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(54) **Title**: METHOD AND ARRANGEMENT FOR TREATING PULP

(57) **Abstract**: The present invention relates to an arrangement and a method for treating a pulp to be fed to a screen room at a pulp mill. The arrangement comprises a tower (100) having an upstanding wall (102), and a bottom (108); a pulp inlet (112) in an upper part of the tower; a device (114) for feeding dilution liquid into the pulp flowing downwards in the tower, said dilution device being located substantially at a level which divides the tower to said upper part (104) and a bottom part (106), and a discharge device (120) for diluted pulp arranged in the bottom part of the tower. A device for (116, 118) homogenizing the consistency of the diluted pulp flow is arranged at a distance downstream of the dilution device in the pulp flow direction and upstream of the discharge device.

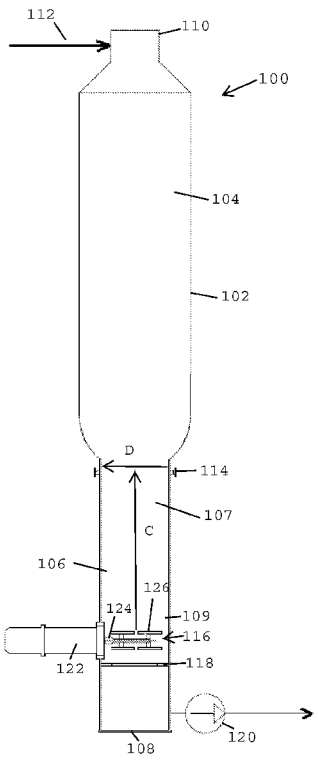

FIG. 3

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METHOD AND ARRANGEMENT FOR TREATING PULP

FIELD OF THE INVENTION

The present invention relates to a method and arrangement for treating pulp to be fed to a screen room at a pulp mill.

BACKGROUND OF THE INVENTION

In chemical wood processing the wood material is fed into a digester where wood chips are treated so that pulp (brown stock) is produced and subsequent to the digester the pulp is mainly in fibrous state or it can at least be easily disintegrated into fibrous state. The so-called brown stock discharged from the digester is washed and taken typically into a delignification stage, in which oxygen is usually used as the delignification chemical. The delignification stage ends with washing.

The brown stock discharged from the digester or the oxygen-delignified pulp is typically screened at a screen room at a suitable process stage. The aim of the pulp screening is to separate the material unwanted for further process and especially for the final product from the pulp. Screening is, however, an operation requiring the consistency of the pulp to be diluted to about 1-4%, depending to some extent on the apparatus to be used. The pulp is typically fed to the screening from a blow tank of the digester plant or a tank following the oxygen delignification reactor where the consistency of the pulp is at medium consistency of 8-14 %. In order to dilute the pulp from this discharge consistency to the consistency of a few percent required by the screening apparatus, a dilution system is arranged in the tank for pumping the necessary amount of dilution liquid. In most cases the pulp is fed into the tank through the top thereof, and the pulp is discharged directly adjacent the dilution mixer located at the bottom of the tank. The pulp is quickly mixed with the dilution liquid introduced preferably through the mixer so that pulp at a relatively even consistency can be pumped from the tank into the subsequent process stage, the screening apparatus.

The screen room consists of different types of screening devices, such as knot separation devices, screens, knot washers, etc. The screen room can be located either after a digester or after an oxygen delignification stage or in another location in a pulp mill where an increase in purity of the pulp is required. As mentioned

above, typically a screen room is fed from a tank or tower in which there is a low consistency zone having a volume of several tens of cubic meters. To homogenize the low consistency volume tank agitators and reasonable amount of dilution water are used.

In the smallest tanks or towers having a diameter of about 3.5 to 7.0 m, the bottom portion may be either straight cylindrical or first somewhat narrowing and below that cylindrical. In bigger towers having a diameter typically larger than 5.0 m, a so-called bottom pillar may be disposed at the center of the tower bottom. The purpose of the bottom pillar is to uphold pulp above the bottom portion and to divide the bottom portion into an annular mixing zone. The shape of the prior art bottom pillars may be either an evenly converging cone (Fig. 1), cylindrical pillar or a cylindrical pillar, the upper end whereof is arranged with an upwardly converging cone. In all those towers which are provided with a bottom pillar, the dilution mixer/dilution mixers are disposed on the sides of the bottom pillar so that they direct the flow to circulate along the annular mixing zone. The bottom pillars are of solid construction and when disposed on the tower bottom they are merely supported by the tower bottom or the foundation therebelow, in any case by the very point which would also otherwise carry the weight of the pulp in the tower. Fig. 1 illustrates a known high consistency pulp tower 10 (Fig. 2a of US Patent 5,711,600) having a tower wall 12, a bottom portion 20, a tower bottom 22, a bottom pillar 30, mixers 40, conduits 50 for feeding dilution liquid, and discharge means 60 for diluted pulp.. In the arrangement of Fig. 1, the bottom portion 20 and the upper part of the tower 10, have a conical wall section 14 between them. Mixers 40 are arranged at about 1.1 m height from the tower bottom and so that the dilution liquid is fed through conduits 50 to the dilution zone of the bottom portion, to a level which is a little higher than the mixer shafts.

A problem with these constructions still is the unevenness of the pulp discharge consistency. In order to eliminate this problem US Patent 5,711,600 discloses a more developed design of a bottom pillar. According to this patent it is essential to the upper end of the pillar that the diameter of a parting member disposed therein is at least in one point larger than the diameter of the lower part of the pillar. In other words, it is a feature of the parting member that in the area of the parting member, the cross section between the parting member and the wall of the tower is smaller than in the bottom area of the pillar. This design still requires several mixers (the number of the mixers may range from two to six, mainly depending on

the tower size), each mixer being connected with a feed conduit for dilution liquid. The mixers are disposed in the bottom portion of the tower so that they cause the pulp to be diluted to circulate fast around the bottom pillar. US Patent 7,622,018 describes a similar arrangement in which the dilution is further improved so that at least a part of the dilution liquid required to dilute the pulp into the tower outlet consistency is introduced between the tower wall and the pillar (or another parting member) at the area substantially at the level of the smallest cross-section of the tower (Fig. 2). Preferably the dilution liquid is introduced in at least two portions in the dilution part of the tower. One portion is introduced to the thick pulp suspension simultaneously as the suspension is taken from the storage part of the tower into the dilution zone, and another portion is introduced with the aid of the agitators positioned in the dilution zone. FIG. 2 shows an improved prior art high-consistency pulp tower 10 in accordance with U.S. Pat. No 7,622,018. The bottom part 20 of the tower 10 is provided with a stationary bottom pillar 30. The upper end of the pillar 30 has been shaped so that the diameter of an also stationary parting member 31 disposed therein is at least in one point larger than the diameter of the lower part of the pillar 30. More broadly expressed, at the level of the parting member 31, the cross-sectional area between the parting member 31 and the wall 12 of the tower 10 is smaller than in the bottom area of the pillar 30 below the parting member. The parting member 31 has an upper section 34, the diameter of which converges conically upwards. In FIG. 2 baffles 36 have been provided with an annular duct 46 located between the bottom pillar 30 and the tower wall 12, said duct 46 being provided with nozzles 48 for introducing dilution liquid into the high-consistency fiber suspension substantially simultaneously with the discharge of the pulp down to the dilution zone. The bottom part of the tower contains several diluting agitators 40. The pulp is discharged through a conduit 60.

