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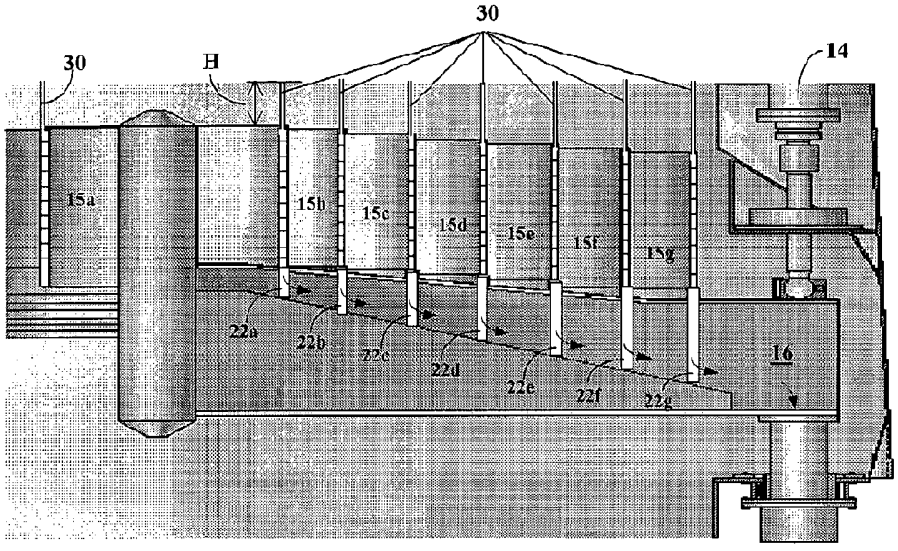
(54) Title: DIFFUSER WASHER FOR CELLULOSE PULP



(57) Abstract: The invention concerns improved ventilation of strainer packages in diffusers used for diffusion washing of cellulose pulp. The strainer packages in the diffuser are provided with exhaust air tubes 30/30a-30f that discharge built-up gas accumulations from inside the strainer to a position in the diffuser at lower pressure. This discharge means that discharged gases do not disrupt the subsequent washing cycle and that the washing efficiency of the diffuser can be kept high even at process locations where large amounts of gas are produced in the to pulp.

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Diffuser washer for cellulose pulps

The present invention concerns a device for washing of cellulose pulps by diffusion in accordance with the preamble to claim 1.

Prior art

SE,C,502274 proposes a diffuser of a type wherein the present invention is applied. The diffuser is used for washing of cellulose pulps by diffusion, a so-called atmospheric diffuser. In this diffuser, the cellulose pulp is fed into the base, passing two sets, one upper and one lower, of concentrically arranged strainer packages from which the washing filtrate is extracted. In principle, the strainer packages move at the pulp flow speed upwards during extraction of washing filtrate, and, when they reach an upper position, the washing filtrate extraction is interrupted, and the strainer packages are rapidly pulled down to a starting position. During the pulling-down movement, the strainer packages are back-rinsed to clean the strainers free from fibre residues. New washing liquor is supplied to the pulp through nozzles that project downwards between the strainer packages, the nozzles being arranged on nozzle arms set in rotation about the vertical central axis of the diffuser.

SE,C,502274 uses two strainer packages arranged on an intermediate strainer arm. Double strainer packages are used when more intense washing is required.

In older diffusers operated in the open by Kvaerner Pulping (previously Kamyr AB) and that only had one strainer package and overlying filtrate collection ducts (headers), boreholes were provided in the roof between these headers for ventilation of accumulated gases in the strainer packages. Since the strainers directed the filtrate upward towards the strainer arms via headers, gas bubbles accompanied the filtrate and collected in the header roof.

After the transition to underlying headers, and also in two-stage diffusers (with two strainer packages), external degassing arranged externally around the diffuser was used instead. This degassing was suitably arranged in a collection duct running around the diffuser, which in turn had a degassing line

connected at one end to the collection duct roof and the other end discharging into the upper part of the diffuser above the pulp level. Were the same technology with boreholes in the headers as well as boreholes in the upper part of the strainers to have been used, this would have led to gas being ventilated into the pulp in a region that would be exposed to extraction in the subsequent washing cycle. The expelled gas would then risk being drawn back into the strainers, which would mean the effect having essentially disappeared.

Purpose and object of the invention

The main purpose of the invention is to improve degassing of strainer packages in diffusers, chiefly diffusers with underlying extraction ducts (headers), where accumulated gas in the strainer package is discharged to a position in the diffuser with lower pressure. This technique allows better and more effective degassing, since degassing need not occur against a space with higher pressure.

