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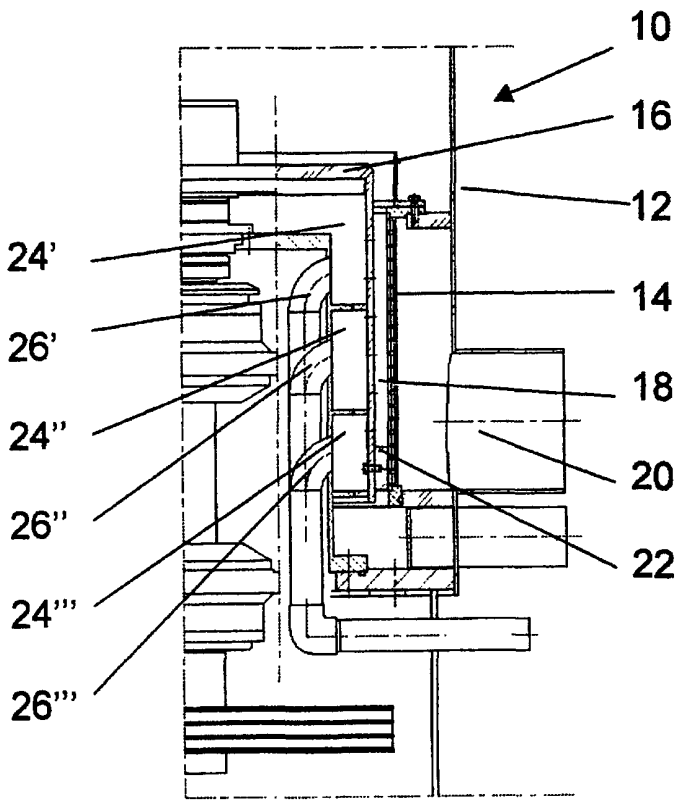
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(54) Title: ARRANGEMENT AND ROTOR FOR SCREENING OF PULP



(57) Abstract: The present invention relates to an arrangement and a rotor for screening of pulp. The arrangement and rotor according to the invention are especially suitable for the screening of chemical and mechanical pulps, i.e. fiber suspensions of the wood processing industry. A characteristic feature of the arrangement and rotor according to the invention is that inside the rotor (16) there is arranged at least one dilution liquid chamber (24', 24'', 24''') restricted by a surface of the rotor (16), which surface is provided with means for opening a dilution liquid connection from said at least one chamber (24', 24'', 24''') to the screening space to a distance of at least 20 mm from the inner surface of the screen drum (14).

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Arrangement and rotor for screening of pulp

The present invention relates to an arrangement and a rotor for screening of pulp. The arrangement and rotor according to the invention are especially suitable for the screening of chemical and mechanical pulps, i.e. fiber suspensions of the wood processing industry.

Naturally, prior art knows several devices used for screening fiber suspension. Reference is here made to solutions according to US patents 5,000,842, 5,224,603 and 5,547,083 which are meant for screening fiber suspensions at a relatively high consistency, which in the field of screening means a consistency of about 2.5 – 5 %. Said consistency is so high, that in order to maintain the screenability of the pulp, special characteristics and construction are required from the pulsation member, i.e. the rotor, to prevent the pulp from forming excessively large and strong fiber accumulations in the screening area. E. g., in the above patents the rotor is essentially cylindrical and on the surface of the cylinder there are so-called bulges arranged according to a certain configuration for maintaining the turbulence level and pulsation of the suspension.

During the years, the screen comprising said rotor has proved to be a reliable and advantageous apparatus, but in some situations the consistency of the suspension in the screening area between the screen drum and the rotor tends to rise so high that said bulges are not capable of increasing the turbulence level high enough to maintain optimum screening efficiency. One solution for the problem is to apply dilution of the suspension in the screening area.

Accordingly, prior art knows several various solutions for diluting the pulp between the cylindrical rotor and the also cylindrical screen drum. As an example of these solutions e.g. US patent 4,234,417 may be mentioned, in which the surface of the rotor cylinder is provided with blades extending to the whole height of the rotor. On the trailing side of these blades, when looking in the rotating direction of the rotor, there are outlet ports via

which dilution liquid is fed in the suspension. Said outlet ports lead inside the rotor, where there are three annular chambers arranged one upon the other so that dilution liquid is fed into each chamber from outside the screen.