A screen room feed tank can have a total height of 6-30 meters and a diameter of 2 – 10 m, sometimes the upper part of a screen room feed tank is bigger than the bottom part, for example if more retention time is required because of process demands.

In a pulp mill having a production of 1000 admt/d the low consistency mixing zone in the tank may be 3–6 meters in diameter and 2–6 meters in height. In a 3000 admt/d pulp mill the mixing zone in a tank or tower can be 6–10 meters in diameter and 3–10 meters in height. To homogenize the diluted zone of the tank, spe-

cial tank agitators are used. Typically a tank agitator operates within a consistency range of 2–5% consistency, but the performance of an agitator becomes poor if the consistency is about 4.5-6% or more.

In a traditional system the retention time of pulp in the low consistency mixing zone is typically 2–5 minutes, but in any case less than 10 minutes. Tank agitators move diluted stock in the tank in such a way that consistency variations become more even and the stock consistency variation from a tank is small enough so that the screen room can handle the flow. Typically 1-–4 tank agitators are required to provide adequately good mixing performance. The number of tank agitators used in mixing depends on the production rate, but also on the volume of the mixing zone.

Although traditional screen room mixing tanks are widely used, they also may create problems, such as unexpected consistency variations. They also need a lot of equipment and instrumentation for agitators. Neither are the tanks very energy-efficient because of agitators. A further problem is also their high space requirements and construction costs.

An object of the new innovation is to eliminate the above mentioned problems and provide a screen room feed tank arrangement, which is more energy-efficient, space-saving and in which the consistency of the pulp to be fed to screening is even so that harmful consistency peaks may be avoided.

SUMMARY OF THE INVENTION

The objects of the invention are fulfilled with an arrangement and a method according to the independent claims. Additionally, other preferred embodiments of the invention become known in the dependent claims.

In a novel screen room feed tower for pulp the mixing volume is reduced, and therefore traditional tank agitators are not required. The dilution liquid (water or filtrate) is fed to the upper section of the bottom part of the tower. Before the diluted pulp enters a discharge pump the pulp is treated in a homogenizing zone where a rotating or static homogenizer is installed. The purpose of the homogenization zone is to mix the fiber suspension so that the consistency differences in the pulp suspension are equalized and dilution liquid is distributed evenly into the

pulp suspension, i.e. the consistency of the pulp is homogenized. After the homogenization zone the pup consistency is even and a normal process pump (conventional centrifugal pump) may be used to pump the pulp into the screening.

A pulp tower (or tank) according to the embodiments of the present invention comprises an upper part to which the pulp is fed, and a bottom part which is divided into a dilution zone, homogenizing zone and discharge (pumping) zone. The upper part of the tower may act as a blow tank or storage (retention) tank, the size of which depends on the needs of the process, if any buffering effect is required. The cross-section of the tower is typically round. The diameter of the upper part is bigger than the diameter of the bottom part of the tower. The difference between the upper and bottom part depends on process requirements, such as retention time for storing pulp in the upper part of the tower.

A device for feeding dilution liquid to the pulp flowing downwards in the tower is located substantially at a level which divides the tower to the upper part and the bottom part and a discharge device for diluted pulp is arranged in the bottom part of the tower. A device for homogenizing the consistency of the diluted pulp flow is arranged at a distance downstream of the dilution device in the pulp flow direction and upstream of the discharge device. The majority of the dilution liquid is added in the uppermost section of the bottom part of the tower. Smaller parts of the dilution liquid may be added between the uppermost dilution point and the homogenizing zone.

The dilution device defines a dilution point in the bottom part of the tower having a diameter. According to an embodiment the distance between the dilution device and the homogenizing device is 1.5–10 times the diameter of the tower at the dilution point, where the majority of the dilution liquid is added. Thus said distance is between the first dilution point and the homogenizing device.

The distance between a dilution point and a homogenization point is determined by the required retention time but also by the maintenance demands of a homogenizer.

The retention time between the dilution point and homogenizer should be so long that non-diluted pulp does not enter the screen room feed pump. When taking into account different controlling systems and delays in the process, the retention time

as short as 5–10 seconds should be sufficient, but in practical applications the retention time is typically 15–120 seconds, but preferably 20–60 seconds.

According to an embodiment dilution liquid can be fed by using normal pipe connections. The dilution is divided to a required number of connections around the mixing tank. The dilution device comprises a number of feed nozzles/outlets arranged in the periphery of the tower wall. The dilution liquid is fed from a supply tank and directed inwards, towards the centre of the tower. The pressure is such that the dilution liquid is sprayed into the tower towards the downwards flowing pulp. The pressure control, the shape of the outlet and the quantity of outlets may vary in a number of different ways, which are evident to the skilled person. The object is, however, to yield maximal penetration into the pulp flow.

According to another embodiment the dilution liquid can also be fed via a feed pipe that is piped so that it goes through the dilution point. In this kind of feed pipe the dilution liquid is led through several holes into the pulp so that dilution liquid flows into the pulp flow that is flowing downwards. The dilution device comprises at least one pipe extending from the wall of the pulp tower inwards, towards the center of the tower, which pipe is provided with a number of outlet holes for the addition of the dilution liquid. Depending on the dilution zone diameter and dilution rate, there can be a number of these kinds of dilution feed pipes through the dilution zone.

The homogenization volume (i.e. the size of the homogenization zone) is small, normally from 0.1m^3 (100 liters) up to 3 m^3, when a traditional mixing tank volume is within a range of 10–300 m^3. The retention time in the homogenization zone of the new arrangement is typically only 2–10 seconds, when in traditional mixing tanks the retention time is typically several minutes.

A homogenizer having a rotating member(s) that generates turbulence in the homogenization zone makes the stock dilution liquid suspension flow even and makes the consistency fluctuations smaller.

When estimating the mixing of a traditional screen room feed tank, a volumetric space close to the rotating agitator blades presents only 0.5-3 % of the total mixing volume. When performing the same calculation for the novel tower and homogenization design the volumetric space of the rotating homogenizer blade pre-

sents 15-20 % of the total homogenization volume. This greater volumetric space results in a more homogenized pulp flow, whereby harmful consistency peaks can be avoided. Said smaller space in the traditional agitator tanks allows consistency peaks to more easily pass the mixing zone.

