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(54) A method and an apparatus for treating fiber suspension.

(57) The present invention relates to a method and an apparatus for treating fiber suspension. The method and apparatus are especially suitable for power screening of fiber suspension flowing to the head box of a paper machine.

In known filter apparatuses the accept pulp is thickened or diluted, the distribution of pulp fraction is changed and the filter apparatuses have created pulses in the accept pulp. In order to eliminate or minimize these problems a new type of a rotor (7) has been developed to be used with the filter cylinder, on the surface of which on the filter cylinder side protrusions (10) of different shape have been arranged, by which protrusions not only is the filter cylinder (6) kept clean, but also is affected on the axial flow of the fiber suspension.

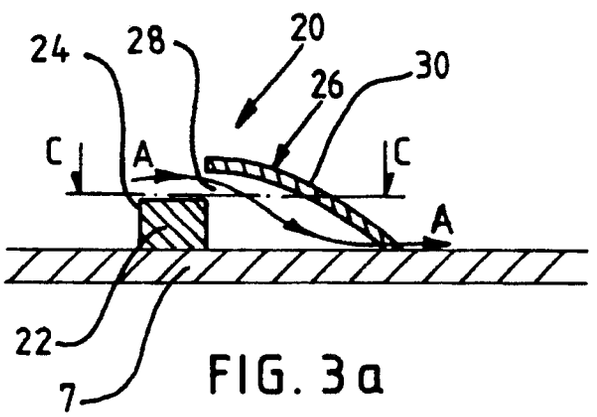
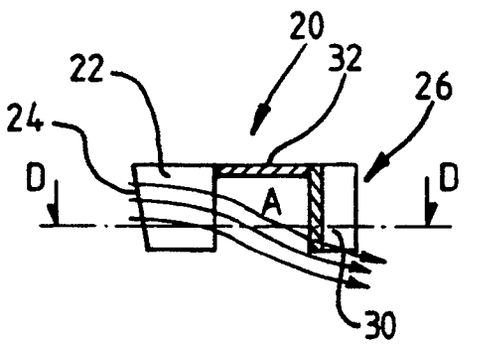


FIG. 3a



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EP 0 398 685 A1

A METHOD AND AN APPARATUS FOR TREATING FIBER SUSPENSION

The present invention relates to a method and an apparatus for treating fiber suspension. The method in accordance with the invention is especially suitable for screening pulps of the pulp and paper industry and also for thickening. The apparatus part of the invention relates to a rotor construction of a power screen or a thickener.

There are, in principle, two previously known types of rotor arrangements, which both are commonly used and the purpose of which is, as well known, to maintain the filter surface clean, in other words to prevent the generation of a fiber matting on the filter surface. An example of one of the types can be appreciated, for example, from the US patent specification 4193865, which discloses a rotor arrangement, in which a rotatable rotor is arranged inside a cylindrical, stationary filter cylinder, and which rotor comprises blades located close to the surface of the filter cylinder, which blades in the construction in accordance with said patent form an angle with the axis of the cylinder. The filter surface is subjected to pressure pulses when the blades move and the pressure pulses consequently open the openings of the surface. There are also arrangements, in which the blades are located on both sides of the filter cylinder. In such a case the suspension being treated is introduced either to the inside or to the outside of the cylinder and the discharge of the accept respectively takes place on the outside or the inside of the cylinder.

An example of the second type is, for example, an arrangement in accordance with US patent specification 3437204, in which the rotor is a substantially cylindrical, closed piece, the surface of which has almost hemispherical protrusions. The pulp in this type of apparatus is introduced to the treating space between the rotor cylinder and the filter cylinder outside the rotor cylinder, whereby the purpose of the rotor protrusions, so called bumps, is both to press the pulp against the filter cylinder and to draw the matted pulp with the trailing edge from the openings of the filter cylinder. Because this type of construction has a highly thickening effect on the pulp, three dilution water conduits have been mounted in the arrangement in accordance with the above mentioned patent at different levels in the filter cylinder so as to satisfactorily carry out the screening of the fiber suspension. A corresponding "bump rotor" is disclosed also in US patent specification 3363759, in which the rotor is slightly conical for the reason explained later on in this description.

Also other embodiments are known of the above mentioned cylindrical rotor, in connection of which different kinds of protrusions on the filter cylinder side are considered to be used with in different specifications.

