

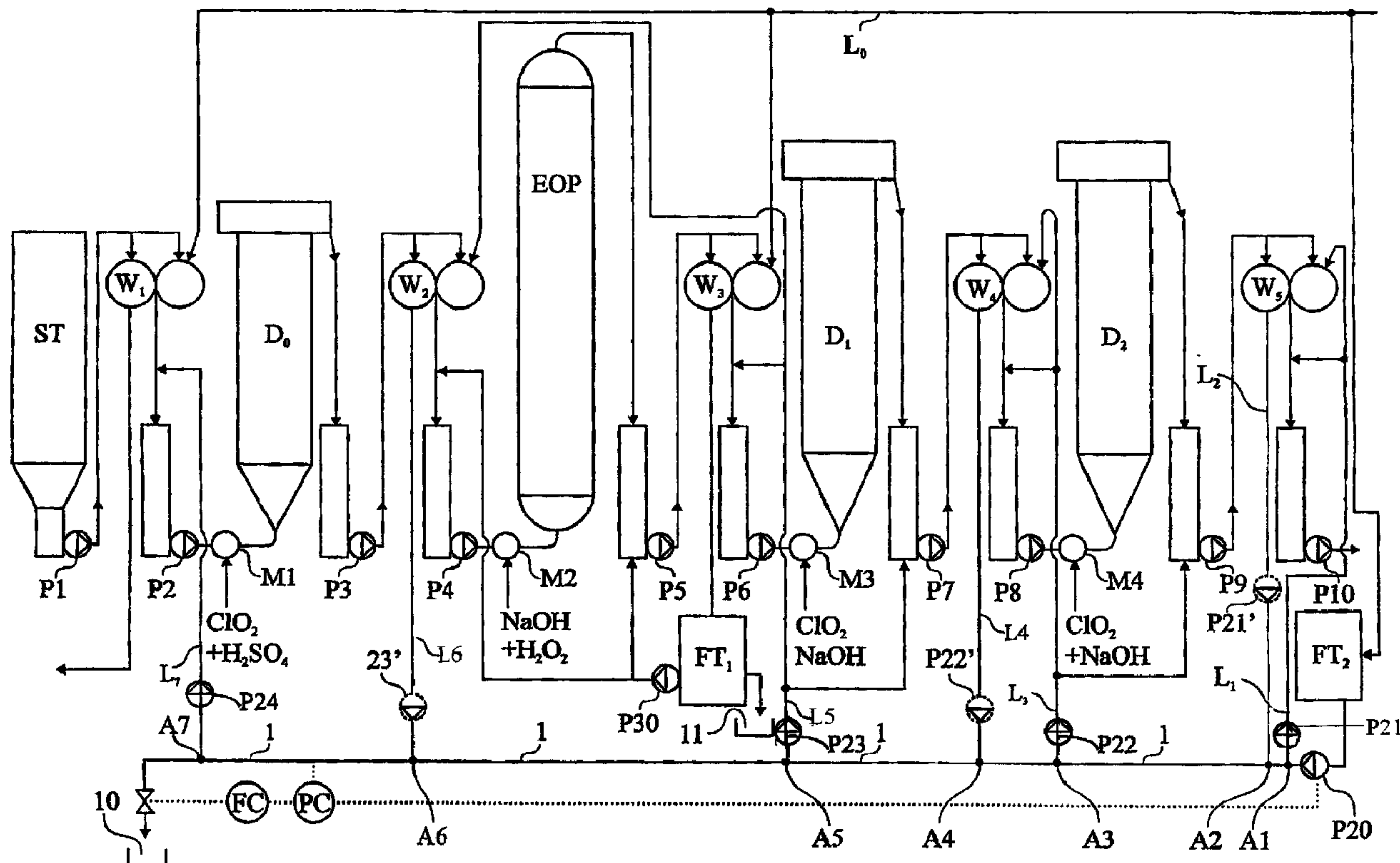


(86) Date de dépôt PCT/PCT Filing Date: 2003/12/09
 (87) Date publication PCT/PCT Publication Date: 2004/08/12
 (45) Date de délivrance/Issue Date: 2011/11/08
 (85) Entrée phase nationale/National Entry: 2005/07/07
 (86) N° demande PCT/PCT Application No.: SE 2003/001915
 (87) N° publication PCT/PCT Publication No.: 2004/067834
 (30) Priorité/Priority: 2003/01/31 (SE0300276-3)

(51) Cl.Int./Int.Cl. *D21C 9/02* (2006.01),
D21C 9/10 (2006.01)
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(54) Titre : PROCÉDE DE LAVAGE DE LA PATE A PAPIER DANS UNE LIGNE DE BLANCHIMENT ET LIGNE DE
BLANCHIMENT

(54) Title: METHOD FOR WASHING PULP IN A BLEACHING LINE AND A BLEACHING LINE



(57) Abrégé/Abstract:

This invention relates to a method of bleaching cellulose pulp in a bleaching line, having at least two bleaching steps comprising a first (D_1) and a second (D_2) bleaching step, as seen in the direction of flow of the cellulose pulp, which bleaching steps have wash apparatuses (W_4 , W_5) for the pulp arranged after the first and the second bleaching step, respectively, and in which wash liquor

(57) **Abrégé(suite)/Abstract(continued):**

and where appropriate dilution liquor is led in principle in counter-current to the pulp flow through the bleaching steps in the bleach line, wherein that a substantial portion of the wash liquor, or all of it, is supplied by means of a main conduit (1), wherein - each one of said wash apparatuses (W_4, W_5) is independently supplied by means of first branch conduits (L_1, L_3) connected to said main conduit (1), - each one of said wash apparatuses (W_4, W_5) independently bleeds out wash filtrate by means of second branch conduits (L_2, L_4) connected to said main conduit (1), and said main conduit has an outlet end (10) which bleeds out at least some of said wash filtrate from said wash apparatus (W_4, W_5).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
12 August 2004 (12.08.2004)

PCT

(10) International Publication Number
WO 2004/067834 A1

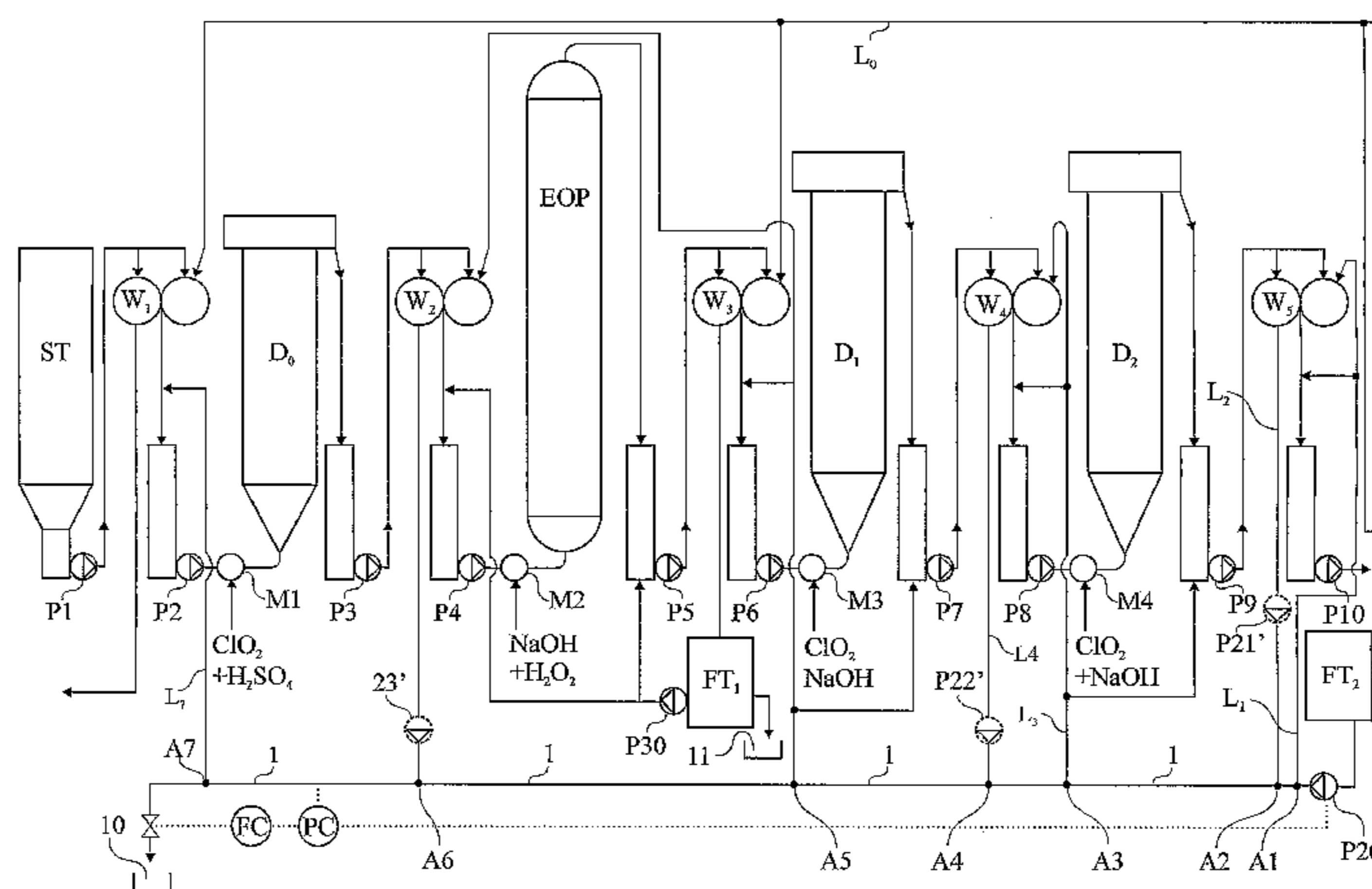
- (51) International Patent Classification⁷: **D21C 9/02**, 9/10
- (21) International Application Number:
PCT/SE2003/001915
- (22) International Filing Date: 9 December 2003 (09.12.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
0300276-3 31 January 2003 (31.01.2003) SE
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- (81) Designated States (*national*): AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, EG, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD FOR WASHING PULP IN A BLEACHING LINE AND A BLEACHING LINE