Another purpose is to discharge accumulated gases in the strainer package at some distance from the effective strainer surface so that expelled gas bubbles are not at risk of being drawn back into the strainer when the extraction sequence of washing filtrate is renewed.

Yet another purpose is to make back rinsing of the strainers more efficient so that no gas cushion is retained in the internal space of the strainer in proximity of the strainer surfaces. Through any such gas cushion being expelled, the space inside the strainers can be 100% pressurised with back-rinsing liquor (chiefly in the form of used washing filtrate). Through the gas cushion being discharged, the quantity of back-rinsing liquor required can also be reduced.

Yet another purpose is, in the bleaching stage with high gas evolution, such as e.g. the D-stage, to be able to retain the high washing efficiency of the diffuser washer without successive reduction of the washing efficiency, which is otherwise most frequently the consequence of gas bubbles being formed in the strainer packages, with impaired pressure equalisation as a result.

List of drawings

Fig. 1 schematically shows a conventional atmospheric diffuser with one washing stage;

Fig. 2 shows a washing stage with atmospheric diffuser arranged after a chlorine dioxide addition, where the subsequent diffuser is used as a reaction stage, a so-called D-stage;

Fig. 3 schematically shows how the strainer package for the atmospheric diffuser has been modified in accordance with the invention;

Fig. 4 shows the strainer in detail with one exhaust air tube in accordance with the invention;

Fig. 5a shows a first version of the exhaust air tube viewed along section V-V in Fig. 4;

Fig. 5b shows a second version of the exhaust air tube viewed along section V-V in Fig. 4;

Fig. 6 shows an advantageous detailed configuration of the upper outlet of the exhaust air tube;

Fig. 7 shows an alternative ventilation design in accordance with the invention; and

Fig. 8 shows Fig. 7, viewed in the opposite direction, in more detail.

Detailed description of preferred embodiment forms

Fig. 1 shows atmospheric diffuser 1 used for washing of cellulose pulp by diffusion. The diffuser incorporates a cylindrical, vertical container 23 to which the pulp is continuously fed through inlet P_{IN} at the base and leaves the container via outlet P_{OUT} at the top, where the pulp flow is indicated by the filled flow arrows in the drawing. Arranged uppermost in the container is rotary delivery scraper 12 driven via motor and gearbox 18. Scraper 12 engages with the upper surface of the pulp bed and scrapes out the pulp towards the container periphery, where the pulp flows over and finally reaches outlet P_{OUT} via an annular duct running around the container periphery.

The pulp is arranged to pass at least one strainer package 15 consisting of a number of concentrically arranged cylindrical extraction strainers from which washing filtrate is extracted via extraction ducts, here via strainer arms 16 and

washing filtrate outlet WF. Each extraction strainer consists of a thin-walled sleeve-like strainer plate with strainer plates on both the inside and outside. Arranged under each strainer is a collection duct 22, called a header, which collects all the filtrate from the strainers and further guides extracted filtrate out to strainer arm 16 for further delivery to outlet WF.

Washing liquor WL is supplied through liquor distributor 10, nozzle arms 20, and vertical washing nozzles 21, the washing nozzles being arranged between each strainer package 15. Washing nozzles 21 extend downwards between the space formed between two extraction strainers from nozzle arms 20, whereby the washing liquor can be supplied to the pulp through the nozzle and be compressed/extracted against strainer surfaces on the radially outside and radially inside strainer surface of each strainer.

Nozzle arms 20 with washing nozzles 21 arranged thereon are rotated by motor/gearbox 18 about the vertical axis of the container so that new washing liquor is supplied to the pulp between two concentric strainers.

During operation, whole strainer package 15 moves upwards with the pulp flow, this movement being imparted to strainer package 15 via hydraulic cylinder 14, which is securely retained in support 13 in the container and which affects strainer arm 16. When the strainer package reaches its uppermost position, extraction of washing filtrate is shut off, and the strainer package is pulled rapidly downwards to the initial position for a renewed washing stroke. The outlet duct of the washing filtrate is connected to pressure equalisation tank 17 to ensure that appropriate depressurisation of the strainers is established.

Fig. 3 shows the invention in an enlarged illustration of strainer package 15. Seen here are concentric strainers 15a-15g, seven in number, fitted on strainer arm 16, which supports the complete strainer package. Connected under each strainer is a collection duct (header) 22a-22g, which collects all the filtrate from each strainer and which guides the extracted filtrate further out to strainer arm 16 for further delivery to outlet WF. In accordance with the invention, each strainer package is provided with exhaust air duct 30 connected to the highest point of the strainer package, which, via at least one

vertically directed tube, discharges at distance H above the highest point of the strainer package.