While the mixing volume is small, the energy input can be divided more evenly but also less mixing energy is needed to achieve a required mixing quality. When comparing traditional screen feed tank arrangement with tank agitators to the novel system where homogenizers are used the installed power can be reduced by 50–80 %, for example by 66 %. A rotating homogenizer typically comprises a shaft which is mounted in the wall of the tower and which is provided extensions which mix the pulp flow when rotating. Lower power consumption can be achieved because of smaller volume in mixing and because of low rotation speed. A homogenizer can operate within a rotation speed range of 600–1200 rpm. A circumferential speed of the homogenizer is 5–20 meters per second, typically 10–15 meters per second. With 5000 admt/d pulp line the installed power to the traditional tank agitators can be 4*90kW = 360kW, but with a homogenizer the installed power can be only 110kW.

The required amount of turbulence can also be generated by using static constructions in a homogenization zone. The homogenizer is a device or construction in the tower that provides a treatment which evens the flow of the pulp and dilution liquid that flows through the bottom part of the tower. Also a combination of rotating homogenizer and static homogenizer constructions is possible.

In a static homogenizer, by throttling the flow, i.e. decreasing the cross-sectional area, an increase in the flow rate and a higher turbulence are achieved, whereby the introduced dilution liquid will mix into the flowing pulp. The static homogenizers preferably consist of protrusions, or annular flange or ring arranged on the inner wall of the tank.

Static homogenizers may be provided with, in addition to the throttling, turbulence-raising devices, such as baffles, ribs, pins, nubs or the like, arranged in the homogenization zone.

In case of a static homogenizer it may be preferable to use a vertical pillar or bar in the middle of the discharge (pumping) and homogenization zones. The pillar is

disposed in the bottom part of the tower. It has a lower end which is supported by the bottom of the tower. The pillar extends through the discharge (pumping) zone and also through the homogenization zone where static homogenizer elements are fixed to the tower wall. The diameter of the pillar is determined so that the homogenization is optimum. The pillar itself can comprise constructions, such as obstacles or extensions, to intensify the homogenization of the pulp flow.

The used design of rotating and/or static homogenizers depends on the required quality of mixing that can be estimated by consistency variations after the screen room feed pump and total energy used in the application.

In a further embodiment of the inventive arrangement it further comprises a construction for at least one flow guidance element, such as a cylindrical pipe, rectangle bar or beam, which is located after the dilution point but above the homogenizer to guide the diluted pulp flow to the homogenization zone. A pipe or bar can be installed so that it is typically located horizontally across the tower. It is fixed at both ends to a wall of the tower. The distance and the location of the guidance element from the homogenizer should be determined so that the flow to the homogenization zone is even and the pulp can flow freely downwards but the flow is guided to the location that gives the best homogenization result.

After homogenization of the pulp flow a normal process pump that can pump pulp at a 3–8 % consistency can be used for discharging the pulp through an outlet from the bottom of the tower to the screen. Depending on the consistency and/or location of the screen room in a process, there may be a need to equip a screen room feed pump with gas removal. The feed consistency of pulp is typically 8–14 % in the upper part of the tower. The bottom part of the tower of the invented arrangement and method is devoid of agitators which mix and dilute the pulp. In the novel tower the dilution liquid which is needed to obtain a discharging (pumping) consistency is introduced into the pulp before the homogenizing device.

In screen room operation the stability of screening consistency is a requirement which has to be taken into account in traditional screen room applications, but also in the invented system. In a traditional system a screen feed tank can generate unexpected consistency peaks, making the screen room operation difficult because of too high screening consistency. In the invented system the screen feed tank mixing (homogenizing) volume is essentially smaller compared to traditional

systems. Because of short retention times a faster response from the consistency control would be needed. Traditionally the screen room consistency control is carried out using a consistency meter that controls dilution flows into the screen room feed tank and into the suction side of the screen room feed pump. This kind of consistency control allows consistency peaks to enter the screening where peaks can generate serious problems such as clogging of screens, pressure and flow fluctuations etc.

If the consistency control is arranged so that some of the dilution liquid is fed also downstream from the consistency measurement point close to the following screen, problematic consistency peaks would be smaller and the screening consistency can be kept between the required values. According to an embodiment of the invented arrangement the outlet of the tower is connected to a conduit provided with a pump for conveying the diluted pulp from the tower to a screening device and with a feeder for adding dilution liquid to the pulp so as to control the pulp consistency, which feeder is located between the pump and screening device. Up to 5-10 % of the dilution liquid may be added to the discharged pulp.

BRIEF DESCRIPTION OF THE DRAWINGS

The inventive arrangement and method that have been developed are described in more detail with reference to the drawings, in which:

Fig. 1 illustrates the bottom part of a pulp tower in accordance of prior art;

Fig. 2 illustrates the bottom part of a pulp tower in accordance of prior art;

Fig. 3 illustrates a screen room feed tower according to an embodiment of the present invention;

Fig. 4 illustrates the bottom portion of a screen room feed tower according to an embodiment of the present invention;

Fig. 5 illustrates, as an example, a static homogenizer, which may be used in connection with the embodiments of the present invention. Figure 5 is a cut view along section A-A of the embodiment of Figure 4.

Fig. 6 illustrates a device for introducing dilution liquid,

Fig. 7 illustrates a control system, which may be applied in connection with the present invention,

Fig. 8 illustrates a screen room feed tower according to a further embodiment of the present invention, and

Fig. 9 illustrates a screen room feed tower according to a further embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 3 illustrates a screen room feed tower according to an embodiment of the present invention. The tower 100 comprises a tower wall 102, an upper portion 104, a bottom portion 106 and a tower bottom 108. The top of the tower may be provided with a device or conduit 110 for discharging gas. In this embodiment the diameter of the upper portion 104 is larger than the diameter of the bottom portion 106. The upper portion of the tower may act as a blow tank or a storage (retention) tank, the size of which depends on the needs of the process, if any buffering effect is required. Pulp from a digester or an oxygen delignification reactor is fed to the tower through a conduit 112.

The bottom portion 106 is divided into a dilution zone 107 and homogenization zone 109, the latter being located after the dilution in the pulp flow direction. In the upper part of the bottom portion conduits 114 are arranged for introducing dilution liquid to the pulp that flows downward in the tank. In the homogenization zone, which is located below the dilution zone, homogenization devices are arranged. The purpose of the homogenization zone is to mix the pulp suspension so that its consistency is homogenized. In this embodiment, there are both rotating 116 and static 118 homogenizers. Connected to the tower through the wall thereof, is a pump 120. The pump 120 is connected adjacent the bottom or to the bottom. It pumps the diluted and homogenized pulp from a discharge zone 121 of the tower to a screen.

