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SIEVE ARRANGEMENT IN CYLINDRICAL CONTAINERS FOR CELLULOSIC PULP

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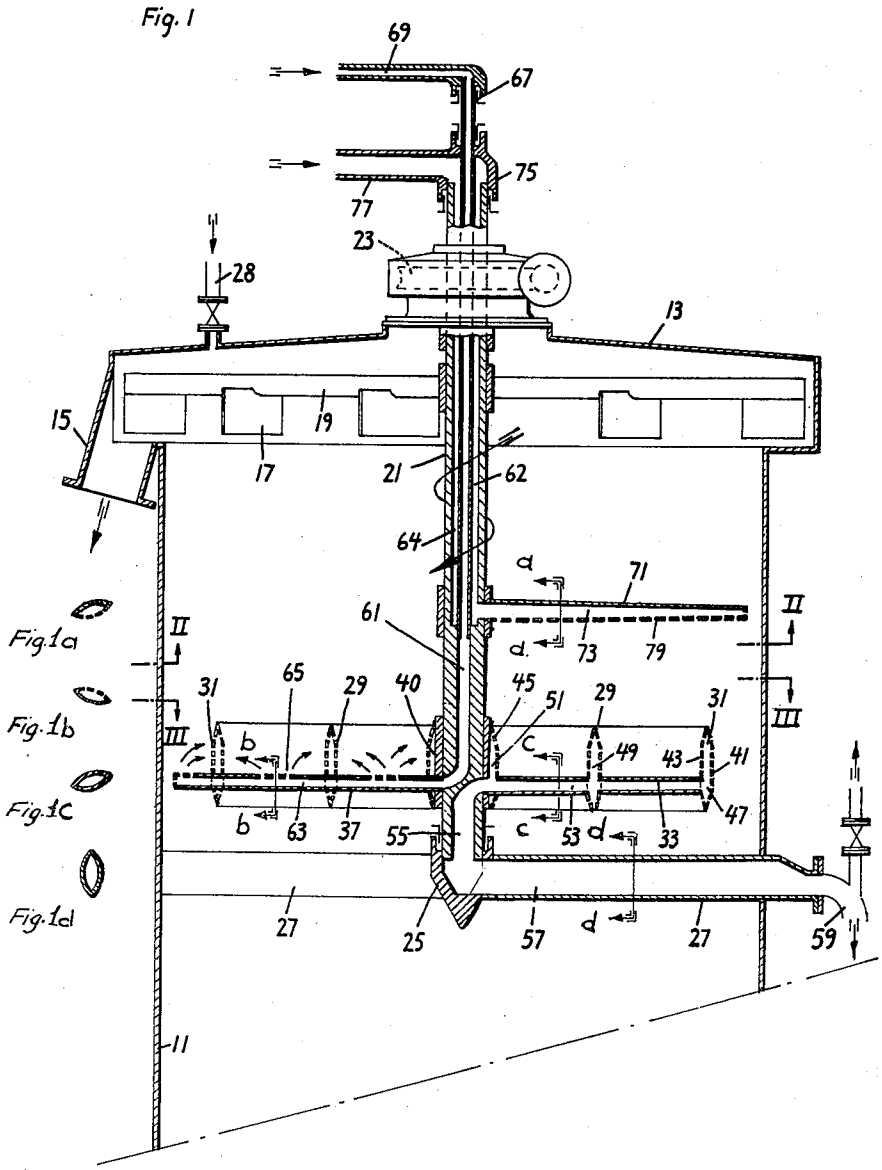
Fig. 1