Fig. 4 shows exhaust air duct 30 in the form of a tube connected to the highest point (roof) 15^T of the strainer. Strainer 15 is seen here with its radially inward directed strainer surface 15^I (which is concave about the vertical central axis of the container) and radially outward directed strainer surface 15^{II} (which is convex about the vertical central axis of the container). Used washing liquor is guided towards each strainer surface and inside the internal extraction space of the strainer, as indicated by flow arrows, the extraction space being divided by partition wall 15^W. In the strainer roof, there is at least one borehole 15^B from each extraction space on both sides of partition wall 15^W and up to exhaust air tube 30. Borehole 15^B should appropriately be kept as small as possible while still allowing safe discharge of gas. During back rinsing, hole 15^B should throttle the flow of back-rinsing liquor so that the liquor does not flow unobstructed up into the exhaust air tube. A suitable borehole diameter should therefore lie between 1.5-3 mm, preferably 2 mm. Exhaust air tube 30 here has an upper outlet, which discharges into the pulp bed via strainer mesh 31, or else a finely drilled plate, on the tube sidewalls and via boreholes 32 in the upper end-piece of the tube. The tube has height H lying between 100-600 mm, preferably around 400 mm, and the strainer mesh is arranged on the upper part of the tube, with an extension H2 over the tube viewed from the upper part of the tube, which is 50% less than the tube length. With tube 30 that is around 400 mm long, height H2 of the strainer mesh may suitably amount to 50-200 mm, preferably around 100 mm.

Fig. 5a shows a first version of exhaust air tube 30 viewed along section V-V in Fig. 4, where the tube has first dimension t1 viewed in the radial direction of the container, dimension t1 not exceeding corresponding strainer package dimension ts, and the tube has a second dimension t2 viewed in the circumferential direction of the container, with t2 exceeding t1 by at least 100%. Fig. 5a only shows tube 30 schematically and without the bend which the strainer normally has in order to follow the strainer curvature.

In this manner, the tube comes to connect with the highest point of the strainer package and a number of boreholes 15^B on the strainer package roof, with each tube being used for ventilation of the strainer package via at least two boreholes. The drawing shows 10 boreholes arranged at the highest point of the strainer package.

In the embodiment form shown, at least parts of the upper outlet of the tube may have a direction facing radially away from the upper part of the tube, with the pulp, as it flows past, exerting a cleansing effect on the outlet opening.

In this version, two exhaust air tubes are sufficient on a strainer with a diameter of 1.5 metres, provided these tubes have 3-5 boreholes in the strainer roof towards each extraction space and with each borehole having a hole diameter of 1.5-4.0 mm, preferably 2 mm. With an increasing strainer diameter $\varnothing_S$, successively more exhaust air tubes are used as appropriate: $\varnothing_S$ = 2.5 m $\Rightarrow$ 3 tubes / $\varnothing_S$ = 3.5 m $\Rightarrow$ 4 tubes / $\varnothing_S$ = 4.5 m $\Rightarrow$ 6 tubes / $\varnothing_S$ = 5.5 m $\Rightarrow$ 7 tubes / $\varnothing_S$ = 6.5 m $\Rightarrow$ 8 tubes.

Fig. 5b shows a second version of exhaust air tube 30 viewed along section V-V in Fig. 4, where the tube is instead cylindrical and connects to at least one borehole from a separating space in the strainer, here shown with two boreholes from each space formed by partition wall 15^W. In this embodiment form, more exhaust air tubes per strainer are self-evidently required as appropriate: $\varnothing_S$ = 2.5 m $\Rightarrow$ 9-15 tubes / $\varnothing_S$ = 3.5 m $\Rightarrow$ 12-20 tubes / $\varnothing_S$ = 4.5 m $\Rightarrow$ 18-30 tubes / $\varnothing_S$ = 5.5 m $\Rightarrow$ 21-35 tubes / $\varnothing_S$ = 6.5 m $\Rightarrow$ 24-40 tubes.

To prevent any plugs from clogging boreholes 32 during extraction of washing filtrate, the upper outlet of the tube can be made internally conical with the largest opening directed upwards, as shown in Fig. 6. In this way, any plugs can be easily blown away while the strainer is being pulled down to the starting position and when washing filtrate is also back-rinsing the strainers.

Fig. 2 shows a highly advantageous position in a bleaching sequence where the device in accordance with the invention is used. Shown here is a bleaching stage with chlorine dioxide, a so-called D-stage, where the pulp is

pumped via pump 3 from a pulp chute to mixer 4, preferably an MC mixer marketed under the name of DUALDMIX, where chlorine dioxide is added batchwise to the pulp. After chlorine dioxide is mixed in, the pulp is guided to the reaction tower/bleaching tower, which is here established by extended inlet part 1 to an atmospheric diffuser. During chlorine dioxide bleaching, large amounts of gas are released, with the diffuser efficiency decreasing with the lapse of time, unless the gas accumulated in the strainers can be removed. A washing filtrate from a diffuser in this position normally contains a large proportion of gas, normally between 5-20% gas calculated by volume (depressurised gas vs pulp volume).