German application 3006482 disclose a knotter, which has on the surface of a cylindrical rotor drum plough-shaped protrusions made of plate material, the purpose of which is to create strongly mixing forces in the pulp between the rotor and the filter cylinder so that the fibers would penetrate the filter cylinder as effectively as possible and the knots, chops and the like were separated from the rest.

US patent specifications 4188286 and 4202761 illustrate a filter apparatus, which has a rotatable cylindrical rotor inside the filter cylinder. Protrusions have been arranged on the rotor surface on the filter cylinder side, and the protrusions are V-shaped of their axial cross-section in such a way that the one rotational edge has an evenly rising front surface, a surface parallel to the rim of the rotor and a back surface substantially perpendicular against the rotor surface. These protrusions are arranged on the surface of the rotor cylinder in a particular angle position relative to the axial direction so that all the protrusions of the rotor are at a similar position relative to the axis of the rotor.

According to the US patent specifications pulp can be introduced into this apparatus at either side of the filter cylinder. If pulp is introduced to the outside of the filter cylinder and the accept is discharged from the inside of the filter cylinder, in other words from the rotor side, the rotational direction of the rotor is such that the accept is subjected to a downwardly inclined force component by the angle position of the protrusions and that said inclined/rising surface of the protrusions operates as a front surface. If, again, the pulp is introduced between the rotor and the filter cylinder, in other words the accept is discharged from the outside of the filter cylinder, the rotational direction is opposite relative to the previously described, the protrusions tend to slow down the downwardly flowing pulp and the surface which is perpendicular relative to the surface of the rotor cylinder operates as the front surface.

Practical industrial experiments have, however, proved that the above described apparatuses do not operate satisfactorily in all application conditions. For example, the first mentioned blade rotor creates too strong pressure pulses at the accept side of the filter cylinder, and is not therefore suitable for example, in head boxes of the paper machines since they should not have any fluctuation of pressure. The apparatus also tends to dilute the accept, and therefore the blade rotor is not applicable in apparatuses, which require pulp of

a constant consistency.

Since the blades, (4 to 8 blades) in the blade rotor are spaced relatively far from each other, a fiber matting always accumulates on the surface of the filter cylinder before the next blade scrapes it off. Thus the use of the filter is not effective. Additionally, said rotor type is expensive to manufacture due to accurate shapes of the blades and a careful finishing.

A substantially cylindrical rotor illustrated as another model, which has almost hemispherical protrusions, operates in some applications almost ideally, but, for example, with the head box of a paper machine its operation can be provided with additional preconditions. Because the pulp suspension flowing to the head box should be homogeneous, both in consistency and in fiber size, the power screen should not vary these values. However, this kind of a "bump rotor" tends to dilute accept and additionally it causes fluctuation in the consistency values. In the performed experiments it was discovered that a rotor of a certain mentioned type diluted accept between -0.15 to-0.45 % when the accept consistency was 3 %. Consequently, the consistency varies absolutely counting +/- 5 %, which is too much when aiming at a homogenous and qualified final product. On the other hand, fractionation also takes place in the screen comprising a "bump rotor", in other words the mutual relation between the fractions of the fiber suspension supplied to the filter cylinder changes in the screen in such a way that the relation of the fractions of the accept is no longer the same as that of the originally supplied pulp. With a "bump rotor" the extent of change of said fractionation was in the experiments between 5 to 10 % according to the clearance of the filter cylinder and the rotor. The corresponding extent of change with a blade rotor was about 20 %, and therefore even a "bump rotor" is a considerable improvement to the previous apparatuses.

These defects of a filter apparatus provided with a "bump rotor" described above have led to some improvement attempts, such as the above mentioned guidance of the dilution water to the filter surface and in another case the slightly conical shape of the rotor. Both described alternatives reflect the problem occurring in communication with the cylindrical rotor i.e. the uneverness in the use of a filter cylinder in its different zones. A fact is that the flow through the filter cylinder is at its greatest immediately after pulp has come into communication with the cylinder and the rotor. Consequently the pulp thickens to some extent and when the pulp flows downwardly along the surface of the filter cylinder, the amount of the suspension flowing through the filter openings continuously diminishes. Attempts have been made to prevent this by feeding dilution water to different levels of the filter surface, which results in a slightly more effective operation of the filter cylinder, but which also results in the disadvantage of a relatively high dilution of the accept. Another possibility is to vary the clearance between a filter cylinder and a rotor, whereby a greater clearance in the upper part of the filter apparatus enables a higher speed of the downwardly flowing pulp, whereby the pulp fills the clearance better and more homogeneously.