(57) Abstract: This invention relates to a method of bleaching cellulose pulp in a bleaching line, having at least two bleaching steps comprising a first (D₁) and a second (D₂) bleaching step, as seen in the direction of flow of the cellulose pulp, which bleaching steps have wash apparatuses (W₄, W₅) for the pulp arranged after the first and the second bleaching step, respectively, and in which wash liquor and where appropriate dilution liquor is led in principle in counter-current to the pulp flow through the bleaching steps in the bleach line, wherein that a substantial portion of the wash liquor, or all of it, is supplied by means of a main conduit (1), wherein - each one of said wash apparatuses (W₄, W₅) is independently supplied by means of first branch conduits (L₁, L₃) connected to said main conduit (1), - each one of said wash apparatuses (W₄, W₅) independently bleeds out wash filtrate by means of second branch conduits (L₂, L₄) connected to said main conduit (1), and said main conduit has an outlet end (10) which bleeds out at least some of said wash filtrate from said wash apparatus (W₄, W₅).

WO 2004/067834 A1

Method for washing pulp in a bleaching line and a bleaching line.

The present invention relates to a method of bleaching cellulose pulp and a bleach line
5 for the method.

PRIOR ART

It is a desire in multi-stage bleaching of cellulose pulp to reduce the water requirement
and the quantity of outlet contaminated process water, which contaminated process
10 water is either pumped to sewage, possibly via sedimentation basins and/or to costly
destruction/deposition.

With the object of reducing the liquor quantities, the bleaching department is ever more
closed and most often the process water is lead in counter-current to the direction of
flow of the cellulose pulp in the process steps of the bleaching line. Accordingly, the
15 fresh water or the clean process water is used in the wash of the last step and the wash
filtrate obtained there from is led as wash liquor to the wash of the preceding step and
further up through the bleaching line.

Commonly, a number of filtrate tanks are used between each bleaching step wash for
this leading of wash filtrate through the process, with the object of guaranteeing supply
20 of wash liquor and securing that the wash liquor is lead in counter-current to the flow of
cellulose pulp.

In addition to such filtrate tanks, expensive control and regulation systems with valves
are required for this handling of the wash liquor in filtrate tanks, to monitor the levels in
the filtrate tanks since the risk can not be taken that a filtrate tank is emptied whereby it
25 may cause a stoppage in the wash of the bleaching step in question.

The number of filtrate tanks also results in a risk of an increased outlet of odorous gases
as all filtrate tanks require ventilation in order to level out changes in the volume in the
filtrate tanks. Often, special degassing systems are required to handle and destruct such
odorous gases.

30 Accordingly, big advantages could be attained if the number of filtrate tanks between
the process steps could be minimised.

THE OBJECT AND PURPOSE OF THE INVENTION

One object of the invention is to reduce the need of, and in some cases completely
35 eliminate, such expensive filtrate tanks, control systems and valves in the wash liquor
systems, whereby the investment costs for the bleaching line may be strongly reduced.
The reduced number of necessary filtrate tanks also results in the possibility of a more

compact and more optimal design of the bleaching line, without consideration of such filtrate tanks that conventionally numbers to at least the same number as the number of bleaching steps, with a more efficient layout of the bleaching steps of the bleaching line.

- 5 Yet another object is to increase the runnability/accessability of the system as several control valves may be removed, that otherwise are always potential risks for plugging/stoppage of the liquor distribution system.

10 Yet another object is to improve the runnability as the risk of mixing-in of air in the filtrate system is considerably reduced when the number of filtrate tanks can be considerably reduced. At the same time, accumulation of floating pulp is avoided, which floating pulp usually accumulates after a certain running time, by surface flotation in filtrate tanks. Principally in alkaline steps, such accumulated floating pulp may rise to a level of a few metres above the surface in the filtrate tanks and it must be
15 continuously taken care of or recycled to the bleaching line in order not to risk plugging of the filtrate systems.

20 Yet another object is that the bleaching plant can be rendered more environmentally friendly as occasional overloads in certain positions, so called over-runs, need not result in outlet of gas or liquor.

Yet another object is to minimise the water consumption.

By the system, the system itself may compensate for occasional changes in wash liquor requirements in the various bleaching steps and secure that a required wash liquor quantity is always guaranteed the bleaching steps.

25

It is yet another object to minimise the energy consumption in pumps in the filtrate distribution system, where instead a pressurised filtrate main conduit is maintained and any required liquor quantity is drawn off from the main conduit, as needed.

- 30 Yet another object is to decrease the length of the tube system, which reduces the costs of installation and the complexity of the system, whereby in the latter case the lucidity is also increased for the operators.

35 A cost reduction of between 1 and 2 millions USD can be obtained for a 4-step bleaching line D_0 -EOP- D_1 - D_2 with intermediate wash steps, if the invention is fully applied.

LIST OF DRAWINGS

Fig. 1 shows a conventional prior art bleaching sequence D_0 -EOP- D_1 - D_2 in which the filtrate is led in counter-current, via filtrate tanks;

Fig. 2 shows the same bleaching sequence D_0 -EOP- D_1 - D_2 in which the filtrate is lead
5 between the steps in accordance with the invention, according to an embodiment using a high pressure mode,

Fig. 3 shows a part of the bleaching sequence as also shown in Fig. 2, but according to another embodiment of the invention where a low pressure mode is used, and,

Fig. 4 shows a section of a further embodiment according to any of the bleaching
10 sequences according to Fig. 2 or Fig. 3, wherein minor modifications have been performed.

PRIOR ART

Fig. 1 shows a conventional bleaching sequence D_0 -EOP- D_1 - D_2 in which the filtrate
15 from the washing between the steps is led in counter-current between the bleaching steps, via filtrate tanks FT_1 - FT_4 .

The pulp is pumped by a pump from a first storage tower, to a first wash W_1 in which the pulp is washed with a clean first filtrate FF_1 . In the figure, wash apparatuses of wash press type are schematically shown, having two contra-rotating wash drums where
20 wash liquor is supplied to the web of pulp on both drums, but subsequently the figure only shows the supply of wash liquor to one drum of the wash press.

It is typical to such bleaching systems having wash presses that the bleaching takes place in reactors at a pulp consistency of 10-14 % and that after treatment in the reactor, the pulp is diluted to about 5-10 %, typically about 8 %, before it is fed to the wash
25 press. After the wash press, the pulp has a consistency of 20-35 %, typically 30 %.

