PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : D21C 3/24, 7/00, 7/14

A1

(11) International Publication Number: WO 94/11565

(43) International Publication Date: 26 May 1994 (26.05.94)

(21) International Application Number: PCT/SE93/00311

(22) International Filing Date: 8 April 1993 (08.04.93)

(30) Priority data:
9203462-8 18 November 1992 (18.11.92) SE

(71) Applicant *(for all designated States except US):* KAMYR AKTIEBOLAG [SE/SE]; P.O. Box 1033, S-651 15 Karlstad (SE).

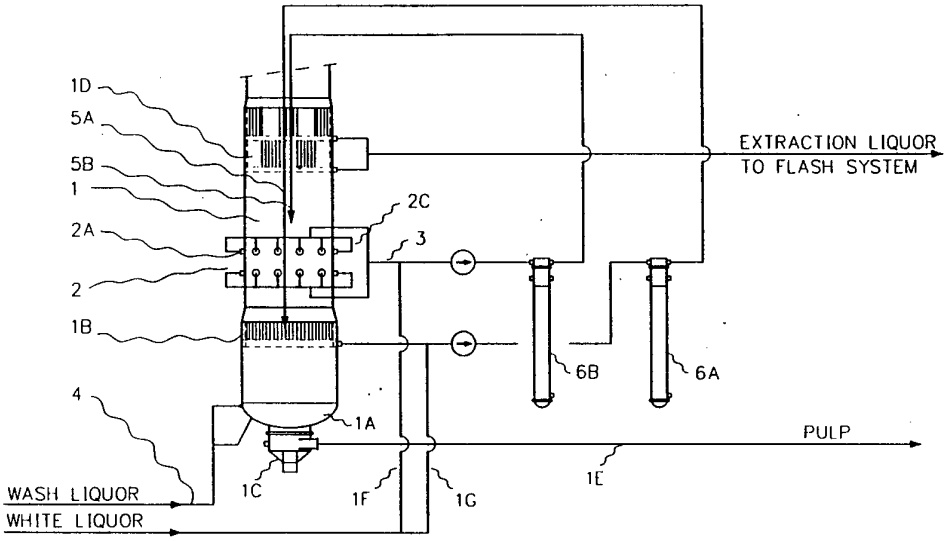
(72) Inventors; and
(75) Inventors/Applicants *(for US only) :* OULIE, Finn [SE/SE]; Sillerudsgatan 3, S-654 69 Karlstad (SE). BACKLUND, Åke [SE/SE]; Herrgårdsgatan 2 A, S-652 24 Karlstad (SE). SVANBERG, Johanna [SE/SE]; Karlagatan 30, S-652 23 Karlstad (SE).

(74) Agent: KYLIN, Peter; Kvaerner Pulping Technologies, P.O. Box 1033, S-651 15 Karlstad (SE).

(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: DIGESTER FOR CONTINUOUS COOKING OF FIBRE MATERIAL



(57) Abstract

The present invention relates to a digester for continuous cooking under raised pressure and temperature of fibre material in a vertical digester (1), where input of fibre material and cooking liquid takes place at the top of the digester, withdrawal of spent cooking liquor is carried out from at least one digester screening arrangement (1D) between the top and the bottom of the digester, and fibre material is fed out from the bottom (1C) of the digester, and at least one screening arrangement (2) in the lower half of the digester, wherein at least one of said screening arrangements (1, 2) has at least one screen element (2A) of which the main configuration is of angular shape, preferably rectangular, most preferred square, having a screen face (3A) of which the total area is less than 1m^2, and which is attached to the digester wall (1A) in a manner to form a sealed volume (V) from which liquid only can be supplied and withdrawn via said screen face (3A) and an inlet and outlet means (15) respectively which outlet means penetrates the digester wall (1A).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

Digester for continuous cooking of fibre material.

The environmental authorities are placing ever more stringent demands on the pulp industry to decrease the use of chemicals which can be damaging to the environment, such as, for example, chlorine. Thus, permitted discharges of organic chlorine compounds in the waste water from bleaching plants, following on from the cooking process, have been decreased progressively and are now at such a low level that pulp factories have in many cases stopped using organic chlorine compounds as bleaching agents. In addition, market forces are tending progressively to increase the demand for paper products which are not bleached with chlorine.