A respective operating method is appreciated from the arrangement disclosed in the US-patent application 4188286, in which the protrusions are inclined relative to the axis of the filter cylinder. The main purpose of the inclination is to prevent the fiber or fiber flocs from attaching to the front edge of the protrusion and from being conveyed with it. A secondary purpose is to bring the accept pulp in the treatment space between the rotor and the filter cylinder subject to a downward force component, by which it is possible to accelerate to some extent the operation of a filter apparatus, at least to accelerate the discharge of the accept from the filter.

The most developed embodiment in the market at the moment is illustrated by the method in accordance with FI patent 77279 and by the arrangement developed to realize this method. The method in accordance with said patent is characterized in that fiber suspension is subjected to axial forces, the intensity and the direction of which vary according to the mutual axial position between the point of application and the counter surface of the filter cylinder, and which are utilized to change the axial speed profile of the fiber suspension yet maintaining the direction of the flow continuously towards the discharge end.

The apparatus in accordance with said invention is characterized in that at least one of the counter surfaces of the filter cylinder, being against the other, has at least one bump or the like, the direction of the front surface of which varies according to the axial position of the bump and by which the pulp particle in the space between the counter surfaces is subjected to an axial force component, the intensity of which varies in function of the axial position of the counter surfaces of the pulp particles, and which changes the speed profile of the fiber suspension flowing between the comter surfaces.

Although the arrangement and the method in accordance with the invention are superior over the prior art technique, it is still possible to further develop the method described in the patent specification and the technical arrangement realizing it. Minute experiments have shown that all rotors, which use any kind of protrusions whether they are of bladelike, hemispherical, rectangular or any oth-

er type, have beginning from the peak of said protrusion towards the trailing direction, pulp, whose consistency and reject content is higher than approximately in the screening zone. This is, of course, due to the fact that the pressure stroke caused on the pulp by the bump has pressed acceptable material through the filter surface, whereby both liquid and acceptable fiber material flows through the screen surface. It has also been discovered in the experiments that said pulp which has a higher consistency and which contains more rejectable material tends to remain against the screen surface regardless of the fact that the effect of the bump on the rotor on said pulp portion stops. This, of cource, weakens the capacity of the screener, because fresh or less screened pulp must first penetrate said layer of a higher consistency to pass the filter. When thickeners are concerned the fiber matting accumulated on the filter surface causes a situation where in order for the filtrate to pass the opening of the filter surface it must also be pressed through said fiber matting.

The present invention relates to a method and apparatus for conveying the above mentioned thicker and courser pulp portion from the filter surface towards the surface of the rotor so that the fresher pulp comes into direct communication with the filter surface, whereby the defects or disadvantages of the prior art apparatuses have been eliminated or minimized.

The method in accordance with the present invention is characterized in that the friction concentrated adjacent to the filter surface and/or containing courser material is subjected to a force component directed away from the filter surface, by means of which said fraction is conveyed away from the adjacence of the filter surface.

An embodiment of the apparatus in accordance with the present invention is characterized in that at least one guide plate is arranged to communicate with the counter member of the filter surface, which guide plate guides the coarser and/or thicker suspension concentrated adjacent to the filter surface, away from the adjacence of the filter surface.

Another embodiment of the apparatus in accordance with the present invention is characterized in that the counter surface to the filter surface has at least one member, which is formed by a protrusion arranged on the counter surface and a guide plate extending from the level of the counter surface higher than said protrusion, which protrusion and guide plate leave an opening therebetween, through which the thicker and/or coarser fraction can flow under the guide plate.

The method and apparatus in accordance with the present invention are described more in detail below, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic illustration of a screener in accordance with FI Patent 77279;

Fig.2 is a schematic side view of a protrusion of a rotor described in the above mentioned FI patent of a screener in accordance with Fig.1;

Figs.3 a and b are schematic illustrations of a protrusion of a rotor in accordance with a preferred embodiment of the present invention developed for the apparatus in accordance with Fig.1; Fig. 3a is a section on the line D-D of Fig. 3b which is a section on line C-C of Fig. 3a and with the rotor surface omitted;

Figs.4 a and b are schematic illustrations of an auxiliary apparatus for intensifying the operation of the protrusion in accordance with the invention arranged into communication with an embodiment in accordance with Fig.3; and

Figs. 5 a and b are schematic sectional illustrations of two protrusion arrangements in accordance with a second embodiment of the invention to replace the substantially spherical calotte shaped protrusions of a so called "bump" rotor, with Fig. 5c being a plan of the protrusions of Figs. 5a and 5b as such look the same in plan and with the rotor surface being omitted.