The rotating homogenizer 116 comprises a driving means 122, a shaft 124 equipped with blades or extensions 126. The blades are rotated so that the dilu-

tion liquid is distributed evenly into the pulp suspension. This is only one preferred design of homogenizers. Also other designs which are able to homogenize the pulp consistency can be used. A feature is that when homogenizers are used the installed power can be reduced by 50–80 %, for instance by 66%. Lower power consumption can be achieved because of smaller volume in mixing and because of low rotation speed. With 5000 admt/d pulp line the installed power to the traditional tank agitators would be 4*90kW = 360kW, but with a homogenizer the installed power would be only 110kW.

In the tower according to Figure 3 there is also a static homogenizer 118, which is a throttling in form of an annular flange or a ring. It further improves the turbulence in the pulp suspension and thus evens out possible consistency differences.

According to a preferred embodiment the dilution point 114 in the bottom part of the tower has a diameter D, wherein the distance C between the dilution device 114 and the homogenizing device 116 is 1.5–10 times the diameter D of the tower at the dilution point.

Fig. 4 shows a bottom portion of the tower 106, in which pulp flows (arrows) from the upper portion through the bottom portion and is discharged from the tank.

The tower is provided with a dilution device 128 which comprises openings 130 in the tower wall, through which openings dilution liquid is fed into the pulp flow. The openings are located around the tower and are connected to a conduit or conduits for supplying liquid into the openings. Two or more openings 130 are arranged at a distance from each other around the tank.

There is a homogenization zone 109 after the dilution point 107. The homogenization is effected by protrusions arranged on the inner surface of the tank. By throttling the flow, i.e. decreasing the cross-sectional area by the use of protrusions 132, an increase in the flow rate is achieved and due to the throttling a higher turbulence, whereby the introduced dilution liquid will further mix into the flowing pulp. The protrusions extend in the vertical direction at a distance X so that the bottom portion of the tower has a reduced cross-section. After the protrusions the cross section of the bottom portion widens again.

Fig. 5 shows static homogenization cross section drawings. Figure 5a is a cut view along section A-A of the embodiment of Figure 4. Fig. 5a shows the protrusions 132 arranged on the inner surface of the tank. Fig. 5 b illustrates turbulence-raising devices, such as plates 134 or protrusions having different kinds of forms, such as rectangular, triangular.

Fig. 6 shows another embodiment for a dilution device 136. The dilution liquid (arrow 140) can be fed via a feed pipe 138 that is piped so that it extends at least partly through the tower and thus through the dilution zone. In this kind of feed pipe the dilution liquid is led through several holes 142 into the pulp so that dilution liquid flows into the pulp that is flowing downwards.

Fig. 7 illustrates a control system, which may be applied in connection with the embodiments of the present invention. The consistency control is arranged so that a portion of the dilution liquid is fed also downstream from the consistency measurement point QIC close to the following screen 148. Thus, the screening consistency can be kept between the required values by using this fine adjustment. The major portion of the dilution liquid is fed through line 144 to the bottom portion 106 of the tank, but some liquid (up to 5-10 %) may be introduced also through line 146 to an inlet of screen 148. The feed line 150 is provided with consistency measurement QIC and dilution liquid conduit 146 for adjusting the feed consistency and maintaining it at a set value. If there are production disturbances, the steady consistency can be kept essentially at the set value by measuring the consistency and reacting quickly to a possible consistency increase by adding dilution liquid also through line 146.

Fig. 8 illustrates a screen room feed tower according to a further embodiment of the present invention. The tower shown in Fig. 8 corresponds to the tower of Fig. 3, but it is provided with two homogenizers 116 installed to the tower wall. In addition, the tower further comprises a construction for at least one flow guidance element. The figure also shows a cut view along cross-section B-B. In this embodiment a cylindrical pipe 123 is disposed horizontally across the tower. The pipe 123 is located after the dilution point 114 but above the homogenizers 116 to guide the diluted pulp flow to the homogenization zone 109. The pipe 123 is installed so that it is fixed at both ends to the wall 102 of the tower. The distance and the location of the pipe from the homogenizer 116 should be determined so that the flow to the homogenization zone is even and the pulp can flow freely

downwards but the flow is guided to the location that gives the best homogenization result.

Fig. 9 illustrates a screen room feed tower according to a further embodiment of the present invention. In case of a static homogenizer it may be preferable to use a vertical pillar or bar in the middle of the discharge (pumping) and homogenization zones. The tower shown in Fig. 9 corresponds to the embodiment according to Fig. 4, but a pillar 131 is disposed in the bottom part of the tower. The pillar 131 has a lower end which is supported by the bottom 108 of the tower. The pillar extends towards the dilution device 128 through the discharge (pumping) zone 121 and also through the homogenization zone 109 where static homogenizer elements 132 are fixed to the tower wall. The pillar contributes to throttling. The diameter of the pillar 131 is determined so that the homogenization is optimum. The pillar itself may further comprise constructions, such as obstacles or other extensions (ribs, pins, nubs or the like), which raise the turbulence level and thus intensify the homogenization of the pulp flow.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

CLAIMS:

1. An arrangement for treating pulp to be fed to a screening room of a pulp mill, which arrangement comprises a tower having an upstanding wall, and a bottom;
a pulp inlet in an upper part of the tower;
a device for feeding dilution liquid into the pulp flowing downwards in the tower, said dilution device being located substantially at a level which divides the tower to said upper part and a bottom part, and
a discharge device for diluted pulp arranged in the bottom part of the tower,
characterized in that a device for homogenizing the consistency of the diluted pulp flow is arranged at a distance downstream of the dilution device in the pulp flow direction and upstream of the discharge device.

2. An arrangement according to claim 1, **characterized** in that the dilution device defines a dilution point in the bottom part of the tower having a diameter, wherein the distance between the dilution device and the homogenizing device is 1.5–10 times the diameter of the tower at the dilution point.

3. An arrangement according to claim 1 or 2, **characterized** in that the homogenizing device comprises at least one throttling member.

4. An arrangement according to claim 1 or 2, **characterized** in that the homogenizing device comprises a shaft and at least one rotating member having a circumferential speed of 5-20 meters per second.

5. An arrangement according to claim 4, **characterized** in that the homogenizing device further comprises a throttling member.

6. An arrangement according to any one of the preceding claims, **characterized** in that the dilution device comprises a number of feed nozzles or openings arranged in the periphery of the tower wall.

7. An arrangement according to any one of the preceding claims, **characterized** in that the dilution device comprises at least one pipe extending from the wall of the pulp tower inwards, towards the centre of tower, which pipe is provided with a number of outlet holes for the addition of the dilution liquid.

8. An arrangement according to any one of the preceding claims, **characterized** in that the bottom part of the tower comprises a homogenizing zone, where the pulp flow is homogenized by the homogenizing device, and the volume of the homogenizing zone is 0.1- 3 m^3.

9. An arrangement according to any one of the preceding claims, **characterized** in that the discharge device comprises an outlet for the diluted and homogenized pulp in the bottom part of the tower.

10. An arrangement according to claim 9, **characterized** in that the outlet is connected to a conduit provided with a pump for conveying the pulp from the tower to a screening device and with a feeder for adding dilution liquid into the pulp so as to control the pulp consistency, which feeder is located between the pump and the screening device.