INVENTORS
JOHAN C.F.C. RICHTER
OLE J. RICHTER

BY Cushman, Darby & Cushman
ATTORNEYS

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Fig. 2

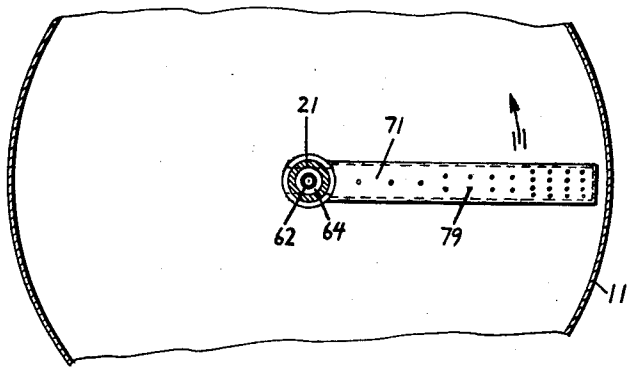
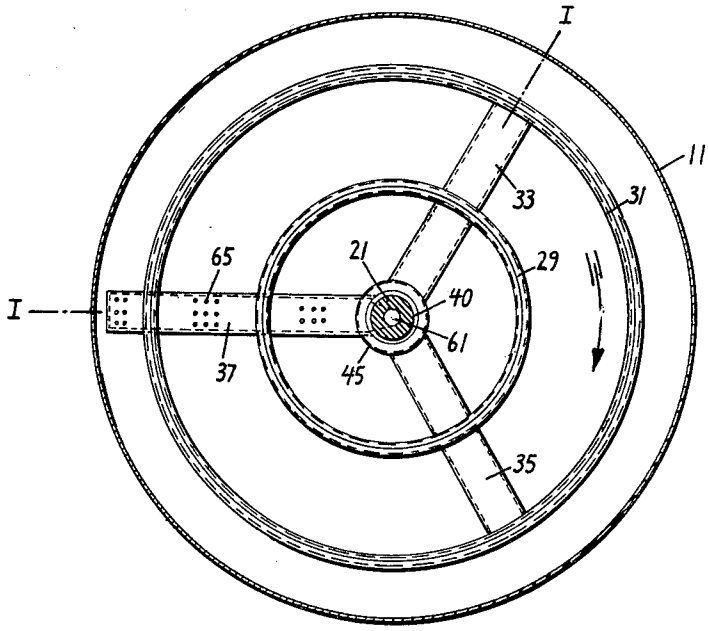


Fig. 3



INVENTORS
JOHAN C.F.C RICHTER
OLE J. RICHTER

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ATTORNEYS

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SIEVE ARRANGEMENT IN CYLINDRICAL CONTAINERS FOR CELLULOSIC PULP

Johan C. F. C. Richter, St. Jean Cap Ferrat, Alpes-Maritimes, France, and Ole J. Richter, Karlstad, Sweden, assignors to Aktiebolaget Kamyr, Karlstad, Sweden, a company of Sweden

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The present invention relates to a sieve arrangement in upright cylindrical containers adapted for axially directed feed of a suspension of a comminuted fiber material and serving particularly for the removal of digesting lye from cellulosic pulp or for washing thereof after its digestion or bleaching. The object of the invention is to create a sieve arrangement by means of which a sieving effect is obtained which is evenly distributed over the cross section of the container and which takes place with an extremely small resistance to the feed of the fiber material.

The main characterizing feature of the invention consists in the provision of the container, of an annular sieve body coaxial to and rotary about the axis of the container, said sieve body being composed of two essentially vertical concentric walls placed one inside the other at a small mutual distance and at least one, but preferably both of said walls being apertured to form a sieve face, said sieve body having a cavity in communication with an exterior outlet for discharge of liquid entering the sieve body through said sieve face. By such a sieve body located at the correct radial distance a double-sided sieving action evenly distributed around the circumference is obtained, and the rotation of the sieve body reduces its resistance to the flow of the pulp, said resistance being small already on account of the sieve body having a thin and preferably streamlined cross section. Two or more sieve bodies of different diameters may be placed coaxially and at the same level in the container in order to obtain an increased equalization of the sieving effect over areas located at different radial distances from the axis of the container. If it is desired to extend the sieving action over a greater axial length of the container, two or more groups of sieve bodies may be placed at different levels therein, each of said groups consisting of concentric sieve bodies arranged essentially at the same level.

The invention will be more closely described hereinbelow with reference to the accompanying drawings. FIG. 1 is a vertical sectional view, taken along the broken line I—I in FIG. 3, of the upper end of a container equipped with a sieve device according to the invention. FIG. 1*a*, FIG. 1*b*, FIG. 1*c* and FIG. 1*d* are sectional views taken on the lines *a—a*, *b—b*, *c—c* and *d—d*, respectively, of FIGURE 1. FIG. 2 is a horizontal view taken from the line II—II in FIG. 1, and FIG. 3 is a horizontal sectional view taken from the line III—III in FIG. 1.