The pulp industry is therefore searching for methods which allow bleaching of pulp without using these chemicals. The lignox method (see SE-A 8902058), in which, inter alia, bleaching is carried out with hydrogen peroxide, may be mentioned as an example of such a method. Ozone is another interesting bleaching chemical which is also gaining increased application. It is thus possible, using bleaching chemicals of this nature, to achieve those brightnesses which are required for marketable pulp, i.e. 89 ISO and greater, without using chlorine-containing bleaching agents.

There is, however, a problem in using presently-known bleaching procedures with these bleaching chemicals which do not contain chlorine, namely that they have a relatively large effect in diminishing the quality of the pulp fibres.

By means of experiments which have been conducted under the auspices of Kamyr AB, it has been found, surprisingly, that extremely good results, with regard to

delignification and strength properties, can be obtained if the pulp is cooked at the same temperature level in principally the whole of the digester, i.e. if essentially the same temperature is maintained in all cooking zones, and if a certain quantity of alkali is also supplied to the lowest zone in the digester, which zone is normally used for counter-current washing. Owing to the fact that essentially the same temperature level is maintained in virtually the whole of the digester, very extensive delignification can be achieved at a relatively low temperature. Besides this, it has been found that the strength properties are affected in a particularly favourable manner, that a higher yield of the crude fibre product is obtained and that the quantity of reject material decreases. These advantages are most clearly apparent from the diagrams shown in the Figures 1 and 2, which show comparative values between pulp (softwood) which has been cooked using a conventional, modified cooking technique and pulp which has been cooked using the process according to the invention, (in a similar digester, i.e. with a concurrent upper cooking zone, a central counter-current cooking zone and a bottom counter-current washing zone) in which a constant temperature level of about + 155°C has been maintained in the whole digester.

The invention especially relates to (but not exclusively) an advantageous arrangement of a set of apparatus for achieving a cooking according to the new process, in particular with regard to digesters built according to an older principle and consisting of an upper concurrent cooking zone and a lower counter-current washing zone. The arrangement is necessary since certain practical problems arise as a consequence of an isothermal cooking process. The first such problem is the difficulty of efficiently reaching and maintaining the

temperature in the lower part of the digester, i.e. that part which is normally employed for washing.

The main object is to create a more efficient screening means in order to improve the circulation and as a consequence also the temperature distribution in the digester. In this context it has been found to be advantageous to use a new concept for digester screening arrangements, especially in connection with building new digesters, of any type, preferably for operation according to the new process, but also in connection with converting existing digesters.

Furthermore it is an object of the invention to create an effective back flushing system in order to rinse the screen faces effectively. Especially the arrangement of pipings and valves in this context has as its object to be of an advantageous kind, cost saving, etc.

Short description of the figures

In Figure sheet 1, a comparison is made in three diagrams between isothermal cooking and so-called modified conventional cooking (MCC). Figure sheet 2 shows a diagram which describes degree of delignification and viscosity (the viscosity is normally regarded as indicating the strength properties of the pulp), and Figures 3A, B and C show how, an existing digester can be converted, using circular screens, to be operated according to the novel process and especially different embodiments of back flushing systems. Figure 4 shows the lower part of a digester seen from the side, which digester has a lowermost screen arrangements of a conventional kind having a header and above which lower screen arrangement there is arranged a preferred kind of angular screen arrangement. Figure 5 shows a cross sectional view of the

digester according to claim 4 along a horizontal line. Figure 6 shows a cross sectional perspective view of a preferred embodiment of a rectangular screen according to the invention, figure 7 shows the lowermost part of a preferred screen seen in a cross sectional view taken along a vertical line, figure 8 is a front view of a preferred screen and figure 9 is a view seen from the side of said screen.

Detailed description

The first figure page shows three diagrams which compare different results obtained with isothermal cooking and conventional modified cooking (MCC). These surprisingly positive results show, according to the upper diagram, that, with a given amount of added alkali, substantially lower kappa numbers are obtained using isothermal cooking. Furthermore, the second diagram shows that manifestly improved strength properties are obtained when cooking down to the same kappa number. In addition, the third diagram shows that there is also the advantage that the quantity of reject wood (shives) decreases. If the fact is also taken into account that overall substantial energy savings are made when the temperature level is kept constant, it is evident that the results may be regarded as being surprisingly positive. Figure 2 additionally demonstrates that, using the method according to the invention, very low kappa numbers are reached while at the same time retaining good pulp strength (viscosity round about 1000) after oxygen delignification. Thus, when employing the method according to the invention, so-called environmentally friendly bleaching chemicals, such as peroxide and ozone, can be employed in subsequent bleaching stages without risking too low a strength for bleaching up to the level

of brightness, and therewith also the level of purity, which the market demands.