According to Fig.1 a filter apparatus 1, in accordance with a preferred embodiment of the invention, comprises the following members: an outer casing 2, conduit 3 for the inflowing pulp, conduits 4 and 5 for the accept and the reject respectively, a stationary filter cylinder 6 and therein a substantially cylindrical or possibly conical rotor 7 having a shaft 8 with drive means 9. The filter cylinder 6 may, in principle, be of any previously known type, but the best results are achieved, if a contoured filter cylinder is used. Generally, the apparatus in accordance with the drawing operates in such a way that the fiber suspension is introduced through conduit 3 and flows to the gap between the filter cylinder 6 and the rotor 7, to the so called "treatment" space. The accept, which has flowed through the openings of the filter cylinder - when a thickener is in question the filtrate corresponds to the accept - is discharged through the conduit 4 as far as to the lower end of the gap between the filter cylinder 6 and the rotor 7 and the pulp, which flows away from the gap is discharged through the reject conduit 5. Fig.1 also teaches that members 10 on the surface of the rotor 7, on the side facing the filter cylinder 6 the shape of which members 10 may vary, for example, in the way described in FI patent 77279, according to in which zone they are located, in other words, in which axial part of the rotor they are located.

Fig.2 is a schematic illustration of a member 10, the front surface 11 of which may be either parallel to the direction of the axis of the cylinder, inclined to some direction relative to the axis or

further divided into portions, the inclination of which portions relative to the axis may be chosen as desired. This kind of front surface 11, when moving relative to the pulp towards arrow B subjects the pulp not only to a tangential force component, but also almost always to an axial force component which pumps pulp towards the center area of the cylinder and also always to a pressure stroke towards the filter surface, intensifying the pulp treatment, due to the effect of which the acceptable fiber material and liquid are pressed through the filter and a zone of coarser, to some extent thickened material is generated on the surface of the filter. The front surface 11 of a member 10 in accordance with an embodiment of FI patent 77279 is substantially perpendicular against the surface of rotor 7. The front surface 11 may, of course, also be inclined either to one or the other direction. The protrusion has a part 13 substantially parallel to the surface of rotor 7 and an inclined surface 14 descending from part 13 to the surface of the rotor 7. The above mentioned pressure stroke, which intensifies screening and also thickening, is generated exactly at the front surface of the protrusion or slightly before it, and on the other hand an underpressure zone has tended to be created on the inclined surface of the trailing side of the protrusion, which zone would draw said coarser and thickened material away from the adjacence of the filter surface.

Figs. 3a and 3b illustrate a protrusion arrangement 20 of the rotor in accordance with an embodiment of the present invention, in which arrangement a pressure pulse towards the filter surface is generated by a protrusion 22, which, in principle, may be of any shape. Significant of the protrusion arrangement 20 is that a member 26 has been arranged at the trailing side of the front surface 24 of the protrusion 22 which member extends closer to the inner surface of the filter 6 then the protrusion 22. Member 26 is further characterized by a gap 28 formed between the member and the protrusion 22, through which the thicker and courser pulp generated between the protrusion and the filter surface is allowed to pass to the space between member 26 and the rotor surface, from where it is further discharged to the adjacence of the rotor surface, as arrows A in Figs. 3a and 3b illustrate. Consequently, an underpressurized zone is generated between the member and the filter surface, which zone is filled by fresher, less treated pulp. The member 26 is formed by a guide plate 30 made of bent plate material in the embodiment of the figure, which plate 30 corresponds to the inclined trailing surface 14 of the member 10 in the arrangement illustrated in Fig. 2 creating a corresponding underpressure stroke on the filter surface, and by a plate 32 located on the flow inlet side of the protrusion 20 (most usually at the level of the upper surface of the protrusion when the rotor is vertically positioned). Plate 32 prevents the flow of the fiber material, which has flowed under part 26 from flowing to the upstream side of the protrusion, and on the other hand, also the suspension flowing along the surface of the rotor from flowing under the guide plate 30.