In the drawings, **11** designates the cylindrical wall of an upright container consisting of sheet iron or concrete and adapted for the performance of any kind of chemical treatment of a suspension of cellulosic fiber material. Thus the container may be a digester for wood chips, straw or similar cellulosic material, or a bleach tower for cellulosic pulp already digested and defibrated and of a more or less fluent consistency. The container is arranged to allow the flow of fiber material in the upward direction, either fully continuously or semi-continuously, i.e. stepwise by periodically supplying thereto batches of pulp small in comparison to the volume of the container. Therefore the container is provided at its bottom with feeding devices (not shown) which cause the material to rise vertically up through the container. Provided at the

upper end of the container covered by a hood **13** is a device for discharging the material through a side outlet **15**. Said discharging device may consist of a scraper composed of obliquely set blades **17** carried by radial arms **19** attached to a rotary vertical shaft **21**. Said shaft is arranged centrally in the container and its upper end which protrudes through the hood **13**, carries a worm wheel pertaining to a gear **23** by means of which the shaft is turned. The lower end of the shaft **21** which extends somewhat below the scraper, rests on a bearing **25** carried by a spider the arms **27** of which are attached to the container wall **11**. If desired, the container can be put under superatmospheric pressure which is maintained e.g. by air under overpressure supplied through a conduit **28**.

In the embodiment shown in the drawings, the sieve device essentially consists of two annular sieve bodies **29** and **31** of different size, which by means of radial carrying arms **33**, **35** and **37** and a hub **40** are attached to the shaft **21** in such positions as to be concentric to each other and to the container wall and also located essentially at the same level. Either sieve body consists of two mainly cylindrical, perforated or slitted sieve plates **41**, **43** of slightly different diameters which are put into each other and joined at their upper and lower edges. The distance between the sieve plates is considerably less than their axial length and is chosen with regard thereto that the cavity formed between the sieve plates shall allow quite free flow of the liquid sieved off and that the sieve body shall be rigid enough. Thus in an axial cross section the sieve body is of a configuration which is elongated in the vertical direction and has pointed or rounded ends in order to form the least possible resistance to the flow of pulp past the same. The upper and lower margins of the sieve plates may be bent towards each other and connected by welding, as shown in FIG. 1, or they may be evenly curved, or angularly bent midway between the edges, the cross section of the sieve body then being either lenticular or acutely rhomb-shaped. In all these cases the sieve face extends essentially vertically. If desired, sieve apertures may be omitted at the marginal zones close to the pointed upper and lower edges of the sieve body. According to a modified embodiment the sieve plates are made fully cylindrical and welded to rings of a triangular or semicircular profile or of any other configuration suitable for cutting through the pulp column and for allowing its passage on both sides of the sieve body with the least possible resistance. Arranged close around the hub **40** is another essentially cylindrical sieve face **45** of the same design as the sieve plate **41** but of a much less diameter. The sieve bodies **29**, **31** are located at such radial distances from the axis of the container that the liquid sieved off through the five sieve plates, viz. the sieve plates **41**, **43** on each of the sieve bodies **29**, **31** and the sieve plate **45**, is approximately evenly distributed in proportion to the size of the various sieve surfaces. Usually that means that the radial distances between neighbouring sieve faces are equally great whereas the distance between the outermost sieve face and the wall of the container is half as great.

The cavities **47**, **49** of the sieve bodies **29**, **31** and the cavity inside the sieve plate **45** communicate with a cavity **53** in one of the carrying arms **33**. Said cavity opens out into a bore **55** in the lower end of the shaft **21**, said bore communicating with a cavity **57** in one of the arms **27** of the carrying spider. On the outside of the container wall **11** said cavity is connected to a drain line **59** which lets out the liquid sieved off through the above-mentioned sieve faces.

In the case that the sieve device is meant to be used merely for separating a part of the liquid contents of the fiber suspension from the solid material, the device as above described is complete and operable. If on the

other hand, the sieving operation shall take place without a simultaneous concentration of the pulp and in connection with an exchange of liquids, such as a partial replacement of a treating liquid by a washing liquid, means are required also for the supply of liquid, and such means will now be described.

The shaft **21** has a bore **61** which is not in communication with the bore **55** and the cavity **53** but which is in communication with a cavity **63** in another one **37** of the carrying arms. On its upper side said arm is provided with a number of ejection apertures **65** which are located approximately midway between the various sieve faces and also outside of the sieve body **31**. A continuation of the bore **61** in the upward direction is formed by a tube **62** which is inserted in a wider bore **64** in the shaft **21**. The tube **62** rotates with the shaft **21** and the upper end of the same is connected by means of a sealing box **67** to a stationary tube **69** for a supply of washing liquid. The liquid pumped in through said tube is spread by means of the ejection apertures of the rotary arm **37**, over the cross section of the container at the level of the sieve faces, as indicated by the curved arrows in FIG. 1, the treating liquid being displaced thereby and discharged through the sieve faces and the drain **59** as above described. If desired, ejection apertures may be provided also upon the carrying arm **35**. As shown in FIG. 2, the number of ejection apertures present in the various groups thereof increases as the distance from the shaft **21**. The object thereof is to distribute the wash water supplied as evenly as possible over the cross section of the container. In the arrangement just described a flow of supplied washing liquid and displaced treating liquid is obtained which is directly mainly horizontally and therefore traverses the fiber material fed vertically upwardly, the movement of the latter thus being influenced merely slightly.