Said construction has both advantages and disadvantages. The only advantage worth mentioning is that the dilution liquid is fed specifically via the rotor, whereby it would not be necessary to guide it near to the screening surface. Nevertheless, when performing according to the patent, i.e. when bringing the dilution liquid via the blades of the rotor onto the back surface of the blades, to the area of intense suction, there is a great risk that the dilution liquid is passed onto the screening surface and therethrough quickly further to the accept side without actually diluting the pulp in the screening area. A second disadvantage worth mentioning is the complexity of the construction, as e.g. making the hole of Fig. 5 requires two opposite drillings in the blade and additionally one drilling in the surface of the rotor cylinder.

Said problems have been solved by the arrangement and rotor according to the present invention, the characteristic features of which are disclosed in the appended claims.

In the following, the invention is disclosed in more detail with reference to the appended figures, of which

Fig. 1 illustrates an arrangement according to a preferred embodiment of the invention in side projection from the direction of the screen axis, and

Fig. 2 illustrates an arrangement according to a second preferred embodiment of the invention in side projection from the direction of the screen axis.

The invention relates to a screen, preferably a pressure screen, comprising an essentially cylindrical outer casing with its end, a stationary essentially cylindrical screen drum (although in some circumstances a conical screen drum is also used) arranged inside it, which leaves between itself and said casing a so-called accept space. Inside the screen drum, there is a rotor arranged at the shaft led via the other end, which rotor is provided

with members for creating pressure impulses required for the screening in the annular so-called screening space between the screen drum and the rotor. The outer casing of the screen is further provided with at least three conduits. A feeding conduit communicates with the screening space and when the screen has been positioned to a vertical position said conduit is arranged at the upper end of the screen casing. An accept discharge conduit is arranged on the outer casing of the screen and communicates with the accept space. And a third conduit is a reject conduit, which communicates with the screening space, from the direction of the feeding conduit with the opposite end thereof. In some cases there is further an apparatus for separating so-called heavy or coarse reject arranged at the upper end of the screen above the screen drum.

The screen 10 according to Fig. 1 comprises in this embodiment primarily the components described above, of which e.g. the following may be mentioned here: an essentially cylindrical casing 12, inside of which there is arranged an essentially cylindrical screen drum 14 attached to the casing, inside of which drum there is a rotating essentially cylindrical rotor 16. From the screening space 18, more specifically from the lower end thereof, between the outer casing 12 and the screen drum 14, a so-called accept conduit 20 leads out of the screen. The outer surface of the rotor 16 is provided with pulsation members located at certain intervals, e.g. so-called bulges 22, which are described e.g. in US patent 5,000,842. According to a preferred embodiment of the invention illustrated in this figure, there is/are at least one, preferably three annular chambers 24', 24'' and 24''' arranged inside the rotor 16. Dilution liquid is fed into these by means of at least one, preferably three tubes 26', 26'', 26''' from outside the screen 10. Preferably there are regulation valves (not shown) arranged in connection with said tubes 26', 26'', 26''', by means of which valves the pressure/amount of liquid flowing in the tubes may be regulated if desired. At the location of the chambers 24', 24'', 24''', the surface of the rotor is perforated so that dilution liquid from the chambers is allowed to flow through the rotor casing. Said chambers 24', 24'' and 24''' extend preferably to at least 50% of the whole length of the rotor, preferably to at least 70% of the length of the rotor. Preferably the lowest chamber 24''' is located in the vicinity of the lower edge

of the rotor so that liquid being fed from the chamber into the screening space dilutes the pulp in the space throughout the whole screen drum 14 and the lower edges of the rotor 16.

Fig. 2 illustrates a screen 100 according to another preferred embodiment of the invention, which screen differs from that of figure 1 in that said screen 100 has two screening zones with two accept spaces 119 and 119' and two screen drums 114' and 114''. Of course, it is possible to arrange the apparatus to operate with one screen drum only, whereby the type of perforation of the lower part of the screen drum 114'' located at the second accept space is preferably different from that of the upper part of the drum 114'. The embodiment of the figure has naturally also two accept discharge conduits, conduits 120' and 120'', one from each accept space 119 and 119'. A further characteristic feature of the invention of this embodiment is that the rotor 116 is further provided with still one dilution liquid chamber 124'''' located opposite the second accept space 119'. The idea of the solution according to this embodiment is that among the reject i.e. the fiber suspension still present in the screening area after screening in the first screening stage, the upper one in the figure, possibly performed at a relatively high consistency, there still is acceptable fiber fraction that might be separated from the suspension in preferable conditions. These conditions may be created so that dilution liquid is fed amply from the lower dilution liquid chamber into the screening space, whereby the consistency of the fiber suspension in the screening space decreases very low, which in turn ensures that all acceptable fiber material is "washed" from the suspension. This way minimizing the reject amount may maximize the efficiency of the apparatus.