Fig.4 illustrates a protrusion 20 in accordance with Fig.3, which communicates with a backwardly inclined plate 40 arranged to the downstream side of it, the purpose of which plate 40 is to guide the unscreened or at least less screened pulp, which has flowed along the surface of the rotor, from under the part 26 to above the flowing pulp layer. In other words the objective is to replace the thickened pulp including reject and flowing according to arrow A by fresh pulp flowing from the filter surface adjacent to the rotor surface according to arrow E.

Figs. 5a, b and c illustrate how the pulp replacement in accordance with the invention may be realized when so called bump rotors in accordance with the prior art are used. As known, the bump is formed either by an exactly hemispherical or at least a sherical calotte-shaped protrusion, which may either be a closed protrusion 50 (Fig.5a) attached to the surface of the rotor or in some cases possibly a protrusion 52 (Fig5b) pressed on the casing of the rotor from inside of the rotor. In that case a scraper 54 may of course be either a completely separate b4nt protrusion made of metal or the like material (Fig.5a) or a protrusion pressed more deeply from inside of the surface of the rotor (Fig.5b), which protrusion is open substantially from the top and from the downstream side as illustrated in Figs.5b and 5c.

The operation corresponding to the previous embodiments may be created by a so called blade, for example, in such a way that both the outer and the inner surfaces of the blade are provided with guide plates arranged within certain distances from each other, which guide plates either "cut" coarser fiber material, thickened adjacent to the filter surface, carry it into the blade and remove it on the trailing edge of the blade to the other side of the blade or guide in a corresponding way fresher, less treated suspension through the inner space of the blade to the filter surface. Naturally, said flow passages of the suspension inside the blade must be separated from each other with intermediate walls, which may be either perpendicular against the blade surfaces or in a suitably chosen angle relative to them. The guide plates are further characterized in that they are located intermittently relative to each other on the opposite surfaces of the blade.

An alternative to the above described arrangement is to arrange the guide plates above the

blade surface with intermediate members in such a way that the flow of the desired pulp fraction takes place from between the blade and the guide plate. By varying the location of these guide plates or the guide plates mentioned in the previous alternative to different parts of the blade, the pulp replacement process described already with the previous embodiments is carried out.

A rotor provided with the protrusion or blade construction in accordance with the invention is applicable to be utilized both with smooth and grooved filter cylinders, so the filter cylinder may be either completely smooth or grooved in different ways, as described in FI-patent 77279.

Thus by utilizing these arrangements in accordance with the invention new rotors may be applied in older type of filter cylinders and vice versa. This results in a filter cylinder-rotor combination operating better than the previous screening and thickening arrangements.

The rotor arrangement in accordance with the invention was tested in the performed experiments in connection with different filter cylinders and different rotors were compared with each other. The filter cylinders used in the experiments were both smooth cylinders and cylinders made of different plate contours. The test results were examined and it was discovered that the apparatus in accordance with the invention operates with all filter cylinders more effectively than the other rotors. In other words the most preferred filter embodiment according to these tests was a filter cylinder, the grooves of which were formed substantially by the bottom surface parallel to the cylinder casing, the inclined side surface on the upstream side (the inflow direction of the flow) relative to the bottom surface and the side surface substantially perpendicular against the casing surface of the cylinder on the downstream side relative to the bottom surface.

As is clear from the above description, the method and apparatus in accordance with the invention have enabled the elimination or minimization of the defects of the methods and apparatuses of the prior art and at same time it has been possible to gain considerable increases in the maximum capacity. However, it must be noted that above description includes only a few most important embodiments of our invention, which are by no means given to restrict the scope of invention from what is defined in the accompanying claims, which alone define the scope of invention.

Claims

1. Method of treating fiber suspension, in which method suspension is introduced to a space between a filter surface and its counter member, a so called treatment space, wherefrom the finer fraction is discharged through the openings of the filter surface and the coarser fraction remains in said space flowing to the discharge end of the filter surface and being discharged there from the apparatus, **characterized** in that the fraction concentrated adjacent to the filter surface and/or containing coarser material is subjected to a force component directed away from the filter surface, by means of which said fraction is conveyed away from the adjacence of the filter surface.

2. Method in accordance with claims 1, **characterized** in that less treated suspension is introduced to the filter surface to replace said fraction conveyed away.

3. Method in accordance with claim 2, **characterized** in that the fraction concentrated adjacent to the filter surface and/or containing coarser material is subjected to a force component directed away from the filter surface, by means of which said fraction is forced away from the adjacence of the filter surface.