After the first wash W_1 , the washed pulp is fed down into a chute in which the pulp is diluted by a liquor that is pumped from a filtrate tank FT_1 , from which chute it is pumped by a pump and a subsequent mixer M_1 to a subsequent bleaching step, here a first chlorine dioxide step D_0 shown as an up-flow tower (the pulp flows upwards in the
30 tower). The chemicals for the bleaching step, ClO_2 and acidifier H_2SO_4 , are mixed-in by the mixer M_1 before the pulp is led to the D_0 bleaching tower.

After the bleaching in the D_0 bleaching tower, the pulp is led to a chute in which the pulp is diluted by filtrate from the first filtrate tank FT_1 . From the chute, the pulp is pumped to a subsequent wash W_2 in which the pulp is washed by wash liquor from a
35 third filtrate tank FT_3 .

Thereafter, the pulp washed in the wash W_2 is led to a chute in which the pulp is diluted by filtrate from a second filtrate tank FT_2 , and from the chute the pulp is pumped by a

pump and a subsequent mixer M2 to a subsequent alkaline extraction step, here an EOP step shown as an up-flow tower. The chemicals for the extraction step, NaOH and peroxide H_2O_2 , and oxygen gas if needed, are mixed in by the mixer M2 before the pulp is led to the EOP tower.

- 5 After the treatment in the extraction tower EOP, the pulp is led to a chute in which the pulp is diluted by filtrate from the second filtrate tank FT_2 , where after the pulp is pumped to a subsequent wash W_3 . In the wash W_3 , the pulp is washed by clean filtrate FF2.

10 After the wash W_3 , the washed pulp is fed down to a chute in which the pulp is diluted by filtrate from a third filtrate tank FT_3 , where after the pulp is pumped by a pump and a subsequent mixer to a subsequent bleaching step, here a second chlorine dioxide step D_1 , shown as an up-flow tower. The chemicals for the D_1 bleaching step, ClO_2 and pH-adjuster, are mixed in by the mixer before the pulp is led to the D_1 bleaching tower. As an alternative, the adjusting of pH can take place by addition of e.g. NaOH in the
15 preceding chute.

After the treatment in the D_1 bleaching tower, the pulp is led to a chute in which the pulp is diluted by filtrate from the third filtrate tank FT_3 , where after the pulp is pumped to a subsequent wash W_4 . In the wash W_4 , the pulp is washed by filtrate from a fourth filtrate tank FT_4 .

- 20 After the wash W_4 , the washed pulp is fed down to a chute in which the pulp is diluted by filtrate from a fourth filtrate tank FT_4 , where after the pulp is pumped by a pump and a subsequent mixer to a subsequent bleaching step, here a third chlorine dioxide step D_2 , shown as an up-flow tower. The chemicals for the D_2 bleaching step, ClO_2 and pH-adjuster, are mixed in by the mixer before the pulp is led to the D_2 bleaching tower. As
25 an alternative, the adjusting of pH can take place by addition of e.g. NaOH in the preceding chute.

After the treatment in the D_2 bleaching tower, the pulp is led to a chute in which the pulp is diluted by filtrate from the fourth filtrate tank FT_4 , where after the pulp is pumped to a subsequent wash W_5 . In the wash W_5 , the pulp is washed by clean filtrate
30 FF3.

The pulp bleached by the shown bleaching sequence, D_0 -EOP- D_1 - D_2 , is subsequently led to a storage tower (not shown) and typically has a brightness above ISO 80 and is often a fully bleached pulp of ISO 90. In certain cases, a subsequent treatment can be used to modify the properties of the pulp in respect of drainage properties etc.

- 35 The main principle of the filtrate distribution of the shown bleaching sequence is that there are filtrate tanks between the treatment steps, which filtrate tanks receive the filtrate from the wash in question.

The filtrate tank FT₄ of the last wash W₅ collects the filtrate and then the filtrate is led in counter-current to the flow of pulp through the bleaching line, via pumps, and is used as dilution or wash liquor in preceding positions. In a corresponding manner, filtrate from the wash apparatuses W₄, W₃, W₂ is collected in the filtrate tanks FT₃, FT₂ and FT₁,
 5 respectively, and then the filtrate is led via pumps, from the respective tank in counter-current to the flow of pulp through the bleaching line.

In certain circulations, a certain share of the filtrate is also bled off, as is shown in the feed from the filtrate tanks FT₁ and FT₂, in order to avoid accumulation of increasing contents of undesired substances, which bleeding-off is compensated by supply of
 10 cleaner filtrates FF1 and FF2. The bleeding-off of filtrate is the principle outlet from the bleaching line. In this counter-current filtrate distribution, alkaline filtrate is separated from acidic. Accordingly, the alkaline filtrate from the EOP step is collected in the filtrate tank FT₂, and no acidic filtrate is used in the wash W₃, but instead clean filtrate FF2 is used. In certain applications, such alkaline filtrate can be fed on, upstream, to the
 15 oxygen delignification, where it is used as wash liquor in the wash after the oxygen delignification.

For the acidic filtrates that are collected in the filtrate tanks FT₄, FT₃ and FT₁, the wash liquor is led strictly counter-current to the flow of pulp, i.e. from FT₄ to FT₃, and finally to FT₁ from where the acidic filtrate is bled off from the bleaching department since it
 20 can not be handled in the recovery system, mainly due to high contents of chloride that destroy the soda recovery boiler.

PREFERRED EMBODIMENT OF THE INVENTION

Fig. 2 shows an embodiment of the invention, in which the same bleaching sequence is
 25 performed as described/shown in relation to Fig. 1, but in which the filtrate distribution system instead of the large number of filtrate tanks, has been replaced by a joint main conduit 1 for all acidic bleaching steps, in accordance with the invention.

Accordingly it is understood that according to the invention bleaching of the cellulose
 30 pulp takes place in a bleaching line with at least two bleaching steps in the bleaching line and at some point including a first and a second bleaching step D₁, D₂ in succession, as seen in the flow direction of the cellulose pulp, which bleaching steps have wash apparatuses W₄ and W₅ for the pulp arranged after the first and the second bleaching step, respectively. As shown in Fig. 2, wash liquor and dilution liquor, is led
 35 in principle in counter-current to the flow of pulp via the main conduit 1 and through the bleaching steps of the bleaching line, which flow of pulp (bold arrows are flow lines) passes through the sequence W₁-D₀-W₂-EOP-W₃-D₁-W₄-D₂-W₅. Pumps P1 to P10 are used to pressurize the pulp.

The wash liquor is supplied to the main conduit 1 that is arranged in parallel to the bleaching line, by a pump P20 from a filtrate tank FT₂. According to this embodiment the pump P20 maintains a pressure of about 5 – 6 bar at a first branch portion A1 within the main conduit 1. At this branch position A1 wash liquor and dilution liquor
5 (depending on what kind of wash equipment is being used dilution liquor may possibly be dispensed with. In the case shown in Fig. 2, i.e. using a wash press both liquors have to be supplied, which would not be the case if e.g. a pressure diffuser was used) is taken in L2 to the subsequent wash W₅ of the second bleaching step D₂, from a first branch position A1 in the main conduit. At least a part of the wash filtrate from that wash W₅ of
10 the second bleaching step D₂ is then led in L₂ to a second branch position A2 in the main conduit 1. Wash liquor and dilution liquor is taken via L₃ to the wash W₄ of the first bleaching step D₁, from a third branch position A3 in the main conduit 1, and the filtrate from this wash W₄ is led via L₄ to a fourth branch position A4 of the main conduit. Here, the branch positions A1-A4 connect to the main conduit with the first
15 branch position A1 arranged first, as seen in the direction of flow in the main conduit 1, and the second to fourth branch positions A2-A4 in succession thereafter, such that an open communication is established in the main conduit between the branch positions A1-A4. Accordingly, the main pump P20 pressurises the main liquor within the conduit and establishes a basic flow in the main conduit in a direction reverse to the formed
20 flow of cellulose pulp in the bleaching line. Thanks to the pressurisation within the main conduit 1 there is no need to use an additional pump to supply wash liquor via each respective branch line supplying each respective wash press, see for example L₁ that supplies W₅ positioned finally in the bleach line. This principle applies to all supply lines L₃, L₅ and L₇, that are connected to the main line 1. However, for the return lines,
25 L₂, L₄ and L₆, there is a need for a pump P21', P22', P23', to be able to achieve sufficient pressure to get it in to the main line again.