The invention in accordance with the embodiment form shown in Fig. 3 can be varied in a number of ways within the frame of the attached patent claims. For example, simple non-return valves may be introduced into boreholes 15^B, where eg flexible rubber lips bear against the upper outlet of borehole 15^B, with the lip sealing during extraction of filtrate but opening under pressure when the strainer is back-rinsed. The non-return valves may be either self-regulating, in the same way as the specified lip valve, or externally controllable.

The ventilation tubes may be given an optional cross-sectional shape, ranging all the way from the version shown in Fig. 5a with a rectangular cross-section to a circular cross-section corresponding to Fig. 5b.

Fig. 7 shows an alternative embodiment form of ventilation system, the essential parts being shown in an enlarged view in Fig. 8 and viewed from the rear in Fig. 7. Located here in place of the vertically directed tubes (30 in Fig. 3) is extraction housing 30a arranged at or extending over the highest point of the strainer package.

Boreholes 15^B discharge inside the extraction housing, with a vertical downward directed extraction tube 30b being connected to the extraction housing base. The extraction housing is in other respects fully sealed against the surrounding pulp and thus includes the gas collected in the extraction housing.

One end of extraction tube 30b is connected to the extraction housing and further runs parallel to the strainer package surface down to and preferably past strainer arm 16 that supports the strainer package.

Located under the strainer arm and securely integrated with a strainer arm is collection box 30c, which can thus follow the strainer package up and down movement. The other end of the extraction tube is connected to this collection box.

In an alternative embodiment form, collection box 30c may be located inside strainer arm 16.

The arrangement with extraction housing 30a and vertical downward directed extraction tube 30b is arranged on at least one of the strainer packages, and preferably on the strainer package or strainer packages able to collect the greatest gas volumes. The strainer packages with the greatest volume are those that have the largest diameters and that are preferably provided with an extraction arrangement on a number of the outer strainer packages, suitably 2-5 of the outer strainer packages. In Fig. 7, the extraction arrangement is located on the three outer strainer packages.

Collection box 30c is common to all extraction tubes 30b, which extraction tubes discharge with their other, lower end inside the collection box.

To be able to draw off the gases supplied to collection box 30c, non-mobile vertically directed evacuation tube 30f secured in the washer is used. Tube 30f connects to, or projects through, collection box base 30d via sliding seal 30e secured in the collection box. The collection box can thus move up and down with the strainer arm while tightly bearing against evacuation tube 30f. Evacuation tube 30f is run through the walls of the washer, and the collection box can be depressurised with pump P for evacuation of the gases drawn off from the strainer packages.

In both versions shown in Fig. 3 and 7, at least one strainer package is provided with an exhaust air duct connected at one end to the highest point of the strainer package, at which highest point a first pressure prevails, being connected at its other end to a position in the washer where a pressure lower than the first specified pressure prevails. In the embodiment form shown in

Fig. 3, this pressure difference is established through the difference in the static head on the pulp surrounding the strainer package.

In the embodiment form shown in Fig. 7, this pressure difference is instead established through the depressurisation obtained by pump P. In the exhaust air duct, gas accumulated at the highest point of the strainer device can thus be delivered, regardless of the flow formed in the exhaust air ducts. For both these embodiment forms, this pressure difference should at least correspond to a 1 decimeter water column, ie at least 0.01 bar, which, in the case of the version shown in Fig. 3, implies a vertically directed tube with a length of at least 1 decimetre. Any excessively large pressure difference should be avoided to avoid any risk of the washing filtrate being drawn off via the degassing system. The maximum pressure difference is suitably limited to 0.1-1.0 bar.

CLAIMS

1. Device for washing of cellulose pulp by diffusion, which incorporates a cylindrical, vertical container (23) to which the pulp is continuously fed through an inlet (P_{IN}) at the base and leaves the container via outlet (P_{OUT}) at the top, where the pulp is arranged to pass at least one strainer package (15) consisting of a number of concentrically arranged cylindrical extraction strainers (15-15g) from which the washing filtrate (WF) is extracted via extraction ducts (22, 16) and where the washing liquor (WL) is supplied through vertical washing nozzles (21) arranged between each strainer package, c h a r a c t e r i s e d in that an exhaust air duct is arranged for at least one strainer package connected at one end to the highest point of the strainer package, at which a first pressure prevails, and being connected at its other end to a position in the washer where a pressure lower than the first specified pressure prevails, in which exhaust air duct gas accumulated at the highest point of the strainer device can thus be delivered, regardless of the flow formed in the exhaust air ducts.