4. Method in accordance with claim 1, **characterized** in that the fraction concentrated adjacent to the filter surface, and that less treated suspension is conveyed to the filter surface to replace said fraction by subjecting said suspension to a radial force component directed towards the filter surface.

5. Method in accordance with claim 1, **characterized** in that the fraction concentrated adjacent to the filter surface and/or containing coarser material is subjected to a force component directed away from the filter surface, by means of which said fraction is forced away from the adjacence of the filter surface and that less treated suspension is forced to the filter surface to replace said fraction by subjecting said suspension to a radial force component directed towards the filter surface.

6. Apparatus for treating fiber suspension, which apparatus (1) comprises an outer casing (2) provided with conduits (3,4 and 5) for the pulp being introduced, the finer fraction and the coarser fraction, and two devices operating with each other, of which one is a filter cylinder (6) and the other a counter member (7), whereby at least one of said devices (6,7) is rotatable, **characterized** in that at least one guide plate is arranged in connection with the counter member, which guide plate is such as to guide the coarser and/or thicker suspension concentrated adjacent to the filter surface away from the adjacence of the filter surface.

7. Apparatus for treating fiber suspension, which apparatus (1) comprises an outer casing (2) provided with conduits (3,4 and 5) for the pulp being introduced, the finer fraction and the coarser fraction, and two counter surfaces operating with each other, of which one is a filter cylinder (6) and

the other a counter surfaoe (7), which substantially corresponds of its form to the filter cylinder (6), whereby at least one of said counter surfaces (6,7) is rotatable, **characterized** in that the counter surface (7) has at least one member (10), which is formed by a protrusion (22,50,52) arranged on the counter surface (7) and a guide plate (30,54) extending from the level of the counter surface (7) higher than the protrusion, which protrusion and guide plate have an opening between them, through which the thicker and/or coarser fraction is allowed to flow under the guide plate (30,54) and sideways from under the guide plate (30,54).

8. Apparatus in accordance with claim 7, **characterized** in that the counter surface (7) is a rotatable rotor, the casing surface of which is provided on the side of the filter surface with at least one member (10), which is formed by a protrusion (22,50,52) arranged on the counter surface (7), and a guide plate (30,54) extending from the level of the counter surface (7) higher than the protrusion.

9. Apparatus in aocordance with claim 7, **characterized** in that the guide plate (30,54) is attached to the counter surface (7) from the trailing side of the protrusion (22,50,52) in such a way that the guide plate (30,54) forms an acute angle with the counter surface (7), opening towards the protrusion (22,50,52).

10. Apparatus in accordance with claim 7, **characterized** in that the guide plate (30) is supported on the counter surface (7) on the plate (32) from the side of the protrusion (22), which receives the axial flow component of the suspension, which at the same time prevents the suspension flowing along the counter surface (7) from flowing under the guide plate (30).

11. Apparatus in accordance with claim 7, **characterized** in that the guide plate (54) is curved, advantageously part of a spherical surface, of its shape.

12. Apparatus in accordance with claim 7, **characterized** in that a blade member (40) is arranged on the trailing side of the protrusion (22,50,52) relative to the axial flow component of the suspension, by which blade member less treated suspension flowing in front of the protrusion (22,50,52) is guided towards the filter surface (6).

13. Apparatus in accordance with claim 6, **characterized** in that the counter member is a blade of a blade rotor, the inner space of which is formed by ducts substantially perpendicular against the axis of the apparatus or slightly deviating therefrom and the outer surface of which is provided with guide plates to guide the thickened/coarser suspension away from the adjacence of the filter surface and/or to guide fresher suspension to the adjacence of the filter surface.

14. Apparatus in accordance with claim 6, **characterized** in that the counter member is a blade of a blade rotor, the surface of which on the side of the filter member is provided with a member of guide plates within certain distances and attached with intermediate members, and by means of which guide plates the pulp in the treatment space is guided away from the adjacence of the filter member.

15. Apparatus in accordance with claim 14, **characterized** in that the farther surface relative to the filter member of the blade is provided with a number of guide plates attached with intermediary members, which plates are located in the longitudinal direction of the blade between the guide plates on the opposite surface of the blade, whereby they guide fresher pulp to the treatment space.

16. Use of an apparatus in accordance with claim 6 or 7 for treating fiber suspensions of pulp and paper industry, **characterized** in that a filter cylinder is utilized in it having a grooved surface on the rotor side.