By way of example it may be assumed that about 10 – 12 m³/h is added through each supply line, L₁, L₃, L₅, L₇ to each wash apparatus W₅, W₄, W₃, W₁. Normally about 1 –
30 2 m³ of this amount is supplied to the wash press for the actual washing through the upper line, whereas about 9 – 10 m³ is supplied as dilution liquor directly after the wash press W₅.

Due to addition of chemicals in the prior bleaching step D₂ and also some fiberlosses,
35 the flow that is taken from the wash apparatus W₅ in return through line L₂ back to the main conduit 1 is somewhat larger than the amount that is supplied through L₁. Accordingly there will be a subsequent addition of liquid flowing in the main conduit in

its downstream direction. As is evident some of the filtrate from the final wash apparatus W_5 will be added into the supply line L_3 to the second last wash apparatus W_4 . As a consequence of the subsequent addition of liquid/chemicals/fibres the flow adjacent the end of the main conduit will be approximately about $1 - 2\text{m}^3/\text{h}$ more than is being added at the inlet. Since about $10 - 12\text{m}^3/\text{h}$ is also supplied through the supply line L_7 at the branch point A_7 at the downstream end 10, there will be a continuous flow of liquid out from the main conduit 1, at the end outlet 10 thereof amounting to about $0,1 - 2\text{m}^3/\text{h}$ (during operation). The skilled person realises that this example does not limit the scope of the invention, but knows that there are many variables, e.g. kind of wash equipment, production level, kind of bleaching, kind of fibres, etc., that will influence the amount/flow of bleed out.

In Fig. 3 there is shown a further embodiment according to the invention, wherein a low pressure main conduit 1 is being used (merely a portion of the bleach line is shown since the process is the same as shown in Fig. 2). Accordingly it is evident that the same principles as shown for the upstream portion of the main conduit shown in Fig. 3 also applies for the downstream portion). Pumps P7 to P10 are used to pressurize the pulp. In such an embodiment a pressure of about $1 - 2$ bar is maintained within the main conduit 1.

As can be seen in Fig. 3 there is therefore a need to use pumps P21, P22, to pressurise the wash liquid that has to be supplied to the wash apparatus through its respective line L_1A , L_3A , etc. However, since the dilution liquid is supplied at an atmospheric addition point, there is no need for using a pump for the supply line L_1B and L_3B for that liquid. Accordingly there is arranged a separate branch position A_1' , A_3' for each of those supply lines L_1B , L_3B . Moreover, it is shown that each standpipe SP9, SP7 directly subsequent to a bleach tower is supplied via its line L_3C , L_4C via conduits A_2' and A_4' , without the need for a pump. Also in this embodiment, however a pump P21', P22', is needed to pressurise the filtrate back into the main conduit 1.

Furthermore, there is shown a modification for achieving the desired pressure in the main conduit, i.e. by replacing the pump with a high tower FT2 and level control LC that controls the pressure by regulating the out flow from the outlet (10, not shown) and/or the inflow from L0 to keep the level within the tower FT2 at a desired level. In all other aspects this embodiment is similar to the function as described in relation to Fig. 2. However, it should be understood that the invention may very well be used merely for two bleach steps, e.g. D1 and D2 as shown in Fig. 3.

In Fig. 4 there is schematically shown a part of a bleach line as in Fig. 3, wherein it is presented that filtrate tanks FT3 may be used within a bleach line according to the invention. Moreover it is also shown that a pressure buffer tank FT4 connected by A4" to the main conduit may be used in

5 order to balance the pressure within the main conduit 1. It is evident that a number of filtrate tanks may be used and that they may be of comparatively limited size, e.g. less than 1m³, possibly about 500 litre. As is disclosed the pump P21' may normally not be dispensed with, since the tank FT₃ is preferably positioned at a relatively low level and is preferably not a pressure vessel. It is also shown that in many cases a further pump P21'' is used to supply the filtrate from the wash W₅ to the tank FT₃.

10 It is evident that a further main conduit 1 may suitably be used for bleaching steps of different alkalinity (above or below pH7). Hence, then one main conduit, (e.g. as in Fig. 2) is used for a number of acidic steps and another main conduit is used for a number of alkaline steps (the latter not shown).

15 It is understood that (as shown in Fig. 2) at least one additional bleaching step D₀ may be provided before the first and second bleaching steps D₁ and D₂, respectively, as seen in the flow direction of the cellulose pulp, after which additional bleaching step D₀ there is a wash apparatus W₂ for the pulp. Then wash liquor and dilution liquor is taken to the subsequent wash W₂ of the additional bleaching step, from a fifth branch position A5 in the main conduit 1. At least a part of the wash filtrate from the subsequent wash W₂ of the additional bleaching step is led to a sixth branch position A6 into the main conduit. The branch positions connect to the main conduit with the fifth branch position A5 arranged after the fourth branch position A4, as seen in the direction of flow in the main conduit 1, and the sixth branch position A6 in succession thereafter, an open communication being established in the main conduit between the branch positions A1-20 A6.

An alkaline extraction step, EOP or alternatively an EO step without peroxide charge, in *aper se* conventional manner, is arranged after the additional bleaching step D₀ and before the first bleaching step D₁, as seen in the direction of flow of the cellulose pulp through the bleaching line, and a wash apparatus W₃ is arranged after the extraction step EOP. The wash filtrate from the subsequent wash W₃ of the extraction step can be collected in a filtrate tank FT₁ and is suitably used as dilution liquor before the extraction step and a part of the wash filtrate can if needed be drawn off from the bleaching line, to sewage 11, or be led forward to an oxygen delignification step.

30 As shown in Fig. 2, the cellulose pulp is washed in a wash apparatus W₁ before the additional bleaching step D₀, (as seen in the direction of flow of the cellulose pulp through the bleaching line) and dilution liquor is taken via L₇ to this wash apparatus W₁

from a seventh branch position A7 in the main conduit. The wash liquor to this wash W₁ is taken from a separate line L₀ as fresh wash liquor.

5 According to the shown embodiment, at least chlorine dioxide, or some other bleaching chemical that is compatible throughout the bleaching steps, is used as active bleaching agent in the bleaching steps D₀, D₁ and D₂, which chlorine dioxide is added to the pulp before the respective bleaching step in a blending apparatus M1, M3 and M4, respectively.

10 At the downstream end of the main conduit 1, where the outlet 10 is provided, from which wash liquor and filtrate is drawn off there is arranged some kind of control device. Preferably, the outlet is controlled by a flow controlling control valve FC, which control valve can establish a certain basic flow and/or a desired bleed-off level of filtrate, during normal operation. The pump P20 is suitable controlled by a pressure
15 regulator PC, enabling feed-back control of the main pump device P20 in order to secure the desired predetermined pressure and/or flow throughout the entire main conduit 1. Suitably, the flow controlling valve can establish a desired flow to the outlet 10 as long as the pressure in the main conduit can be maintained. In an alternative embodiment, the flow controlling valve FC may be a fixed or variable throttle valve
20 with a high pressure drop over the valve.

According to the invention a bleaching line is provided for the bleaching of cellulose pulp, having at least two bleaching steps comprising a first and a second bleaching step D₁ and D₂, respectively, as seen in the flow direction of the cellulose pulp, which
25 bleaching steps have wash apparatuses W₄ and W₅ for the pulp arranged after the first and the second bleaching step, respectively, and in which wash liquor and where appropriate dilution liquor is led in principle in counter-current to the pulp flow through the wash apparatuses in the bleach line.

30 The bleaching line preferably also includes at least one additional bleaching step D₀, which is arranged before the first and second bleaching steps D₁ and D₂, as seen in the direction of flow of the cellulose pulp. After this additional bleaching step D₀, a wash apparatus W₂ for the pulp is arranged. At least one liquor of wash liquor and dilution liquor is taken to the subsequent wash W₂ of the additional bleaching step, from a fifth
35 branch position A5 in the main conduit 1 and at least a part of the wash filtrate from the subsequent wash of the additional bleaching step is led to a sixth branch position A6 in the main conduit 1. The branch positions A5-A6 connect to the main conduit 1 with the

fifth branch position A5 arranged after the fourth branch position A4, as seen in the direction of flow in the main conduit, and the sixth branch position A6 in succession thereafter, an open communication being established in the main conduit between the branch positions A1-A6.