What makes the arrangement according to the present invention superior to prior art solutions is that the dilution liquid is led onto the cylindrical rotor as far away from the screen drum as possible, whereby the risk of the dilution liquid passing quickly into the accept is minimized. However, it is clear that the dilution liquid is efficiently mixed in the fiber suspension, as the continuously operating turbulence-generating elements in

the space between the rotor and the screen drum maintain continuous turbulence in the screening space.

In our experiments we have noticed that by bringing the dilution liquid to a distance of at least about 20 mm, though preferably at least 25 mm from the screening surface, the dilution of the accept may be minimized, while the consistency of the fiber suspension in the screening space may be maintained during the whole screening operation essentially the same as the consistency of the untreated fiber suspension being fed into the apparatus. Further our experiments attested our fear, i.e. that if the dilution liquid is brought nearer to the screening surface, the dilution of the accept initiates and the consistency of the suspension in the screening space increases, whereby part of the usable fiber material inevitably remains in the reject.

Additionally our experiments showed that the turbulence-generating elements on the surface of the rotor should preferably be, if not exactly similar to the ones described in US patent 5,000,842, at least relatively closely resembling them. That is, the turbulence-generating elements shall most preferably be angular and in many cases plow-like in order to both generate an intense turbulence in the fiber suspension and guide the movement of the suspension in the screening space to a desired direction.

As noticed from the above, a new way of treating pulp in connection with screening has been developed, in which way the consistency of the pulp in the screening space between the rotor and the screen drum remains essentially the same during the whole screening operation. What has been presented in the above, is to be understood as just some preferable examples of the invention, from which the invention may differ in many relations within the scope of the appended claims. Thus, it is completely possible that inside the rotor there are not only one or three but e.g. two or four, or even more, dilution liquid chambers. The number of the chambers is completely dependent on the object of application of the rotor. Accordingly, it is totally possible and in some cases even recommendable that the walls between the chambers are not completely imperme-

able, but between them may be arranged some kind of e.g. throttled flow connection. Further it is possible to lead dilution liquid into all chambers via one and the same inlet tube and to regulate the flow of the liquid into the screening space by changing the size of the flow openings in the longitudinal direction of the rotor. Further it is naturally clear that the screen may be positioned in another position than the vertical position presented in the above description.

CLAIMS

1. Arrangement for screening of pulp, which arrangement relates to a screen (10, 100), the screen comprising at least an outer casing (12, 112) and at least one stationary essentially cylindrical screen drum (14, 114', 114'') arranged inside the casing and a rotating essentially cylindrical rotor (16, 116) arranged inside the drum, onto the essentially cylindrical surface of which rotor there are turbulence-generating members (22, 122) attached and on the inside of the essentially cylindrical surface of which rotor there is arranged at least one dilution liquid chamber (24', 24'', 24''', 124', 124'', 124''', 124''''), **characterized** in that the surface of the rotor (16, 116) restricting one side of said at least one dilution liquid chamber (24', 24'', 24''', 124', 124'', 124''', 124'''') is provided with means for opening a dilution liquid connection from said at least one chamber (24', 24'', 24''', 124', 124'', 124''', 124'''') to the screening space to a distance of at least 20 mm from the inner surface of the screen drum (14, 114', 114'').

2. Arrangement according to claim 1, **characterized** in that said at least one chamber (24', 24'', 24''', 124', 124'', 124''', 124'''') is attached to the outside of the screen by means of at least one tube (26', 26'', 26''', 126', 126'', 126''', 126'''') for leading dilution liquid to said at least one chamber (24', 24'', 24''', 124', 124'', 124''', 124'''').

3. Arrangement according to claim 1, **characterized** in that in said at least one tube (26', 26'', 26''',126', 126'', 126''', 126'''') there is arranged a valve for regulating the dilution liquid flow.

