of their rotation, the pulp tightly pressed against the outside of the sieve plates by the differential of pressure between the outside and inside of the sieve plates, is eliminated when the plates have rotated to a position toward the outlets **19** or **21**. Since the pressure is released, the bond between the pulp and the disc is also relieved so that the pulp may be let loose from between adjacent disc members.

In order to guide the flow of pulp through the sieve apparatus and prevent the same from being carried around by the sieve discs in a complete circle, the shell has a partition which allows free passage of the pulp merely on one side of the shaft of the sieve discs. In the embodiment shown, the partition is formed as a plate **73** attached to the wall and extending inwardly towards the shaft **35**. The plate **73** has a half-circular edge fitting the inside of the shell along the upper half of its periphery and is attached to knobs **75** thereon. The inwardly and downwardly directed free edge of the plate is slit like a cam and forms resilient tongues **77, 79, 81, 83** extending in between and along the sides of the sieve discs and bearing with their ends against the rotary sleeves **61, 56, 57** and the ring **59**, respectively, and preferably also against the sleeve-like ends **85, 87** of the stuffing boxes **37**. The line of contact is located on the outlet side of the shaft **35** and the tongues extend approximately in the direction of a tangent to the shaft of the rotary disc set. The plate **73** is slightly bent and forms part of a cylinder, the generatrices of which are parallel to the shaft **35**, the concave side of the plate facing the shaft **35** or the inlet **17**. By designing the partition plate **73** in this manner it serves as a deflector or scraper for removing pulp from the spaces between the sieve discs and for conveying it towards the outlet. When the sieve disc members **41** turn in the direction indicated by the arrow **89**, of Figure 1, pulp sticking to the disc members will meet the plate **73** in an acute angle and be forced to slide in a spiral path toward the periphery of the sieve disc members. Removal of the pulp is also facilitated, as heretofore mentioned, by the sectors of the interior space of the sieve disc members located opposite the plate **73** being shut off from communication with the outlet **67**, so that the pressure of the pulp against the sieve disc members is relieved at these places.

The above-described design of the straining device constitutes merely an example of the practical application of the invention and it is obvious that the design can be modified in several respects without departing from the spirit of the invention. For instance, the device may be modified with respect to the shape of the shell and the location of the inlet, the inlet **17'** for instance being located on the upper side of the shell and the inlet end of the shell being half-spherical in shape. The sieve disc members may be built in a different manner and the liquor outlet passages may be arranged within the shaft **35** and may lack any binding means **71**.

The terminology used in this specification is for the purpose of description and not limitation, the scope of the invention being defined in the claims.

I claim:

1. In an apparatus of the type adapted for use in separating used liquor from cellulosic pulp, the liquor and pulp being fed under pressure from a digester or the like: a shell having an inlet adapted to be connected to the digester for receiving flow of liquor and pulp, a first outlet for discharge of thickened pulp and a second outlet for discharge of separated liquor, said shell being circular in cross-section taken in a plane transverse to the flow of liquor and pulp; a plurality of spaced parallel substantially planar members mounted within said

shell normal to its plane of circular cross-section, said members having varying diameters so that their peripheral edges are equally distanced from the wall of said shell, each of said members being provided with apertures on each of its planar surfaces, and passages therein communicating with said apertures; and means providing communication between the passages in said members and said second outlet in said shell for discharge of liquor expressed through the apertures in said members.

2. An apparatus of the character described in claim 1, including means to vary pressure within said planar members.

3. In an apparatus of the type adapted for use in separating used liquor from cellulosic pulp, the liquor and pulp being fed under pressure from a digester or the like: a shell having an inlet adapted to be connected to the digester for receiving flow of liquor and pulp, a first outlet for discharge of thickened pulp, and a second outlet for discharge of separated liquor, said shell being approximately circular in cross-section taken on a plane normal to the flow of liquor and pulp; a rotatable shaft extending through said shell in its plane of circular cross-section, a plurality of spaced disc members carried by said shaft for rotation therewith, said disc members having varying diameters so that their peripheral edges are equally distanced from the wall of said shell, each of said disc members comprising closely spaced sieve plates closed at the periphery, said rotary shaft being provided

with a passage in communication with the spaces between the plates of each of said disc members and in communication with said second outlet in said shell for carrying off liquor expressed through the plates of said disc members.

4. An apparatus of the character described in claim 3, including means to vary pressure across said sieve plates during rotation of said disc members.

5. An apparatus of the character described in claim 3, including a plate extending from the wall of said shell and provided with tongue-like portions extending between each of said disc members toward said shaft.

6. An apparatus of the character described in claim 3, including an agitator rotatably mounted on an axis transverse of the axis of said disc members, said agitator being positioned on the outlet side of said disc members and arranged to cause the thickened pulp passing from between said disc members to break up and discharge through said first outlet.

7. An apparatus of the character described in claim 5, including means to vary pressure across said disc members so that pulp removed by said tongue-like portions is facilitated.

References Cited in the file of this patent

FOREIGN PATENTS

15,986 France ---------- Aug. 13, 1912
(Addition to No. 427,901)