11. An arrangement according to claim 3, **characterized** in that a pillar is disposed in the bottom part of the tower, said pillar being a throttling member and having a lower end supported at least in part by the bottom of the tower.

12. An arrangement according to any one of the preceding claims, **characterized** in that a flow guidance element is arranged between the dilution device and the homogenizing device.

13. A method for treating pulp to be fed to a screening room of a pulp mill, in which method

- pulp having a consistency of 8–14 % is fed to a tower having an inlet in an upper part of the tower;
- the pulp flows from the upper part of the tower to a bottom part thereof,
- dilution liquid is introduced into the pulp in the bottom part of the tower, and
- the pulp having a decreased consistency is discharged from the bottom of the tower,

characterized in that the pulp and the dilution liquid is treated by a homogenizing device in a homogenizing zone for equalizing the consistency of the pulp flow and producing the pulp having the decreased consistency, which homogenizing zone is located between the dilution zone and discharge zone.

14. A method according to claim 13, **characterized** in that the dilution liquid to be added into the pulp flowing in the tower is introduced upstream of the homogenizing zone.

15. A method according to claim 13 or 14, **characterized** in that the homogenizing of the pulp is effected by a rotating device.

16. A method according to claim 13 or 14, **characterized** in that the homogenizing of the pulp is effected by throttling.

17. A method according to claim 13, 14, 15 or 16, **characterized** in that the pulp is homogenized in a zone having a volume of 0.1–3 m^3.

18. A method according to any one of claims 13-17, **characterized** in that the pulp is discharged from the tower and pumped to a screening device, wherein a portion of the dilution liquid is added upstream of the screening device for controlling the consistency of the discharged pulp.

19. A method according to claim 18, **characterized** by introducing up to 10 % of the dilution liquid to the discharged pulp.