4. Arrangement according to claim 1, **characterized** in that there is a flow connection arranged between the chambers (24', 24'', 24''', 124', 124'', 124''', 124'''').

5. Arrangement according to claim 1, **characterized** in that said means for opening a dilution liquid connection is perforation arranged on the surface of the rotor (16, 116).

6. Arrangement according to claim 5, **characterized** in that the surface of the rotor (16) in the zone of the chambers (24', 24'', 24''', 124', 124'', 124''', 124'''') has perforation on at least half of its length, preferably on 70% of its length.

7. Arrangement according to claim 5, **characterized** in that the surface of the rotor (16) has perforation starting from its lower edge in the zone of the chambers (24', 24'', 24''', 124', 124'', 124''', 124'''').

8. Arrangement according to claim 1, **characterized** in that the screen (100) is provided with two screening zones with two screen drums or parts of drums (114', 114''), whereby said at least one dilution liquid chamber (124'''') of the rotor (116) is situated at the location of the screen drum or its part (114'') of the second screening zone of the screen.

9. Arrangement according to claim 1, **characterized** in that said dilution liquid connection is provided by openings made in the casing of the rotor (16, 116), which openings open to the outer surface of the rotor (16, 116).

10. Rotor for screening of pulp, which rotor (16, 116) is rotating and essentially cylindrical and onto the essentially cylindrical surface of which there are turbulence-generating members (22, 122) attached and on the inside of which cylindrical surface there is arranged at least one dilution liquid chamber (24', 24'', 24''', 124', 124'', 124''', 124''''), **characterized** in that the surface of the rotor (16, 116) restricting at least one side of said at least one dilution liquid chamber (24', 24'', 24''', 124', 124'', 124''', 124'''') is provided with means for opening a dilution liquid connection from said at least one chamber (24', 24'', 24''', 124', 124'', 124''', 124'''') to the outer surface of the rotor (16, 116).

11. Arrangement according to claim 10, **characterized** in that at least one tube (26', 26'', 26''',126', 126'', 126''', 126'''') is connected to said at least one chamber (24', 24'', 24''', 124', 124'', 124''', 124'''') for leading dilution liquid to said at least one chamber (24', 24'', 24''', 124', 124'', 124''', 124'''').

12. Arrangement according to claim 10, **characterized** in that there is a valve arranged in said at least one tube (26', 26'', 26''',126', 126'', 126''', 126'''') for regulating the dilution liquid flow.

13. Arrangement according to claim 10, **characterized** in that there is flow connection arranged between the chambers (24', 24'', 24''', 124', 124'', 124''', 124'''').

14. Arrangement according to claim 10, **characterized** in that said means for opening a dilution liquid connection is perforation arranged on the surface of the rotor (16, 116).

15. Arrangement according to claim 14, **characterized** in that the surface of the rotor (16) in the zone of the chambers (24', 24'', 24''', 124', 124'', 124''', 124'''') has perforation on at least half of its length, preferably on 70% of its length.

16. Arrangement according to claim 14, **characterized** in that the surface of the rotor (16) has perforation starting from its lower edge in the zone of the chambers (24', 24'', 24''', 124', 124'', 124''', 124'''').