A radially directed arm **71** is attached to the shaft **21** somewhat above the sieve bodies **29**, **31**. Said arm is provided with an inner cavity **73** which is in communication with the wide bore **64** of the shaft outside the tube **62**, which bore in its turn is connected by means of a sealing box **75** to a second fixed tube **77** for supply of wash liquid. The arm **71** is provided with a number of ejection apertures **79** which, as shown in FIG. 2, are made the closer the farther from the shaft in order to distribute the washing liquid evenly over the section of the pulp in the container. When washing liquid is supplied through the tube **77**, the same is let out through the above-mentioned ejection apertures **79**, and when the arm **71** is turned by means of the shaft **21**, the washing liquid is spread in an even distribution over the cross section of the container. Then the washing liquid penetrates the pulp in the downward direction, i.e. in counter-current thereto, and pushes the treating liquid to the sieve faces and therefrom to the outlet **59**.

Instead of a single arm **71**, if desired, several such arms may be arranged in an even distribution around the circumference. Washing liquid may be supplied through one or the other of the tube **69**, **77** but also simultaneously through both of them, if that proves advantageous. In most cases, however, either of these two separate systems of wash water supply will be sufficient.

The above-mentioned arms **33**, **35**, **37**, the separate wash water supply arm **71** and the arms of the spider **27** all are of a streamlined cross section, as shown by the cross sectional views FIGS. 1*a*, 1*b*, 1*c* and 1*d* placed on the left side of FIG. 1. The cross section of the arms connected to the rotary shaft is oblique to the vertical line and the degree of obliqueness should be chosen with regard to the speed of rotation of the shaft as well as to the feed of the pulp in such a manner that the arms

give the least possible resistance to the flow of the pulp past the same.

Within the scope of the following claims the above described embodiment may be modified as to its details. Thus for instance, the liquid sieved off can be discharged through an other path than that one shown, e.g. upwardly through the shaft. When several, at different levels placed groups of sieve bodies are provided, means for supply of washing liquid can be arranged also between said groups. Furthermore, for the cleaning of the sieve plates there may be provided doctors or similar means, e.g. vertical resilient steel blades attached to the arms of the spider.

We claim:

1. Apparatus for treating a suspension of comminuted fiber material in a liquid medium comprising: an upright cylindrical container for accommodating an axial flow of the suspension; an annular sieve body within and coaxial with said container, said sieve body including two essentially vertical and concentric walls placed one within the other and spaced apart a small distance so as to form a cavity therebetween, at least one of said walls being apertured to form a sieve face; means mounting said sieve body for rotation about the axis of said container; said mounting means having a bore which communicates with said cavity and with an outlet for said container.

2. Apparatus as in claim 1 in which a plurality of concentric sieve bodies of different diameters are mounted within said container at approximately the same level.

3. Apparatus as in claim 1 in which a plurality of sieve bodies are mounted within said container.

4. Apparatus as in claim 1 wherein said mounting means includes a rotatable shaft concentric to said container and a radial arm extending from said shaft and connecting said sieve body to said shaft, said arm having a bore communicating with a bore in said shaft and with said cavity in said sieve body.

5. Apparatus as in claim 4 wherein said shaft is rotatably supported by a spider attached to the wall of said container, at least one of the arms of said spider having a bore in communication with the bore of said shaft.

6. Apparatus as in claim 4 wherein means for delivering liquid to said container are mounted within said container for rotation with said sieve body.

7. Apparatus as in claim 4 wherein a radially extending hollow arm having ejection apertures therein is attached to said shaft above said sieve body whereby liquid may be directed into said container in a direction opposite to that of the flow of suspension through said container.

8. Apparatus as in claim 4 including a second radial arm extending from said shaft and connecting with said sieve body, said second arm having apertures therein and a bore which communicates with a second bore in said shaft whereby liquid may be directed into said container in a direction transverse to that of the flow of suspension through said container.

9. Apparatus as in claim 4 wherein said arm has a stream-lined, elongated transverse cross-section which is oblique to the axis of said container.

10. Apparatus as in claim 1 wherein said sieve body in radial cross-section is elongated in the vertical direction and has tapered upper and lower edges, thereby being shaped to give a low resistance to the flow of suspension passing past said sieve body.

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