2. Device in accordance with claim 1, c h a r a c t e r i s e d in that an extraction housing (30a) is arranged at the highest point of the strainer package, with at least one and preferably several boreholes (15^B) in the roof of the strainer package discharging into the extraction housing (30a).

3. Device in accordance with claim 2, c h a r a c t e r i s e d in that one end of a vertical downward directed extraction tube is connected to the extraction housing (30a) for discharge of gases, and where the other end of the extraction tube is connected to a collection box (30c), which collection box is common to at least two extraction tubes for different strainer packages.

4. Device in accordance with claim 3, c h a r a c t e r i s e d in that the collection box is secured on a strainer arm (16) supporting the strainer package (15a-15g).

5. Device in accordance with claim 4, c h a r a c t e r i s e d in that connected to the collection box (30c), via a sliding seal (30e), is an evacuation tube (30f) discharging into the collection box, to which evacuation tube is connected a pump (P) for evacuation of gas.

6. Device in accordance with claim 1, c h a r a c t e r i s e d in that the exhaust air duct comprises at one vertically directed tube (30) whose upper outlet discharges at distance H above the highest point of the strainer package.

7. Device in accordance with claim 6, c h a r a c t e r i s e d in that the tube (30) has an upper outlet which discharges into the pulp bed via a strainer mesh (31).

8. Device in accordance with claim 6, c h a r a c t e r i s e d in that the tube (30) has a first dimension t1 viewed in the radial direction of the container, which dimension (t1) does not exceed corresponding strainer package dimension (ts), and that the tube has a second dimension (t2) viewed in the circumferential direction of the container, with the first dimension (t2) exceeding the second dimension (t1) by at least 100%.

9. Device in accordance with claim 6 or 8, c h a r a c t e r i s e d in that the tube (30) connects to the highest point (15^T) of the strainer package and a number of boreholes (15^B) in the roof of the strainer package, with each tube being used for ventilation of the strainer package via at least two boreholes arranged at the highest point of the strainer package.

10. Device in accordance with claim 6, c h a r a c t e r i s e d in that the upper outlet (31) is directed radially away from the upper part of the tube, with the pulp, as it flows past, exerting a cleansing effect on the outlet opening.

11. Device in accordance with claim 6, c h a r a c t e r i s e d in that the upper outlet (32) is internally conical with the largest opening directed upwards.

12. Device in accordance with claim 6, c h a r a c t e r i s e d in that the tube is cylindrical and connects to at least one borehole (15^B) from a separating space in the strainer (15) and preferably connects to two boreholes from each extraction space formed by a partition wall (15^W) in the strainer.

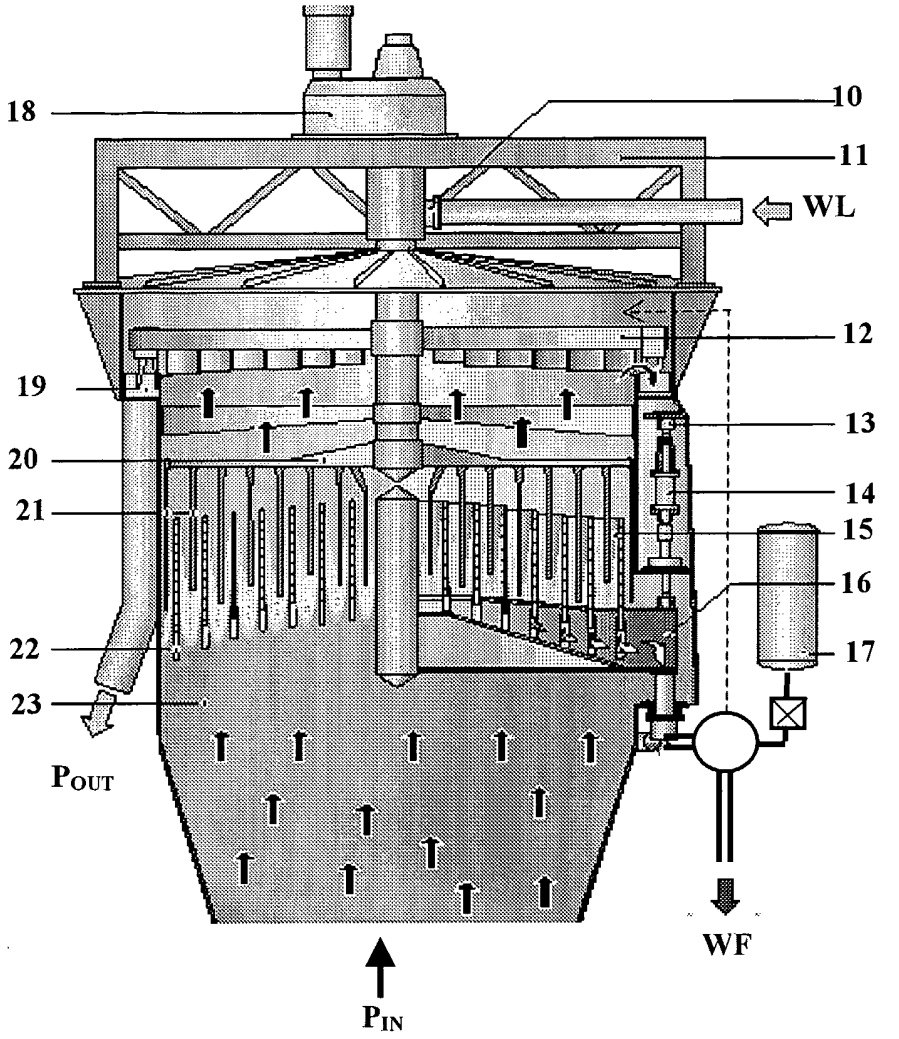
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Fig. 1