5

An extraction step may be arranged in the shown bleaching line, preferably of EOP or EO type, which is arranged after the additional bleaching step D₀ and before the first bleaching step D₁, as seen in the direction of flow of the cellulose pulp through the bleaching line, and a wash apparatus W₃ is arranged after the extraction step. The wash
10 filtrate from the subsequent wash W₃ of the extraction step is led to a filtrate tank FT₁, via a conduit, and filtrate from the filtrate tank is, at least partly, led as dilution liquor after the wash step W₂ subsequent to the additional bleaching step D₀, via pump P30 and conduits, and a part of this wash filtrate is when needed drawn off from the process, preferably via an outlet from the filtrate tank FT₁. As shown in the figure, a part of the
15 liquor in the filtrate tank may also be used as dilution liquor in the chute after the EOP reactor.

In the bleaching line, cellulose pulp is suitably washed in a wash apparatus W₁ before the additional bleaching step D₀, as seen in the direction of flow of the cellulose pulp
20 through the bleaching line, and to this wash apparatus W₁ at least one liquor of wash liquor and dilution liquor is led from a seventh branch position A7 in the main conduit 1 to the wash apparatus W₁, via a pump device P2 and associated tubing. If the pulp in the storage tower ST is acidic, both wash and dilution liquor in and after the wash W₁, respectively, can be taken from the main conduit. But if the pulp in the storage tower is
25 alkaline, a cleaner alkaline filtrate or a clean filtrate is used as wash liquor in the wash apparatus W₁, where the use of a clean filtrate is shown in Fig. 2.

In the bleaching steps D₀, D₁, D₂ of the bleaching line, e.g. chlorine dioxide is charged as active bleaching agent or some other bleaching chemical that is compatible
30 throughout the bleaching steps, such as a chelating agent, a pH adjuster or some additional bleaching chemical, which chlorine dioxide or bleaching chemical is added to the pulp before the respective bleaching step in a blending apparatus M1, M3 and M4, respectively.

35 At the end of the main conduit 1, as seen after the branch points A1-A7, an outlet 10 is provided, from which wash liquor and filtrate can be drawn off from the main conduit.

Suitably, the outlet 10 is controlled as is described above, by a pressure and/or flow controlling control valve PC and/or FC.

The invention can be varied in a number of ways, within the scope of the claims. The
5 bleaching steps that in their subsequent wash apparatuses have a joint main conduit that receives wash filtrate and dilution and/or wash liquor may, for example, all be of alkaline type or the bleaching chemicals in question may be compatible/blendable. In multi-stage bleaching sequences, a main conduit may be used for the alkaline filtrate from two or more alkaline steps and another main conduit may be used for the acidic
10 filtrate from two or more acidic steps.

In the embodiment shown in Fig. 2, the pumps P21-P24 are placed in the feed conduits from the main conduit. In an alternative embodiment, powerful pumps may be provided in the return conduits that connect to the branch points A2, A4 and A6, respectively,
15 which in such case, together with the main pump P20, pressurise the entire main conduit. With a pressure in the main conduit established at 4 bar, pumps in the feed conduits for dilution and/or wash liquor can normally be eliminated. The supply of dilution liquor after wash normally requires a very low pressure of about 1 bar, why a throttle is required for such dilution liquor supply. Normally, the dilution liquor is
20 supplied to an atmospheric dilution screw in which fluffed-up pulp of high consistency, about 30 %, is blended with dilution liquor to a consistency suitable for subsequent pumping. Therefore, there is a low pressure need on the liquor supply.

In another, alternative embodiment, a basic pressure of about 1 bar may be established in the main conduit, which is enough to feed dilution water, but in which a supplying
25 pump is provided in the feed conduit for the wash liquor.

Normally, wash liquor is added in a converging wash slot in a wash press at a higher pressure and normally, a wash liquor pressure of at least 2 - 4 bar is required in this position.

30 As an additional precautionary measure, a check valve may be provided between the branch positions for filtrate recycling to the main conduit and feeding of dilution and/or wash liquor to the wash apparatus in question, especially if the branch positions of construction reasons are close to each other. It is preferred that an open communication is established between all branch points in the main conduit, as seen in the direction
35 from the first end of the main conduit, with the filtrate tank FT2, to the second end of the main conduit, with the outlet 10, but this does not eliminate that valves may be positioned within the main conduit 1.

Other wash apparatuses than wash presses may of course be used. At less heavy requirements on chemical carry-over to the subsequent bleaching step, ordinary filters or simple presses (without washing) may of course be used, in which the filtrate from the filter or the simple press is led to the main conduit and optional dilution liquor before the filter or the press is taken from the main conduit. Also, wash presses such as a filter or a simple press without wash, may be connected to a joint main conduit.

The skilled person further realises that the at least two bleach steps being connected to the main conduit 1 may have one or more non-connected bleach steps, belong in to the same bleach line, in intermediate position/s between them.

It is also evident that auxiliary equipment, e.g. filtrate tank/s, valves, may be used together with the invention, in certain applications, despite the fact that such equipment mostly in considered as superfluors if the invention is used in an optimized manner. Moreover, it is evident that despite the fact that an optimised embodiment of the invention implies open communication within the whole main conduit, there may be situations/applications where a part or parts of the main conduit (intermittently or temporarily) may be cut off from that communication, e.g. by means of a valve/s. Finally it is understood that the extension of the main conduit may vary, e.g. following a straight line and/or being curved and/or having several bends (e.g. 90°), etc. to fit different needs at different cites, depending on the position of items in the bleach line.

It is also evident for the skilled person that the pressurisation at different locations may be achieved by other means than a pump, e.g. instead of pump P20 a tower or the positioning of the main conduit high up may be used to apply the desired pressure (static pressure).

CLAIMS

1. A method of bleaching cellulose pulp in a bleaching line, having at least two bleaching steps comprising a first (D₁) and a second (D₂) bleaching step, as seen in the direction of flow of the cellulose pulp, which bleaching steps have wash apparatuses (W₄, W₅) for the pulp arranged after the first and the second
5 bleaching step, respectively, and in which wash liquor and where appropriate dilution liquor is led in principle in counter-current to the pulp flow through the bleaching steps in the bleach line, characterised in that the wash liquor is supplied by means of a main conduit, wherein
 - 10 - each one of said wash apparatuses (W₄, W₅) is independently supplied by means of first branch conduits (L₁, L₃) connected to said main conduit,
 - each one of said wash apparatuses (W₄, W₅) independently bleeds out wash filtrate by means of second branch conduits (L₂, L₄) connected to said main conduit, and said main conduit has an outlet end which bleeds out at least some
15 of said wash filtrate from said wash apparatus (W₄, W₅).
2. A method according to claim 1, characterised in that said main conduit has an inlet end which under steady state conditions continuously is fed with wash liquid and an outlet end which under steady state conditions continuously bleeds
20 out at least some of said wash filtrate from said main conduit.
3. A method according to claim 2, characterised in that the inlet and outlets ends are arranged at opposite ends of the main conduit with said branch conduits connected to the main conduit inbetween the inlet and the outlet.
25
4. A method according to any one of the claims 1 to 3, characterised in that the main conduit is connected to receive and distribute filtrate that is mainly acidic or mainly alkaline.

5. A method according to claim 4, characterised in that there are two main conduits, one to receive and distribute mainly alkaline filtrate and one to receive and distribute mainly acidic filtrate.

- 5 6. A method according to any one of claims 1 to 5, characterised in that upstream a first branch position (A1) in the upstream end of the main conduit, a main pressurising device (P20) is provided which supplies fresh wash liquid and pressurises the main conduit and establishes a basic flow in the main conduit in a direction in the main conduit in reverse to the formed flow of cellulose pulp in
10 the bleaching line, wherein preferably said pressurising device being located connected to the main conduit at a position at the opposite end in the main conduit in relation to the outlet end.

7. A method according to any one of claims 1 to 6, characterised in that said
15 filtrate is led to the main conduit, via a pump device (P21'; P22').