Figure 3A shows the lower part of a digester 1, which is intended to represent an existing digester shell on which has been arranged a new digester screening arrangement 2 in order to be able to raise the temperature in the counter-current zone. The digester is of the type which has an upper concurrent part and a lower counter-current part. In such a digester, full cooking temperature is normally maintained in the concurrent zone (i.e. about 162°C for hardwood and about 168°C for softwood) while in the counter-current part, which in the main is a washing zone, the temperature is about 135°C on a level with the lower screen.

In the following text, the counter-current zone of the digester which has been fitted with a further screening arrangement will be referred to as a cooking zone, even if it is to be considered as a washing zone according to conventional operation.

The new digester screening arrangement 2 (in figure 3A) shows a number of circular screens 2A for withdrawal 3 of cooking liquid in the lower part of the digester and is arranged immediately above the lower screening arrangement 1B, preferably at most 1.5 metres above and more preferably at most 1 metre above, measured from the upper edge of the lower digester screening arrangement to the lower edge of the newly fitted digester screening arrangement. Wash liquor is supplied to the lower part of the digester through an inflow arrangement 4 attached in the vicinity of the bottom 1A of the digester and cooking liquid (alkali addition) through the central pipes 5A, 5B. The cooked pulp is taken out from the bottom of the digester via a conduit 1E.

One of these central pipes, 5A, which belongs to

the original system of the digester, penetrates down to the lower screening arrangement 1B of the digester, after which the liquid, after heating via the first heat exchanger 6A, discharges through the said pipe on a level with the latter digester screening arrangement. Subsequently, a part of the liquid flows in a counter-current direction upwards towards the newly fitted digester screening arrangement 2. The liquid withdrawn from this system passes through the said conduit arrangement 3 and is heated via a heat exchanger 6B to the desired temperature before it discharges, via a second, newly fitted central pipe 5B, immediately above the newly fitted digester screening arrangement 2. A part of the cooking liquid supplied in this manner, which liquid has thus reached the desired temperature (e.g. 158^{o}C), chemical strength and distribution (spreading) over the whole of the cross-section of the digester, continues to flow upwardly in the digester. In a central digester screening arrangement 1D, the spent cooking liquid, together with undissolved wood material, is drawn off for further treatment.

The surface of each screening element 2A is made relatively small, preferably less than 0.3 m^2 , e.g. if a square screen is used a measure of about 500 mm x 500 mm is preferred. An advantage of screening elements of small area is that efficient back flushing can be achieved, which is often of great importance if the circulation flow is to function efficiently. The new screening arrangement 2 is preferably fitted with ring pipes 2C from which an individual conduit goes to each and every one of the screening elements 2A. Using such a construction, and a valve arrangement belonging to it, a limited number (for example 4) of screening units 2A can be efficiently back-flushed at a time. Owing to the relatively small total screening surface which is

back-flushed under these circumstances (for example 0,5-1 m^2), a very efficient back-flushing which cleans the screens is obtained, thereby ensuring that the circulation is highly efficient.

In figure 3B it is shown a first embodiment of how such a back flushing system can be arranged. As a way of example the back flushing system is shown in connection with circular screens, but could of course also be used for angular screens, e.g. rectangular screens. The back flushing liquid is collected via a branch conduit 7 (the main conduit for back flushing) from the liquid which circulates from the screens 2A via conduit 3 and out through central pipe 5B. The liquid which is fed into the main back flushing conduit 7 is thereafter sequentially fed to the different screens 2A by means of a number of valves 8, 9 (see enlarged part of figure 3B). Beside the two valves needed for each screen 2A for providing the back flushing there is also provided a main valve 10 which provides for the possibility of shutting off the liquid supply from and to a screen totally. The liquid is withdrawn from the screen element 2A via a ring pipe 2C (and further via main pipe 3) and accordingly the main valve 10 and withdrawal valve 9 would then be opened whereas the back flushing valve 8 would then be closed.