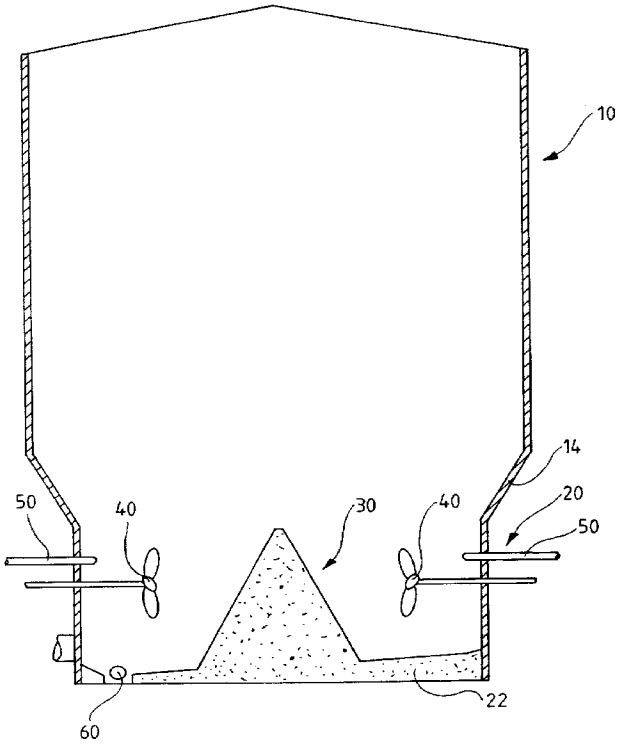

FIG. 1 Prior art

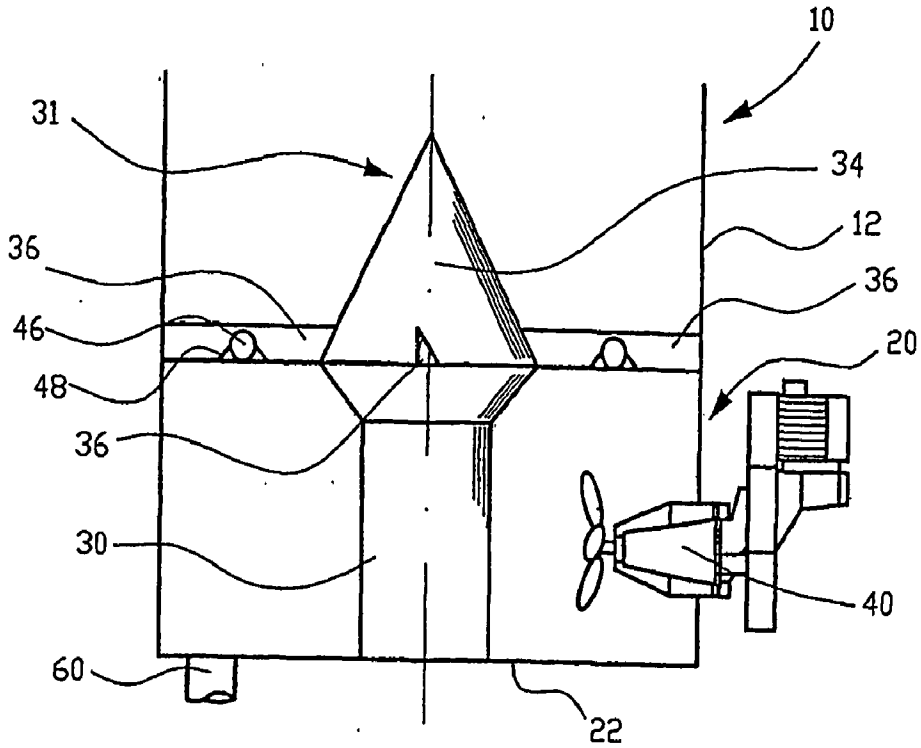

FIG. 2 Prior art

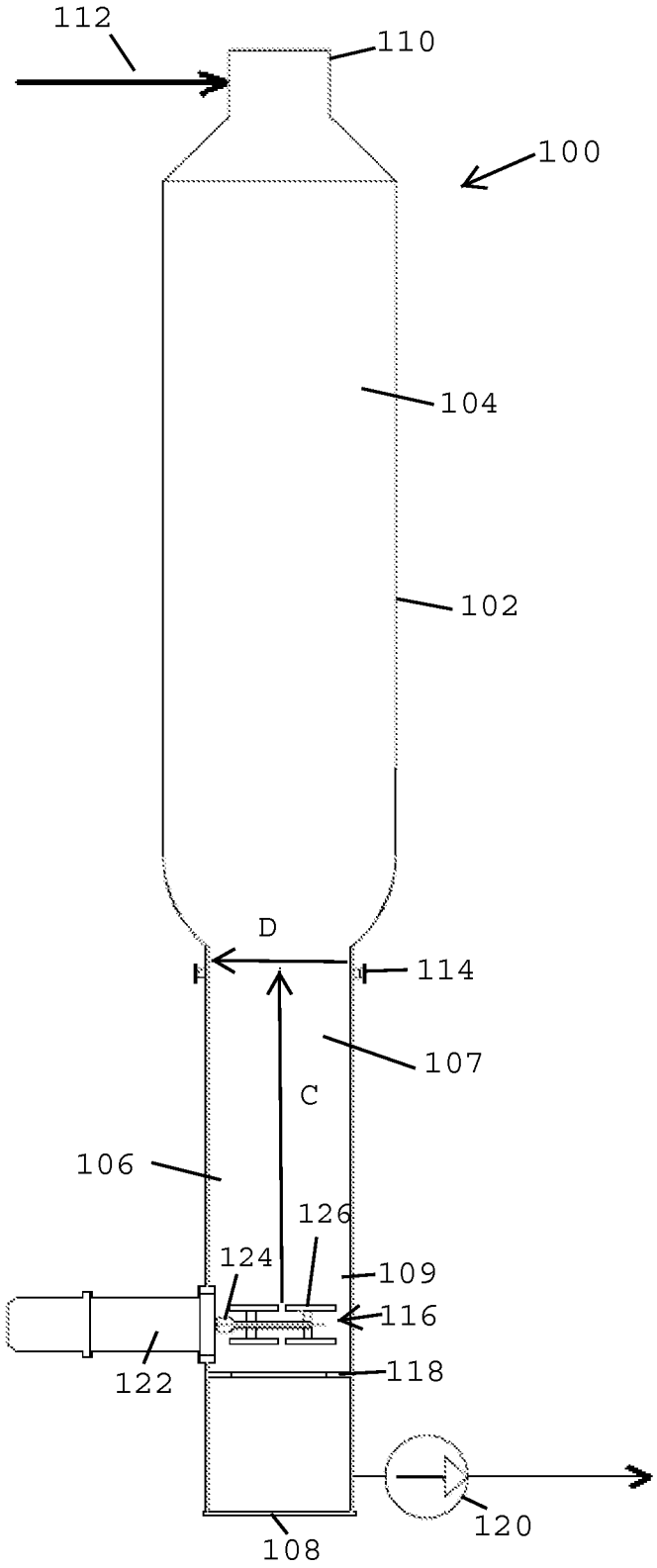
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FIG. 3