8. A method according to any one of claims 1 to 7, characterised in that the pressure within the main conduit is maintained at a pressure of at least 0,5 bar above atmospheric pressure.
20

9. A method according to claim 8, characterised in that the pressure within the main conduit is maintained, during steady state, at a pressure below 3 bar above atmospheric pressure.

- 25 10. A method according to claim 9, wherein the pressure is maintained within a range of 1 – 2 bars pressure above atmospheric pressure.

11. A method according to claim 9, characterised in that wash liquor is led from the main conduit to the respective wash apparatuses (W_5 , W_4) via each respective supply line (L_{1A} , L_{3A}), by means of a pump devices (P_{21} , P_{22}).
- 5 12. A method according to claim 9, 10 or 11, characterised in that dilution liquid to at least one position of the bleach line is supplied directly via a branch line (L_{1B}) connected to the main conduit.
- 10 13. A method according to claim 8, characterised in that the pressure in said main conduit, during steady state, is maintained within a range 3 – 20 bar above atmospheric pressure, whereby in the preferred mode supply pumps for wash filtrate may be dispensed with.
- 15 14. A method according to claim 13, wherein the pressure is maintained within a range of 4 – 10 bars above atmospheric pressure.
15. A method according to claim 13, wherein the pressure is maintained within a range of 5 – 6 bars above atmospheric pressure.
- 20 16. A method according to any one of claim 1 to 15, characterised in that an intermediate extraction step (EO-EOP) is provided intermediate an additional bleach step and the said first bleach step, which additional bleach step has an opposite pH-level compared to said first and second bleach steps, wherein at least a portion of the filtrate from a wash apparatus (W_3) belonging to said
25 intermediate stage is not taken back to the main conduit.
17. A method according to claim 1, characterised in that the outlet is controlled by a pressure and/or flow controlling valve.

18. A method according to claim 17, characterised in that said pressure and flow control valve, can achieve feed back control of the main pressurising device (P20) to secure a predetermine pressure and/or flow through the main conduit.
- 5 19. A method according to claim 18, characterised in that the flow at said outlet, during steady state, is within the range $0,1 - 12 \text{ m}^3$.
20. A method according to claim 19, wherein the flow at said outlet during steady state, is within the range of $0,5 - 10 \text{ m}^3$.
- 10 21. A bleaching line for bleaching cellulose pulp in a bleaching line, having at least two bleaching steps comprising a first (D_1) and a second (D_2) bleaching step, as seen in the direction of flow of the cellulose pulp, which bleaching steps have wash apparatuses (W_4, W_5) for the pulp arranged after the first and the second
- 15 bleaching step, respectively, and in which wash liquor and where appropriate dilution liquor is led via lines ($L_1, L_3; L_1A, L_3A$) in principle in counter-current to the pulp flow through the bleaching steps in the bleach line, characterised in that there is arranged a main conduit to supply the wash liquor, wherein
- 20 - each one of said wash apparatuses (W_4, W_5) is independently connected to said main conduit by means of first branch conduits (L_1, L_3),
- each one of said wash apparatuses (W_4, W_5) is independently connected to said main conduit to bleed out wash filtrate by means of second branch conduits (L_2, L_4), and
- 25 said main conduit is arranged with an outlet end to bleed out at least some of said wash filtrate from said wash apparatus (W_4, W_5).
22. A bleaching line according to claim 21, characterised in that the outlet end is arranged opposite an inlet end of the main conduit, with said branch conduits

(L₁, L₃; L₂, L₄) connected to the main conduit inbetween the inlet end and the outlet end.

23. A bleaching line according to claim 21 or 22, characterised in that there are two
5 main conduits, one to receive and distribute mainly alkaline filtrate and one to receive and distribute mainly acidic filtrate.
24. A bleaching line according to any one of claims 21 – 23, characterised in that
10 upstream a first branch position (A1) in the upstream end of the main conduit, a main pressurising device (P20) is provided to supply fresh wash liquid and to pressurise the main conduit.
25. A bleaching line according to any of claims 21 – 24, characterised in that a
15 pump device (P21'; P22') is arranged within at least one of said branch conduits (L₂, L₄) to pump said filtrate to the main conduit.
26. A bleaching line according to any one of claims 21 – 25, characterised in that
20 there is arranged at least one branch line (L₁B) connected to the main conduit, to supply dilution liquid to at least one position of the bleach line.
27. A bleaching line according to any one of claims 21 – 26, characterised in that
the outlet is arranged with a control device.
28. A bleaching line according to claim 27, wherein the control device is in the form
25 of a pressure and/or flow controlling valve.
29. A bleaching line according to claim 27 or 28, characterised in that said control device and/or said main pressurising device (P20) is connected to a pressure sensing device (PC) to control pressure and/or flow in the main conduit.

30. A method of bleaching cellulose pulp in a bleaching line, having at least two bleaching steps comprising a first (D₁) and a second (D₂) bleaching step, as seen in the direction of flow of the cellulose pulp through the bleaching line, which
- 5 bleaching steps have wash apparatuses (W₄, W₅) for the pulp arranged after the first and the second bleaching step, respectively, and in which wash liquor and where appropriate dilution liquor is led in principle in counter-current to the pulp flow through the bleaching steps in the bleach line (W₁-D₁-W₄-D₂-W₅), characterised in
- 10 - that the wash liquor is supplied in a main conduit that is pressurised during steady state,
- that at least one of wash liquor and dilution liquor is taken to the subsequent wash (W₅) of the second bleaching step (D₂), from a first branch position (A1) in the main conduit and at least a part of the wash filtrate from the subsequent
- 15 wash of the second bleaching step is led to a second branch position (A2) in the main conduit,
- that at least one liquor of wash liquor and dilution liquor is taken to the subsequent wash (W₄) of the first bleaching step (D₁) from a third branch position (A3) in the main conduit, and at least a part of the wash filtrate from the
- 20 subsequent wash of the first bleaching step is led to a fourth branch position (A4) in the main conduit,
- in which the branch positions (A1-A4) connect to the main conduit with the first branch position (A1) arranged first, as seen in the direction of flow in the main conduit, and the second to fourth branch positions (A2-A4) in succession.
- 25
31. A method according to claim 30, characterised in that a base level of pressure in the main conduit is established at a level in the range 1,5 – 3,5 bars.

32. A method according to claim 31, characterised in that dilution and wash liquids taken from the main conduit to dilution vessels or wash apparatuses operating at pressures above the base level is pressurised by a second pressurising means.
- 5 33. A method according the claim 32, wherein the second pressurising means is a pump.
34. A method according to claim 30, characterised in that the base level of pressure in the main conduit is established at a level in the range 4,5 – 6,5 bars.
- 10 35. A method according to any one of claims 30 – 34, characterised in that the main conduit is connected to receive and distribute acidic filtrate from and to, respectively, acidic bleaching steps.
- 15 36. A method according to any one of claims 30 – 34, characterised in that the main conduit is connected to receive and distribute alkaline filtrate from and to, respectively, alkaline bleaching steps.
- 20 37. A method according to claim 35 or 36, characterised in that upstream said first branch position (A1) in the first end of the main conduit, a main pressurising device is provided which pressurises the main conduit and establishes a basic flow in the main conduit in a direction reverse to the direction of flow of cellulose pulp in the bleaching line.
- 25 38. A method according to claim 37, wherein the main pressurising device is a pump or a pressurised wash liquid tank.

39. A method according to claim 37, characterised in that before the second (A2) and fourth (A4) branch positions, filtrate is led to the main conduit, via pump devices (P21', P22').
- 5 40. A method according to claim 30, 35 or 36, characterised in
- that at least one additional bleaching step (D₀) is provided before the first and second bleaching steps, as seen in the direction of flow of the cellulose pulp, after which additional bleaching step, a wash apparatus (W₂) is provided for the pulp (W₁-D₀-W₂-D₁-W₄-D₂-W₅),
 - 10 - that at least one liquor of wash liquor and dilution liquor is taken to the subsequent wash of the additional bleaching step, from a fifth branch position (A5) in the main conduit and that at least a part of the wash filtrate from the subsequent wash of the additional bleaching step is led to a sixth branch position (A6) in the main conduit,
 - 15 - in which the branch positions connect to the main conduit with the fifth branch position arranged after the fourth branch position, as seen in the direction of flow in the main conduit, and the sixth branch position in succession thereafter, and wherein the fifth and sixth branch conduits are connected to the established common base level of pressure in the main conduit.
- 20
41. A method according to claim 40, characterised in that an extraction step (EO/EOP) is provided after the additional bleaching step and before the first bleaching step, as seen in the direction of flow of the cellulose pulp through the bleaching line, and that a wash apparatus (W₃) is arranged after the extraction
- 25 step (W₁-D₀-W₂-EO/EOP-W₃-D₁-W₄-D₂-W₅).
42. A method according to claim 41, characterised in that the wash filtrate from the subsequent wash of the extraction step, at least partly is used as dilution liquor for the wash step subsequent to the additional bleaching step, and that a part of
- 30 this wash filtrate when needed is drawn off from the process.