During back flushing the main valve 10 is opened, the withdrawal valve 9 is closed and the back flushing valve 8 opened. Preferably this is performed in a sequential manner so that four screens are back flushed at the same time meanwhile the remaining screens, e.g. 20, would withdraw liquid. Hence preferably the pressure in the main conduit for back flushing 7 would be substantially equal.

In figure 3C it is shown a preferred embodiment of how to arrange a back flushing system (which can also be used for angular screens). Also here there is a main conduit 3 for withdrawal of a liquid and main pipe 7 for the supply of back flushing liquid. Two screen elements 2A are interconnected with each other via a conduit forming a loop. This loop has an upper part 13A interconnected with the back flushing conduit 7 via branch conduit 7A. A valve 11 is arranged in this branch conduit 7A. The lower part of the loop 13B is interconnected with a branch conduit 3A which is joined with the withdrawal conduit 3. A valve 12 is fitted in the withdrawal branch conduit 3A. During withdrawal the valve 11 in the upper branch conduit 7A would be closed whereas the withdrawal valve 12 would be opened. Liquid will then be withdrawn from both of the screens 2A via the lower part of the loop 13B and the branch conduit 3A and further into the withdrawal conduit 3. During back flushing, which is performed sequentially, the upper valve 11 will open and the lower valve 12 will close and the back flushing liquid will then be introduced via branch pipe 7A through the upper part of the loop 13A into both of the screens 2A in order to rinse the screen faces. The advantage with the latter described embodiment is that the number of valves required is reduced, in relation to a conventional arrangement.

In figure 4 there is shown the lower part of a digester which has been designed in order to provide for highly efficient liquid distribution in the lower part. The operation of the digester is the same as for the one shown in figure 3A. A major difference, however, is that the digester shown in figure 4 has two screen arrangements 1B, 2 positioned within the lowermost cylindrical portion 1E (the so-called lowest step-out) of

the digester. As can be seen from figure 4 (see also figure 8) the second screen arrangement 2 comprises a number of rectangular (preferably squared) screen elements 2A which are positioned in a chess formed manner adjacent above the lowest screen arrangement 1B. The lowest screen arrangement 1B (as has already been mentioned) is of the conventional kind comprising a circular row of a number of screens each being in connection with a header volume via which the liquid is withdrawn from the screens into the circulation flow via heating means 6A and further into the central pipe 5A. Furthermore it is shown in figure 4 that each screen element 2A is provided with an individual inlet and outlet pipe 15, in order to withdraw liquid and back flush liquid respectively.

For performing the back flushing any of the two methods described in connection with the figures 3B and 3C could be used but the method according to 3C is more preferred. Further in this connection it should be noted that the efficiency of the back flushing of each screen is inversely proportional to the number of screens being back flushed at the time, since the flow is substantially constant, i.e. it is more effective to direct all the flow to two screens than to four. For example, four screens can be shut off from withdrawal at the same time but only two of them being back flushed at the time. If for instance each set of four screens is shut off from withdrawal for a period of 20 seconds only two of them are back flushed during the first 10 seconds and accordingly the remaining pair during the last 10 seconds. Using such a system each screen will be back flushed every four minutes during 10 seconds. Even more effective would be to back flush one screen at the time, e.g. during 5 seconds.

In figure 5 there is shown a cross sectional view along a horizontal line of the digester arrangement shown in figure 4. From this figure it is made clear that the screens do not penetrate the wall 1A of the digester 1 but only a pipe 15 for withdrawal and supply of liquid.

Figure 6 shows a perspective view of a screen according to the preferred embodiment of the invention. Accordingly it is shown that each screen element 2A is welded onto the inner surface of the digester vessel 1. It is important that the screen is welded to the digester wall 1A in such a manner that a sealing function is obtained in order to be able to back flush the screens 2A efficiently.

In this embodiment (not exclusively) there is shown rods 3 forming the screen face 3A. The rods are welded onto vertical bars 4. The rods 3 preferably have a height (H) which substantially exceeds the width (B). The gaps between the rods would normally be somewhere between 3-5 mm. The bar 4 is preferably made of a material of extraordinary strength, so that the rods 3 could be supported without any other supporting members. A shoulder 7 supports each bar 4 at each respective end. The shoulders 7 are also welded 9 onto the digester shell 1A.