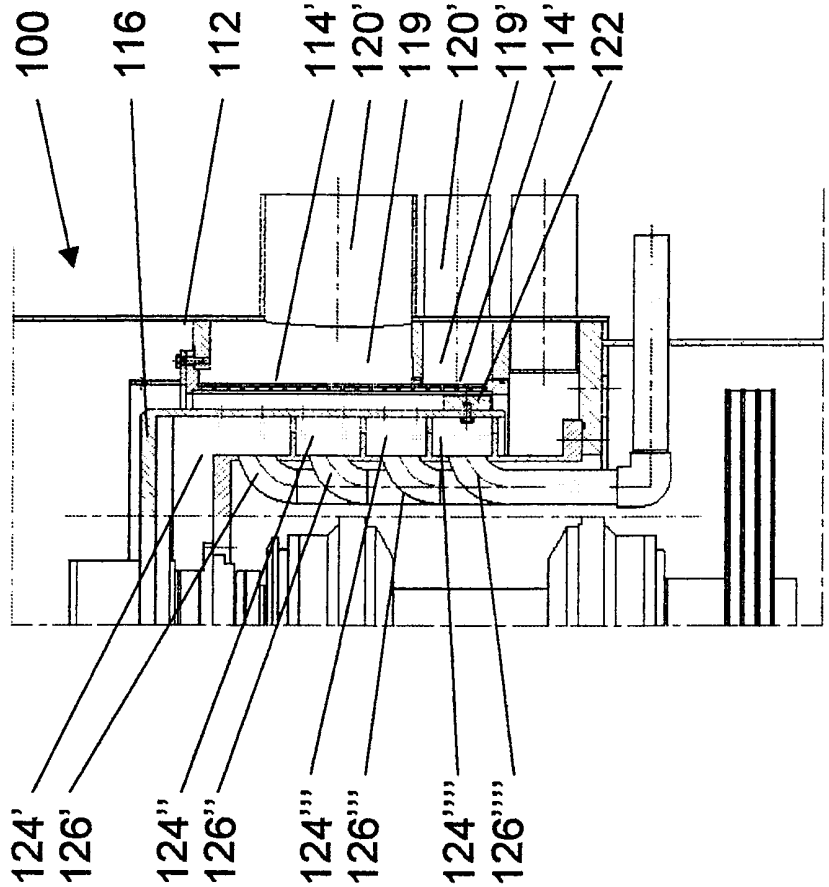

100
116
112
114'
120'
119
120''
119'
114''
122
124'
126'
124''
126''
124'''
126'''
124''''
126''''

Fig. 2

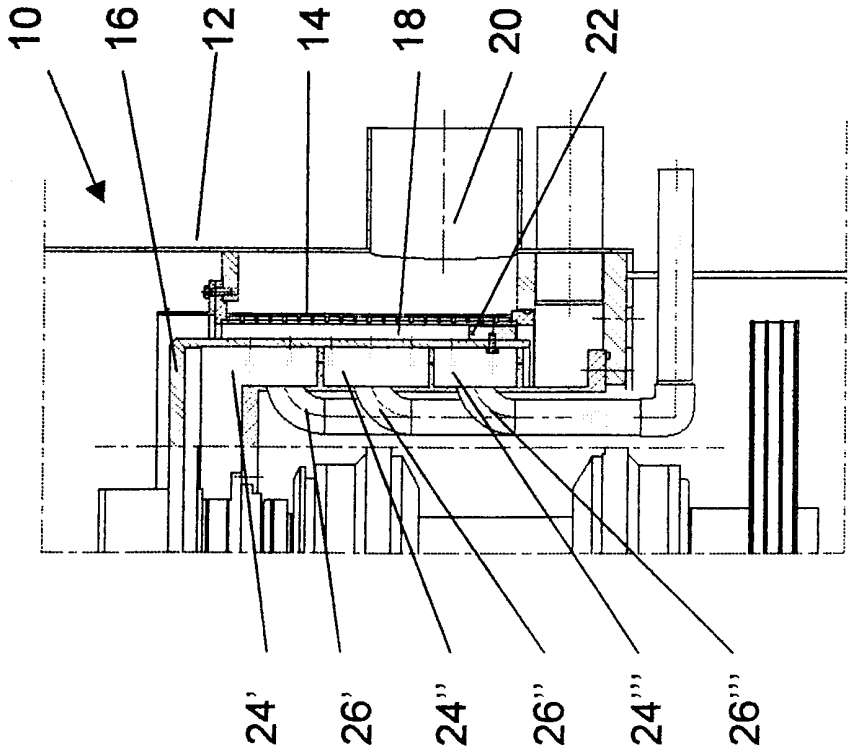

10
16
12
14
18
20
22
24'
26'
24''
26''
24'''
26'''

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/01014

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21D 5/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 1007576 A1 (MARTIN, ANDREW C.), 29 March 1977 (29.03.77), page 4, line 7 - line 10; page 4, line 14 - line 15; page 5, line 15 - line 20, page 6, line 1 - line 9	1-16
A	WO 9323609 A1 (POM DEVELOPMENT OY AB), 25 November 1993 (25.11.93), claim 1, abstract	1-16
A	CA 1335191 A1 (PIILONEN, TIMO T.), 11 April 1995 (11.04.95), abstract	1-16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CA 1007576 A1	29/03/77	NONE	
WO 9323609 A1	25/11/93	AU 4071393 A	13/12/93
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