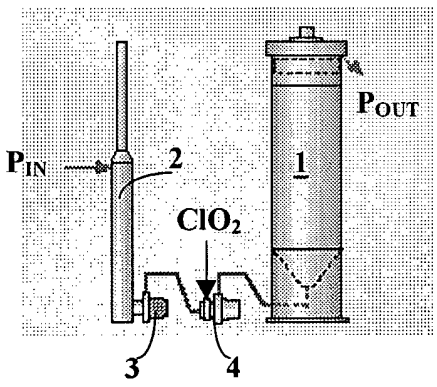
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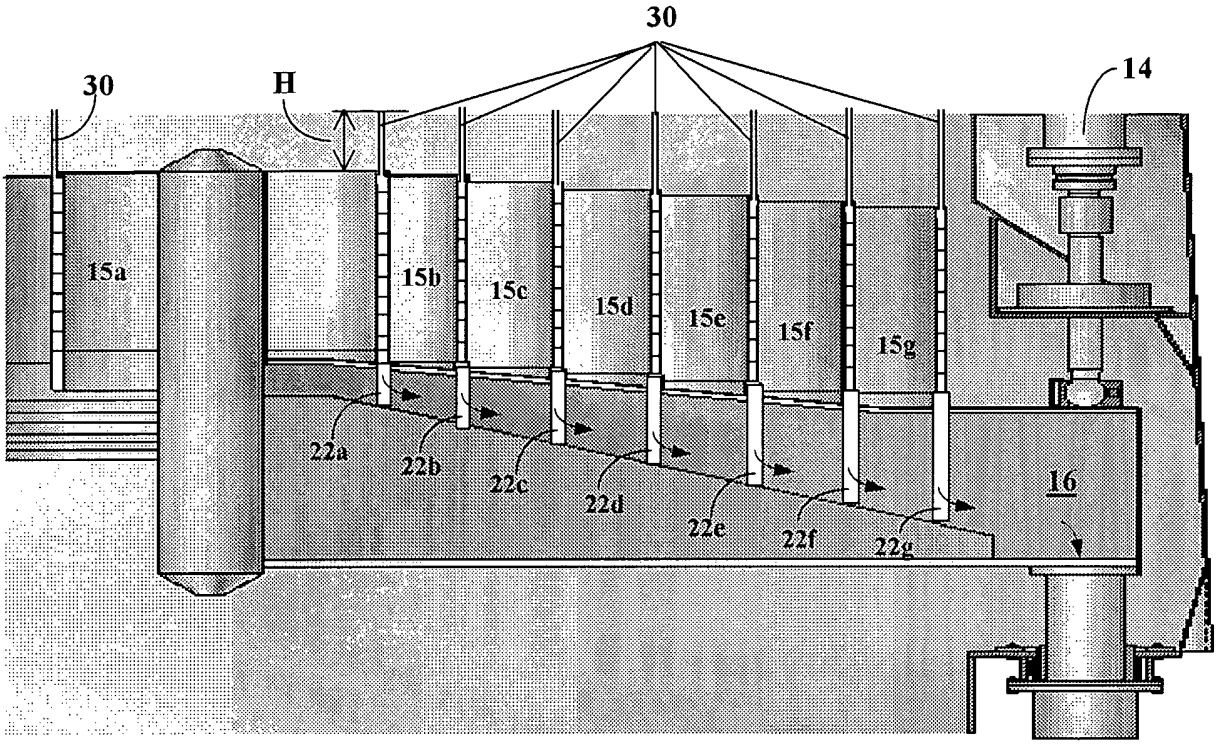
Fig. 2