43. A method according to claim 40, characterised in that the cellulose pulp is washed in a wash apparatus before the additional bleaching step, as seen in the direction of flow of the cellulose pulp through the bleaching line, and that at least one liquor of wash liquor and dilution liquor is taken to this wash apparatus from a seventh branch position in the main conduit.
44. A method according to any one of the claims 30 to 43, characterised in that at least chlorine dioxide, or some other bleaching chemical that is compatible throughout the bleaching steps, is used as active bleaching agent in the bleaching steps, which chlorine dioxide is added to the pulp in a blending apparatus before the bleaching step.
45. A method according to any one of claims 30 to 44, characterised in that at the other end of the main conduit, as seen after the branch points (A1-A7), an outlet is provided, from which wash liquor and filtrate can be drawn off.
46. A method according to claim 45, characterised in that the outlet is controlled by a pressure and/or flow controlling control valve, which control valve can achieve feed-back control of the main pump device to secure a predetermined pressure and/or flow throughout the entire main conduit.
47. A method of bleaching cellulose pulp in a bleaching line, having at least two bleaching steps comprising a first (D_1) and a second (D_2) bleaching step, as seen in the direction of flow of the cellulose pulp, which bleaching steps have wash apparatuses (W_4 , W_5) for the pulp arranged after the first and the second bleaching step, respectively, and in which wash liquor and where appropriate dilution liquor is led in principle in counter-current to the pulp flow through the bleaching steps in the bleach line (W_1 - D_1 - W_4 - D_2 - W_5), characterised in

- that the wash liquor is supplied in a main conduit that is arranged in parallel to the bleaching line,
 - that at least one of wash liquor and dilution liquor is taken to the subsequent wash (W_5) of the second bleaching step (D_2), from a first branch position (A1) in the main conduit and at least a part of the wash filtrate from the subsequent wash of the second bleaching step is led to a second branch position (A2) in the main conduit,
 - that at least one liquor of wash liquor and dilution liquor is taken to the subsequent wash (W_4) of the first bleaching step (D_1) from a third branch position (A3) in the main conduit, and at least a part of the wash filtrate from the subsequent wash of the first bleaching step is led to a fourth branch position (A4) in the main conduit,
 - in which the branch positions (A1-A4) connect to the main conduit with the first branch position (A1) arranged first, as seen in the direction of flow in the main conduit, and the second to fourth branch positions (A2-A4) in succession thereafter, an open communication being established in the main conduit between the branch positions (A1-A4).
48. A method according to claim 47, characterised in that the main conduit is connected to receive and distribute acidic filtrate from and to, respectively, acidic bleaching steps.
49. A method according to claim 47, characterised in that the main conduit is connected to receive and distribute alkaline filtrate from and to, respectively, alkaline bleaching steps.
50. A method according to claim 48 or 49, characterised in that upstream said first branch position (A1) in the first end of the main conduit, a main pump device (P20) is provided which pressurises the main conduit and establishes a basic

flow in the main conduit in a direction reverse to the direction of flow of cellulose pulp in the bleaching line.

51. A method according to claim 50, characterised in that after the first (A1) and
5 third (A3) branch positions, wash liquor is led to the respective wash
apparatuses (W₅, W₄), via pump devices (P21, P22).
52. A method according to claim 50 or 51, characterised in that before the second
10 (A2) and fourth (A4) branch positions, filtrate is led to the main conduit, via
pump devices (P21', P22').
53. A method according to claim 47, 51 or 52, characterised in
- that at least one additional bleaching step (D₀) is provided before the first and
15 second bleaching steps, as seen in the direction of flow of the cellulose pulp,
after which additional bleaching step a wash apparatus (W₂) is provided for the
pulp (W₁-D₀-W₂-D₁-W₄-D₂-W₅),
 - that at least one liquor of wash liquor and dilution liquor is taken to the
subsequent wash of the additional bleaching step, from a fifth branch position
20 (A5) in the main conduit and that at least a part of the wash filtrate from the
subsequent wash of the additional bleaching step is led to a sixth branch position
(A6) in the main conduit,
 - in which the branch positions connect to the main conduit with the fifth
branch position arranged after the fourth branch position, as seen in the direction
of flow in the main conduit, and the sixth branch position in succession
25 thereafter, an open communication being established in the main conduit
between the branch positions.
54. A method according to claim 53, characterised in that an extraction step
(EO/EOP) is provided after the additional bleaching step and before the first

bleaching step, as seen in the direction of flow of the cellulose pulp through the bleaching line, and that a wash apparatus (W_3) is arranged after the extraction step ($W_1-D_0-W_2-EO/EOP-W_3-D_1-W_4-D_2-W_5$).

- 5 55. A method according to claim 54, characterised in that the wash filtrate from the subsequent wash of the extraction step, at least partly is used as dilution liquor for the wash step subsequent to the additional bleaching step, and that a part of this wash filtrate when needed is drawn off from the process.
- 10 56. A method according to claim 53, characterised in that the cellulose pulp is washed in a wash apparatus before the additional bleaching step, as seen in the direction of flow of the cellulose pulp through the bleaching line, and that at least one liquor of wash liquor and dilution liquor is taken to this wash apparatus from a seventh branch position in the main conduit.
- 15 57. A method according to any one of claims 47 to 56, characterised in that at least chlorine dioxide, or some other bleaching chemical that is compatible throughout the bleaching steps, is used as active bleaching agent in the bleaching steps, which chlorine dioxide is added to the pulp in a blending apparatus before the bleaching step.
- 20 58. A method according to any one of claims 47 to 57, characterised in that at the other end of the main conduit, as seen after the branch points (A1-A7), an outlet is provided, from which wash liquor and filtrate can be drawn off.
- 25 59. A method according to claim 50, characterised in that the outlet is controlled by a pressure and/or flow controlling control valve, which control valve can achieve feed-back control of the main pump device to secure a predetermined pressure and/or flow throughout the entire main conduit.

60. A bleaching line for bleaching of cellulose pulp, having at least two bleaching steps comprising a first (D_1) and a second (D_2) bleaching step, as seen in the flow direction of the cellulose pulp, which bleaching steps have wash apparatuses (W_4, W_5) for the pulp arranged after the first and the second
- 5 bleaching step, respectively, and in which wash liquor and where appropriate dilution liquor is led in principle in counter-current to the pulp flow through the wash apparatuses (W_1-W_5) of the bleaching steps in the bleach line ($W_1-W_2-D_1-W_4-D_2-W_5$) characterised in
- 10 - that the wash liquor is supplied in a main conduit that is arranged in parallel to the bleaching line,
- that at least one of wash liquor and dilution liquor is taken to the subsequent wash (W_5) of the second bleaching step (D_2), from a first branch position (A1) in the main conduit and at least a part of the wash filtrate from the subsequent
- 15 wash of the second bleaching step is led to a second branch position (A2) in the main conduit,
- that at least one liquor of wash liquor and dilution liquor is taken to the subsequent wash (W_4) of the first bleaching step (D_1) from a third branch position (A3) in the main conduit, and at least a part of the wash filtrate from the
- 20 subsequent wash of the first bleaching step is led to a fourth branch position (A4) in the main conduit,
- in which the branch positions (A1-A4) connect to the main conduit with the first branch position (A1) arranged first, as seen in the direction of flow in the main conduit, and the second (A2) to fourth (A4) branch positions in succession
- 25 thereafter, an open communication being established in the main conduit between the branch positions (A1-A4).
61. A bleaching line according to claim 60, characterised in that the main conduit is connected to receive and distribute acidic filtrate from and to acidic bleaching
- 30 steps, respectively, via conduits that receive acidic wash filtrate from wash

apparatuses and via conduits that distribute wash apparatuses with acidic wash filtrate, respectively.