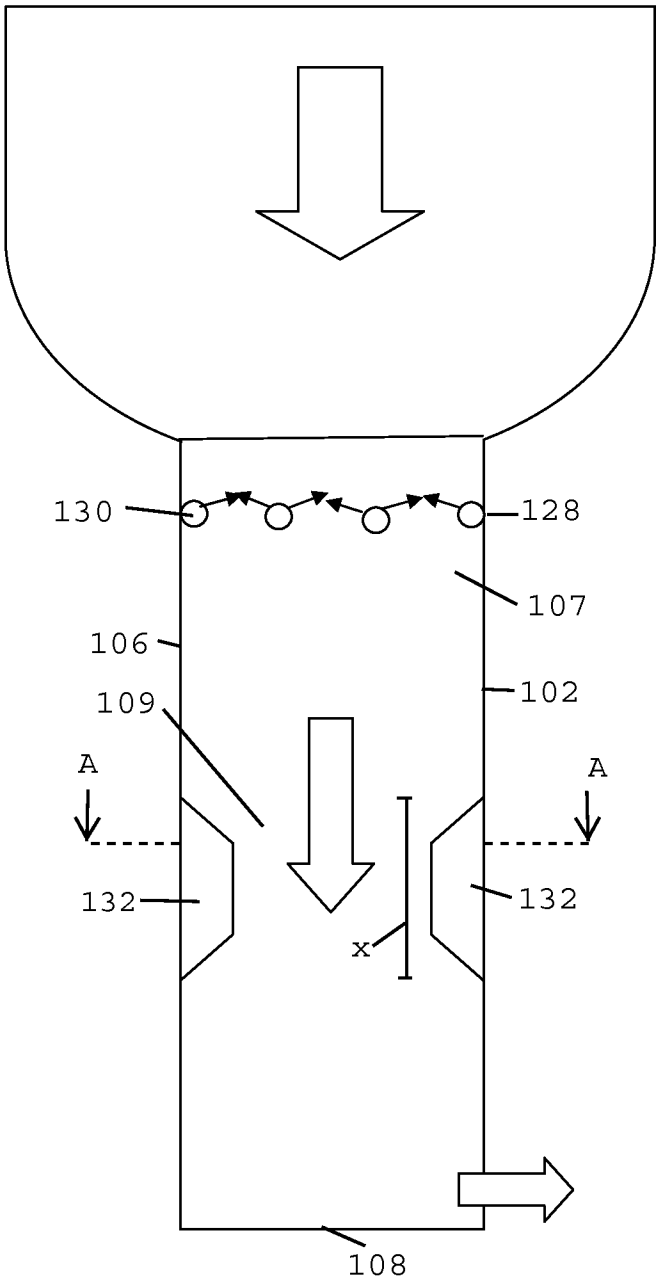


FIG. 4

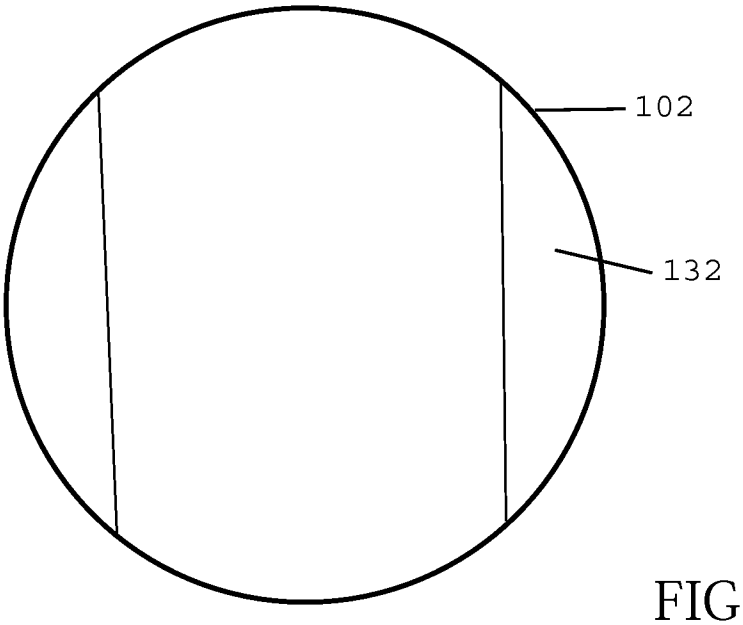


FIG. 5a

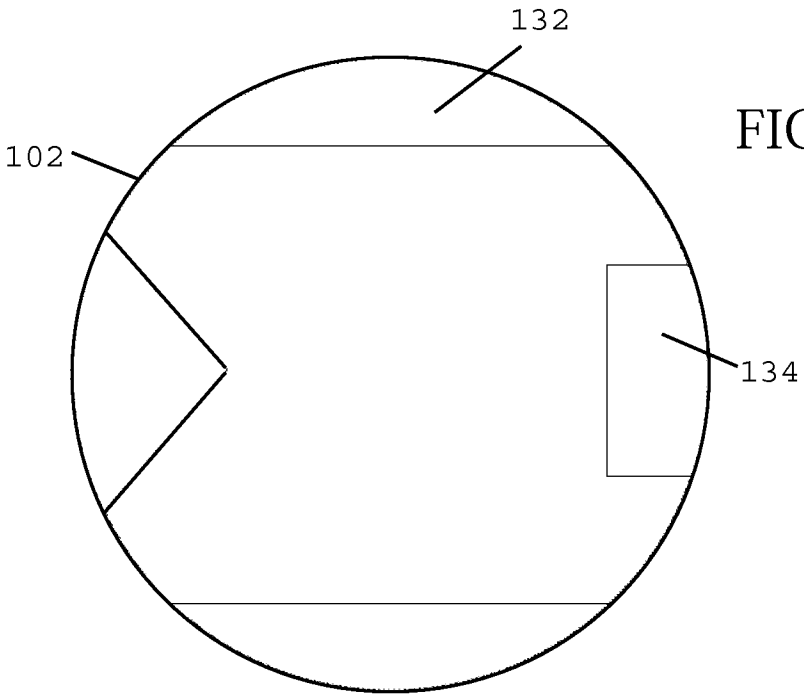


FIG. 5b

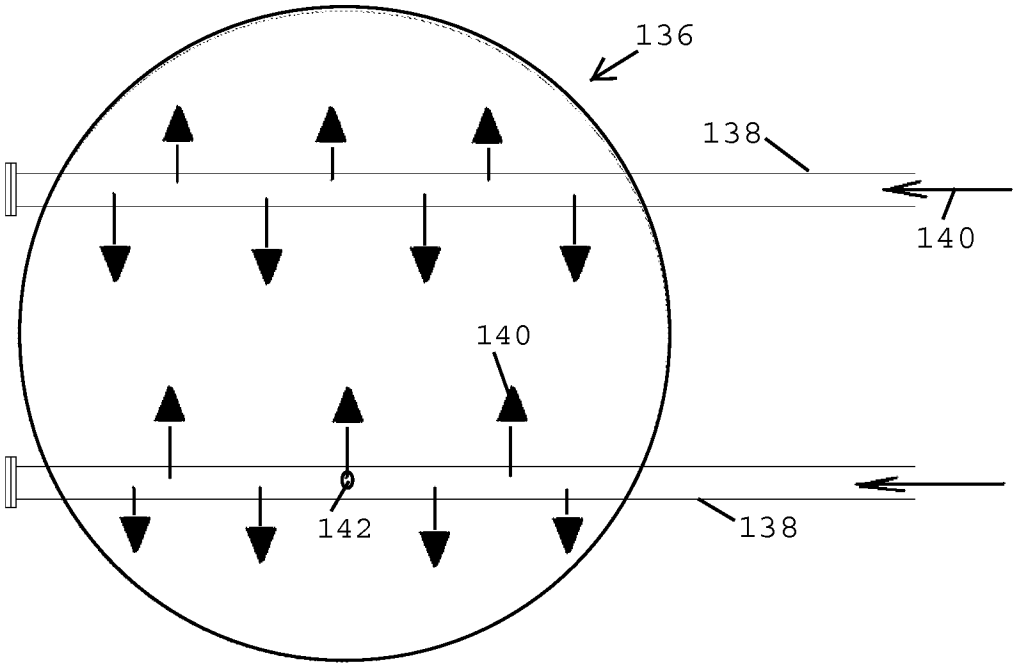
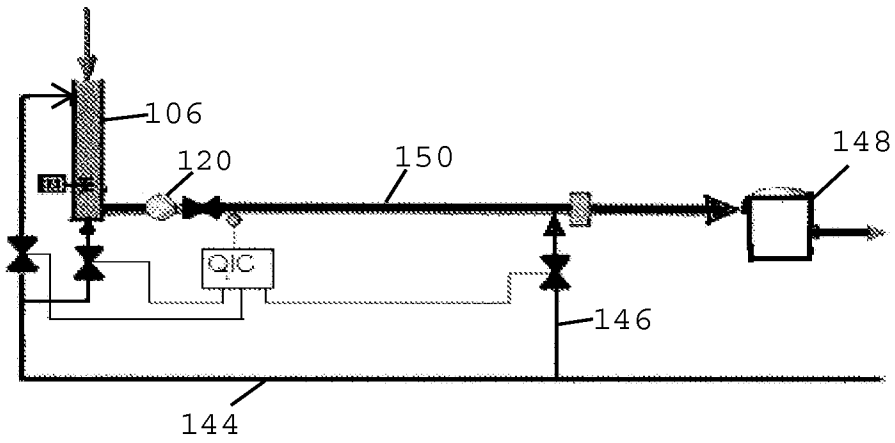