Fig. 3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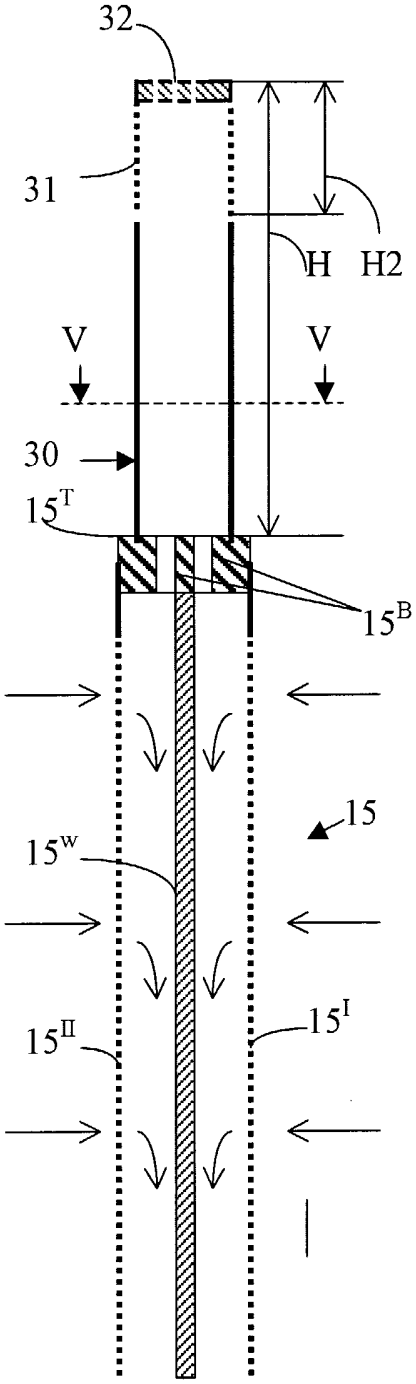