- 5 62. A bleaching line according to claim 60, characterised in that the main conduit is connected to receive and distribute alkaline filtrate from and to alkaline bleaching steps, respectively, via conduits that receive alkaline wash filtrate from wash apparatuses and via conduits that distribute wash apparatuses with alkaline wash filtrate, respectively.
- 10 63. A bleaching line according to claim 61 or 62, characterised in that a main pump device (P20) is arranged upstream the first branch position (A1) in the main conduit, which on its low side is connected to a liquor tank (FT₂) and the high side of which pressurises the main conduit and establishes a basic flow in the main conduit, reverse to the formed flow of cellulose pulp in the bleaching line.
- 15 64. A bleaching line according to claim 63, characterised in that from the first (A1) and third (A3) branch positions, wash liquor is led to the respective wash apparatuses (W₅, W₄), via respective pump devices (P21, P22) and associated tubing.
- 20 65. A bleaching line according to claim 63 or 64, characterised in that before the second (A2) and fourth (A4) branch positions, filtrate is led to the main conduit, via pump devices (P21', P22').
- 25 66. A bleaching line according to claim 60, 63 or 64, characterised in
- that at least one additional bleaching step (D₀) is provided before the first (D₁) and second (D₂) bleaching steps, as seen in the direction of flow of the cellulose pulp, after which additional bleaching step a wash apparatus (W₂) is provided for the pulp (W₁-D₀-W₂-D₁-W₄-D₂-W₅),

- 5 - that at least one liquor of wash liquor and dilution liquor is taken to the subsequent wash (W_2) of the additional bleaching step, from a fifth branch position (A5) in the main conduit and that at least a part of the wash filtrate from the subsequent wash of the additional bleaching step is led to a sixth branch position (A6) in the main conduit,
- 10 - in which the branch positions (A5-A6) connect to the main conduit with the fifth branch position (A5) arranged after the fourth branch position (A4), as seen in the direction of flow in the main conduit, and the sixth branch position (A6) in succession thereafter, an open communication being established in the main conduit between the branch positions (A1-A6).

15 67. A bleaching line according to any one of the claims 60, 61 or 63-66, characterised in that an extraction step (EOP) is provided after the additional bleaching step (D_0) and before the first bleaching step (D_1), as seen in the direction of flow of the cellulose pulp through the bleaching line, and that a wash apparatus (W_3) is arranged after the extraction step (W_1 - D_0 -EOP- W_3 - D_1 - W_4 - D_2 - W_5).

20 68. A bleaching line according to claim 67, characterised in that the wash filtrate from the subsequent wash (W_3) of the extraction step is led to a filtrate tank (FT_1), via a conduit, and filtrate from the filtrate tank is, at least partly, led as dilution liquor to the wash step (W_2) subsequent to the additional bleaching step (D_0), via pump (P30) and conduits, and a part of this wash filtrate is when needed drawn off from the process.

25

69. A bleaching line according to claim 68, wherein the wash filtrate is drawn off via an outlet from the filtrate tank (FT_1).

30 70. A bleaching line according to claim 65, characterised in that cellulose pulp is washed in a wash apparatus (W_1) before the additional bleaching step (D_0), as

seen in the direction of flow of the cellulose pulp through the bleaching line, and to this wash apparatus (W_1) at least one liquor of wash liquor and dilution liquor is led from a seventh branch position (A7) in the main conduit to the wash apparatus (W_1), via a pump device (P24) and associated tubing.

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71. A bleaching line according to any one of claims 57, 58 or 60 to 65, characterised in that at least chlorine dioxide, or some other bleaching chemical that is compatible throughout the bleaching steps, is charged as active bleaching agent in the bleaching steps (D_0 , D_1 , D_2), which chlorine dioxide or bleaching
10 chemical is added to the pulp in a blending apparatus (M1, M3, M4) before the respective bleaching step.

72. A bleaching line according to any one of claims 57 to 66, characterised in that at the end of the main conduit, as seen after the branch points (A1-A7), an outlet is
15 provided, from which wash liquor and filtrate can be drawn off from the main conduit.

73. A bleaching line according to claim 63, characterised in that the outlet is controlled by a pressure of flow controlling control valve (PC/FC), which control valve, via a feed-back device, has a feed-back coupling to the main
20 pump device (P20) for controlling of the main pump device, to secure a predetermined pressure and/or flow through the entire main conduit.

1/4

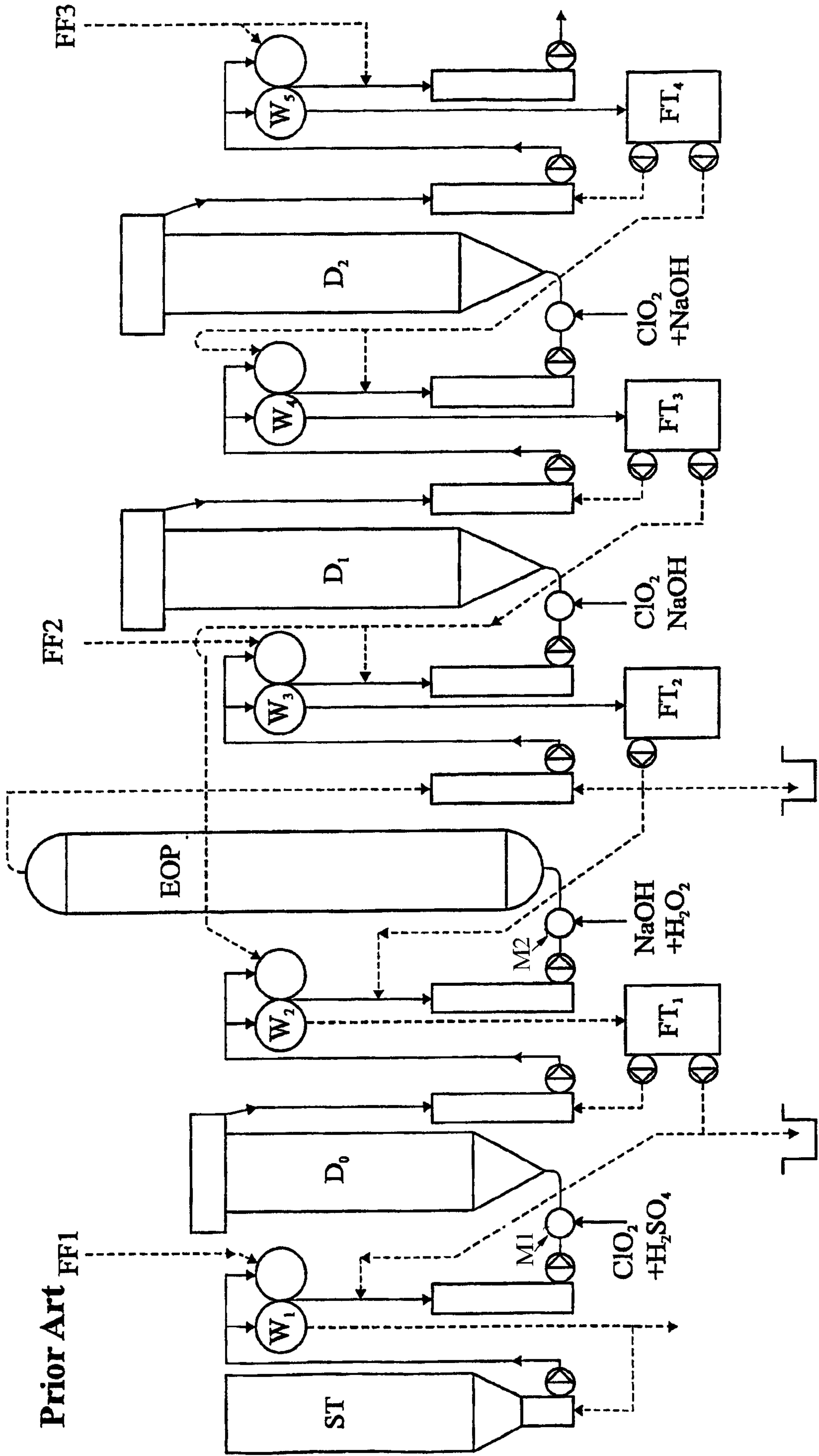


Fig. 1