17. Use in accordance with claim 16, **characterized** in that a filter cylinder is utilized in it, the grooves of which are formed at least by a side surface, substantially perpendicular against the rim, and an inclined side surface.

18. Use in accordance with claim 16, **characterized** in that a filter cylinder is utilized in it, the grooves of which are formed by at least two inclined or curved side surfaces.

19. Use in accordance with claim 16, **characterized** in that a filter cylinder is utilized in it, the grooves of which are formed by a bottom surface, substantially parallel to the casing surface of the filter cylinder, an inclined side surface on the upstream side relative to the bottom surface and a side surface, substantially perpendicular against the casing surface on the downstream side relative to the bottom surface.

20. A counter member (7) on its own for use in an apparatus for treating fiber suspension, **characterized** in that at least one guide plate is provided on or formed from the counter member and is shaped and/or dimensioned so as in use to guide the coarser and/or thicker suspension concentrating adjacent the filter surface away from the adjacence of the filter surface.

21. A counter member in accordance with claim 20, having any of the features thereof claimed in anyone of claims 8 - 19.

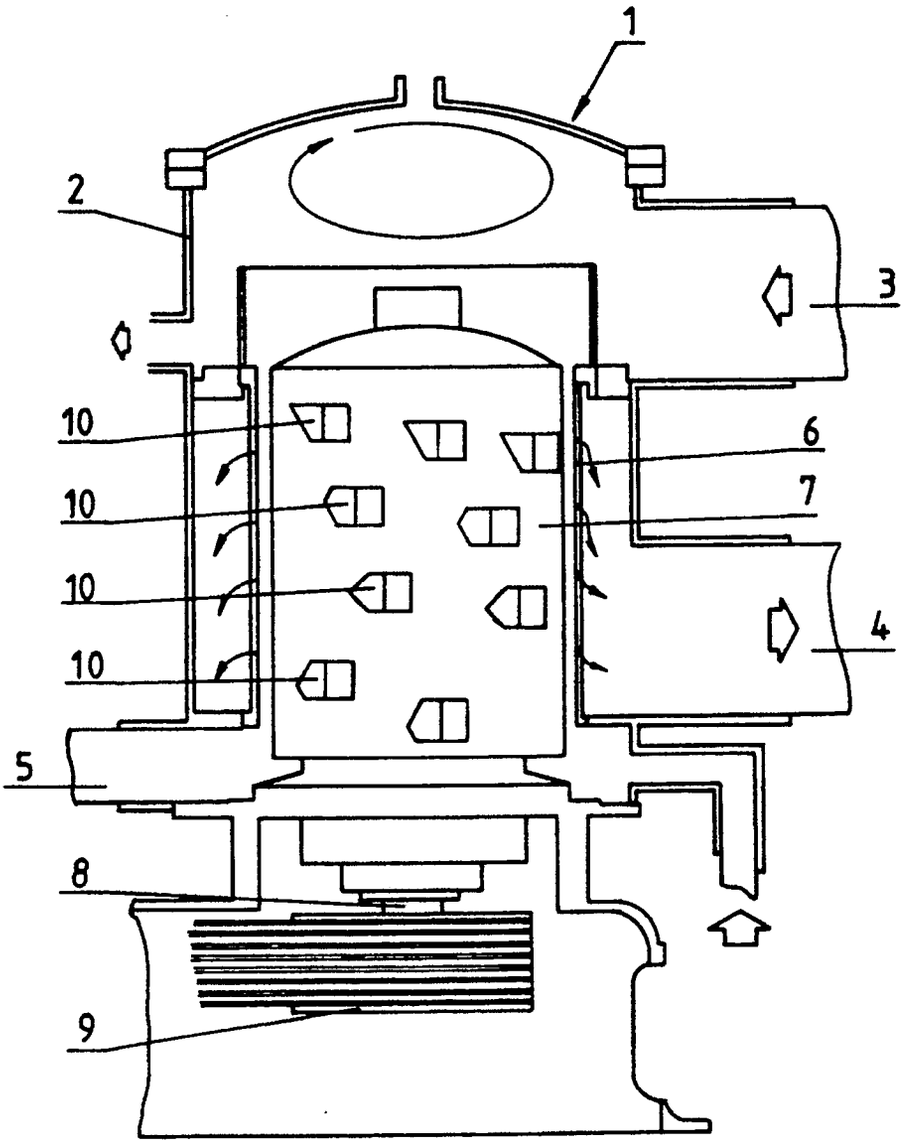


FIG. 1

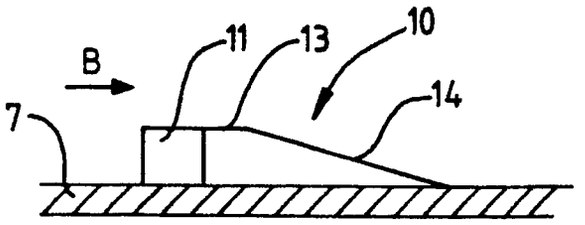


FIG. 2

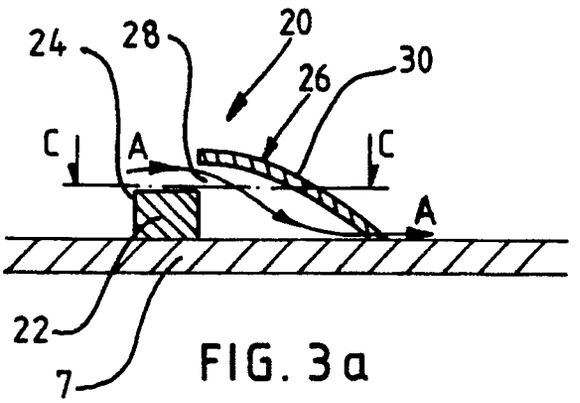
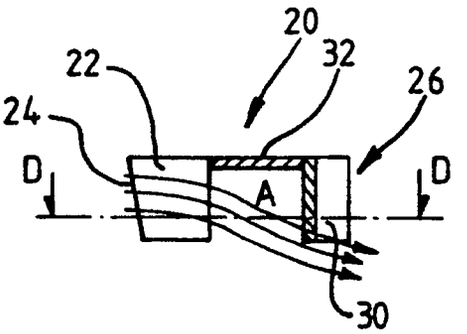


FIG. 3a



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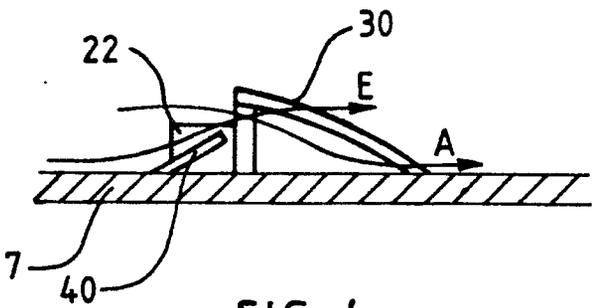
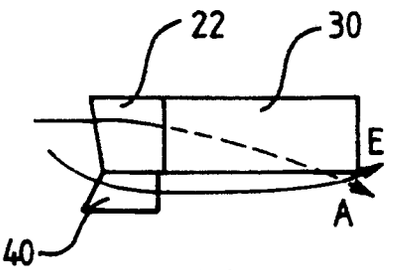


FIG. 4a



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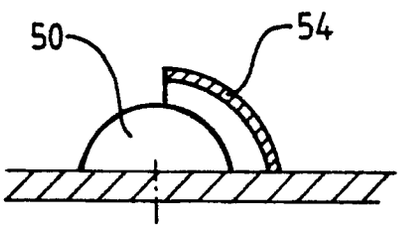
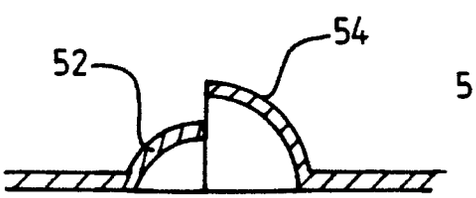
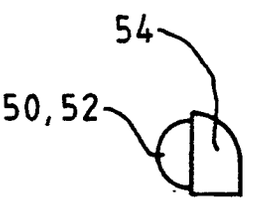


FIG. 5a



5b



5c

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 30 5288

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2547605 (ESCHER WYSS) * the whole document *	1-6, 20	D21D5/02
A		7, 8, 11	
X	US-A-3953325 (NELSON) * the whole document *	1, 3	
A		6, 13	
A	EP-A-289020 (AHLSTRÖM) * the whole document *	1, 16-19	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 SEPTEMBER 1990	DE RIJCK F.

CATEGORY OF CITED DOCUMENTS

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1