FIG. 6

FIG. 7



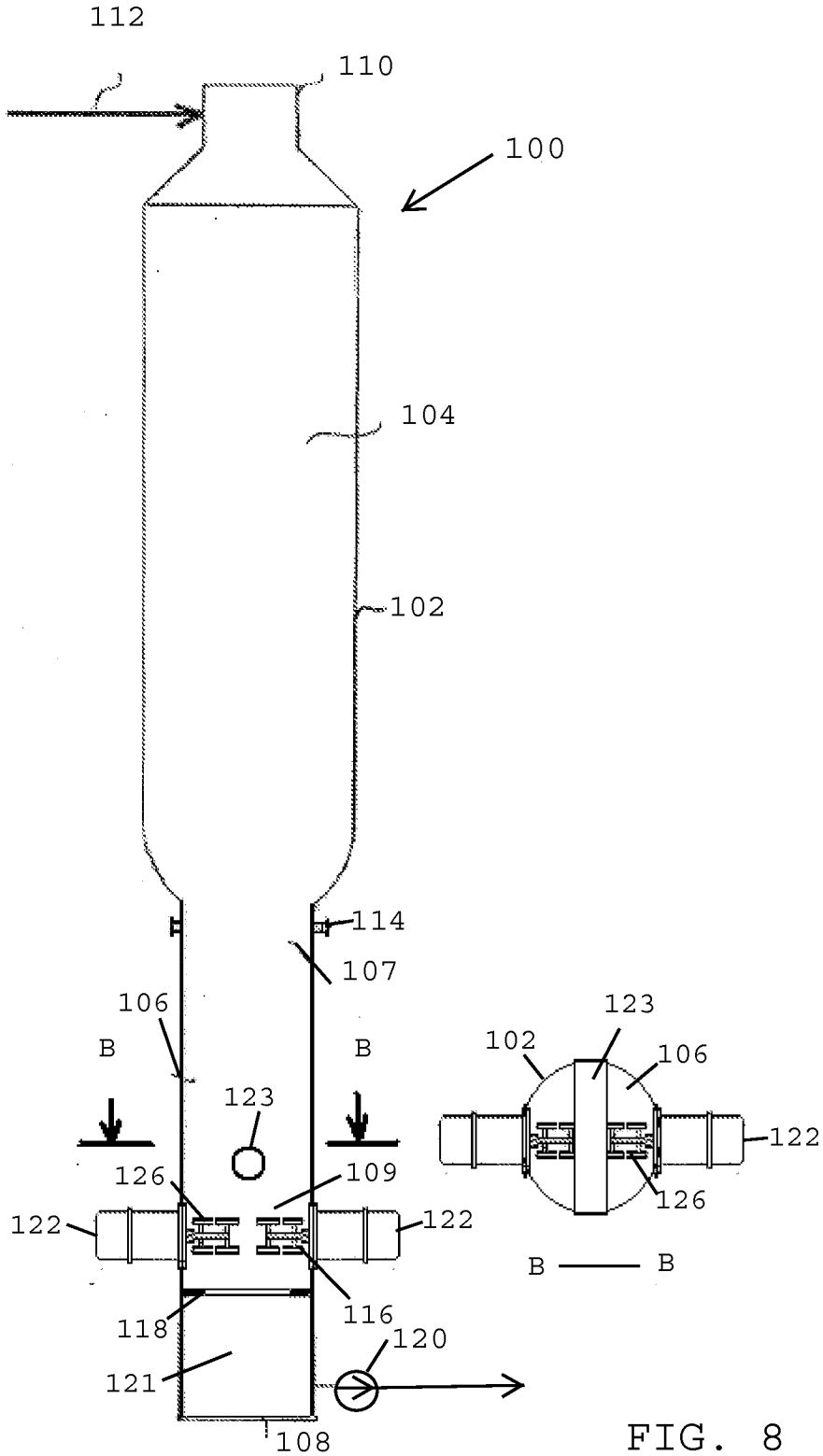

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FIG. 8

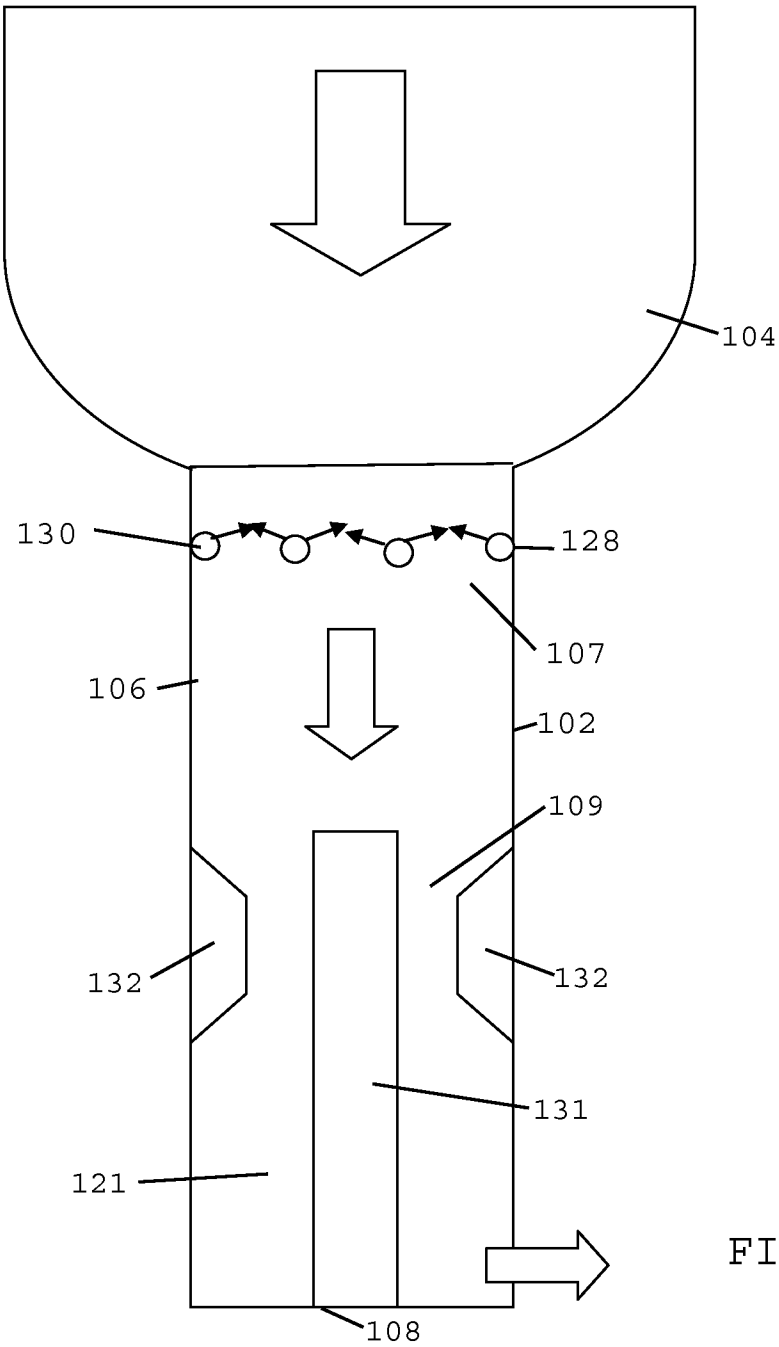

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2011/050881

A. CLASSIFICATION OF SUBJECT MATTER
INV. D21D5/28
ADD.

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)
D21D D21B D21C

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE 10 2006 008763 B3 (VOITH PATENT GMBH [DE]) 6 December 2007 (2007-12-06) paragraphs [0011] - [0020]; figure -----	1,3,6,9, 11,12 10,16,18
X Y	WO 2009/037091 A1 (SULZER PUMPEN AG [CH]; VESALA REIJO [FI]) 26 March 2009 (2009-03-26) page 4, line 19 - page 5, line 9 page 7, line 7 - page 9, line 13; figure 2 -----	1,6,9, 13-15 16
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 December 2011	23/12/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Maisonnier, Claire

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 5 711 600 A (TOUKONUMMI OLAVI [FI]) 27 January 1998 (1998-01-27) cited in the application column 4, line 64 - column 5, line 16; figure 2a	1,6,9,12
X	EP 0 965 682 A1 (VOITH SULZER PAPIERTECH PATENT [DE] VOITH PAPER PATENT GMBH [DE]) 22 December 1999 (1999-12-22) paragraph [0015]; figure 6	1,6,9
Y	WO 2005/005716 A1 (SULZER PUMPEN AG [CH]; KOSO ARTO [FI]) 20 January 2005 (2005-01-20) page 7, line 26 - page 8, line 20; figure 2	10,18

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Information on patent family members

International application No
PCT/FI2011/050881

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