Fig. 4

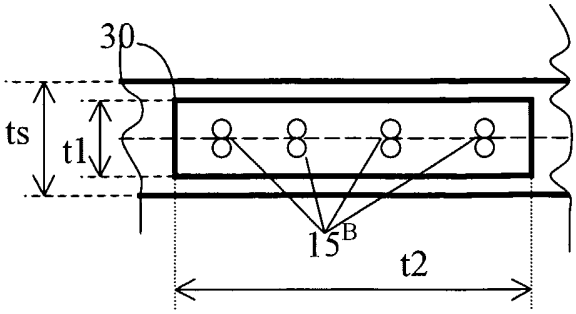


Fig. 5a

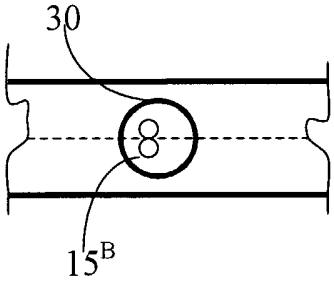


Fig. 5b

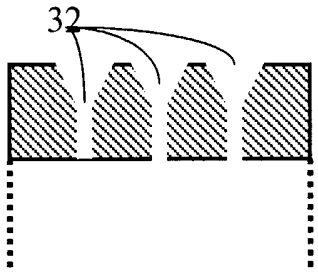
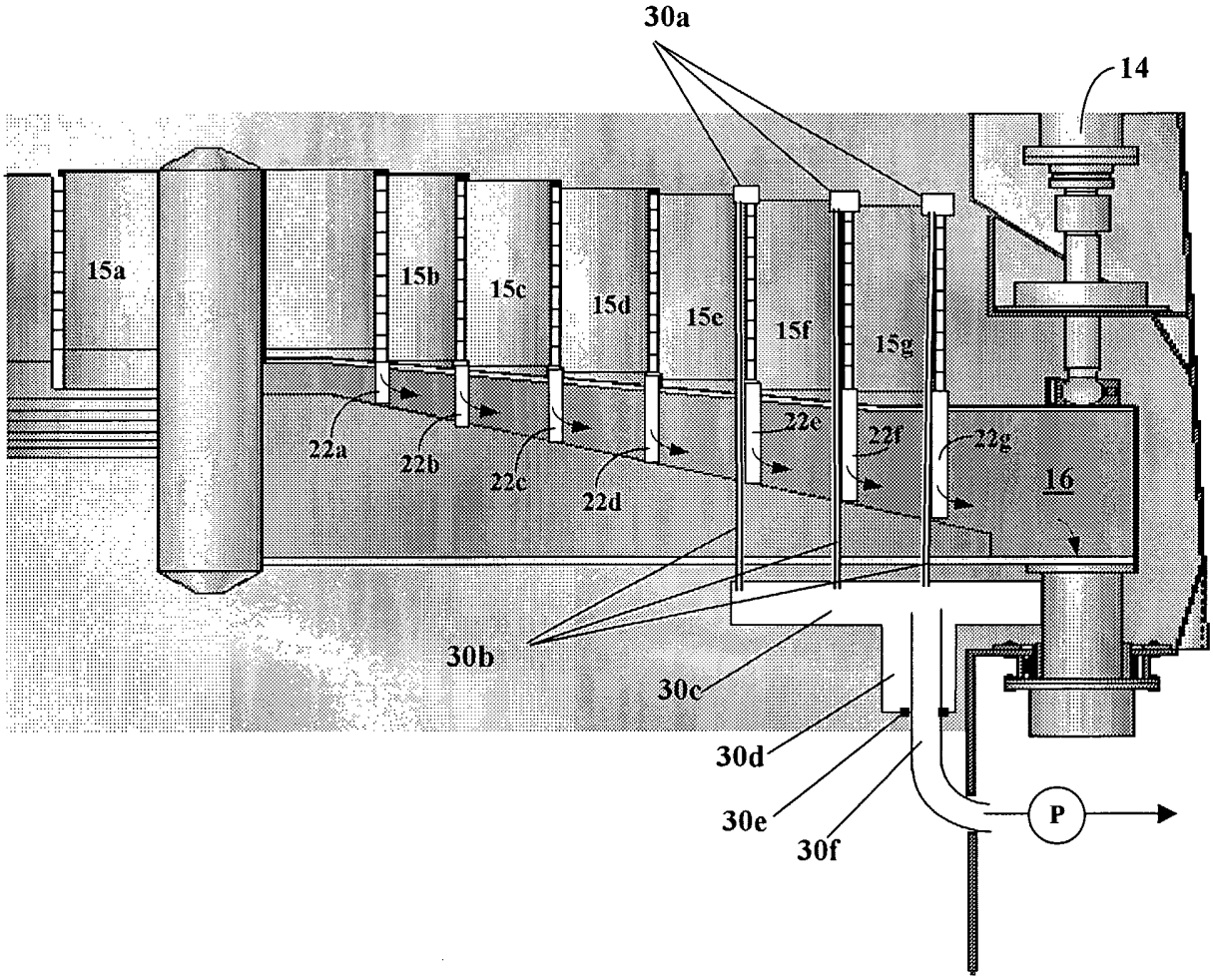


Fig. 6

Fig. 7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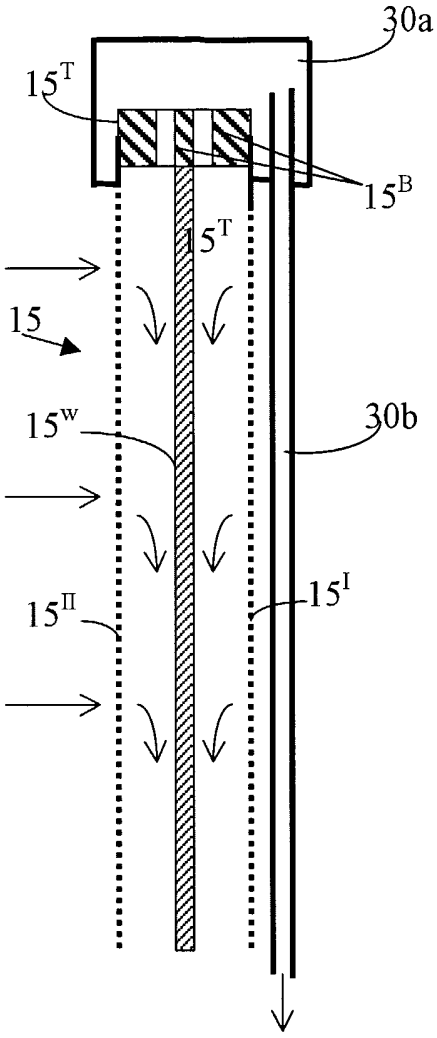

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 03/00638

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21C 9/04
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: D21C

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)

EPO-INTERNAL, WPI DATA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9520067 A1 (KVAERNER PULPING TECHNOLOGIES AB), 27 July 1995 (27.07.95) --	1-12
A	EP 0377427 A2 (KAMYR AB), 11 July 1990 (11.07.90) -- --------	1-12

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

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"P" document published prior to the international filing date but later than the priority date claimed
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