As has already been mentioned each screen has to be fitted in such a manner that a volumer is created behind the screen back 3B and between the digester shell 1A which is substantially sealed, i.e. can only communicate via the gaps between the rods 3 and the outlet and inlet pipe 15. In order to provide for this seal arrangement the screen is arranged with L-formed bars 10 along its

periphery. (See also figure 7). At the vertical edges of this periphery these L-formed bars 10 are positioned on vertically extending supports 13, which support is welded onto the digester shell 1A and which support 13 has a height which substantially exceeds the total height of the rods 3 and bars 4. The height is adapted in such a manner that the bar 4 rests on the shoulder 7 when the inner side of the L-formed bar 10 rests on a inwardly facing surface of the support 13. Also along the horizontal periphery of the screen 2 the same principle is used, i.e. a horizontally arranged support 14 is welded to the digester shell 1 A, which support is joined with an L-formed part 5 of the screen 2 which extends substantially horizontal.

In figures 8 and 9 it is shown that the in- and outlet pipe 15 is positioned in the lower part of the screen in order to provide for effective withdrawal of the liquid. The horizontal L-formed part 5 of the screen 2 is designed in a manner to avoid hanging of the pulp. Therefore it is arranged distanced from the screen face and has angles which are advantageous for this purpose. Moreover it is provided with slots 5B in order to receive the outwardly projecting corners of the bars 3. When the screen needs to be disassembled the welds fixing the L-formed bars 5, 10 on the supports 13, 14 are taken away (e.g. by means of grinding). Thereafter a new screen can be attached to the support members 13, 14 in a corresponding manner as has been described above. The vertical support 13 has such a width that two screens can be supported by it, in such a manner that a gap is created between the two adjacent L-formed bars 10, in order to provide for space for welding and grinding respectively.

The invention is not limited by that which has been described above, but can be varied within the scope of the subsequent patent claims. Thus, it is evident for the skilled man that any kind of digester can be fitted with the above described kind of screen, and that this kind of screen can be fitted at any level within a digester. Accordingly, e.g. a digester of the so-called MCC-type or the hydraulic type, may also advantageously be fitted with a digester screening arrangement according to the invention for cooking, so-called, isothermally, or non-isothermally. Additionally the preferred method may be used in connection with all types of cooking liquids, even if the method is principally intended for producing sulphate pulp. In addition, it is obvious to the person skilled in the art that the invention is not limited to the above mentioned exemplifying temperature levels. In this connection, however, it is important that the average temperature level in the digester preferably exceeds +150°C but is lower than +165°C, and preferably is between +150-155°C for hardwood and between +160-165°C for softwood, and furthermore that the average temperature in the cooking zone/zones is preferably about +151°C +-1°C, when the wood is hardwood, and that the average temperature in a digester is +159°C +-1°C, when the wood is softwood. In addition, it is understood that screens deviating from a purely square form, for example rectangular screens, may also be used. Further it is stressed that both old and new digesters can be fitted with screens according to the invention. Further it should be noted that the basic design concept could also be used together with other screen faces than the rod-type, e.g. slotted screen faces. In an extreme embodiment it would be possible to use other kind of attachment methods than welding, e.g. glue, screws together with sealing means, etc., in order to provide for the sealed

volume behind each screen face. Even if it is preferred to use one pipe 15 for each screen 2A it is of course possible to connect two or more screens to one and the same pipe.

PATENT CLAIMS

1. A digester for continuous cooking under raised pressure and temperature of fibre material in a vertical digester (1), where input of fibre material and cooking liquid takes place at the top of the digester, withdrawal of spent cooking liquor is carried out from at least one digester screening arrangement (1D) between the top and the bottom of the digester, and fibre material is fed out from the bottom (1C) of the digester, and at least one screening arrangement (2) in the lower half of the digester, characterised in at least one of said screening arrangements (1, 2) has at least one screen element (2A) of which the main configuration is of angular shape, preferably rectangular, most preferred square, having a screen face (3A) of which the total area is less than 1 m^2, and which is attached to the digester wall (1A) in a manner to form a sealed volume (V) from which liquid only can be supplied and withdrawn via said screen face (3A) and an inlet and outlet means (15) respectively which outlet means penetrates the digester wall (1A).

2. A digester according to Claim 1, characterised in said screen element (2A) comprising a screen face assembly (3, 4, 5, 10) which is supported by shoulders (7), whereby said shoulders (7) support each end of at least one horizontally arranged bar (4).

3. A digester according to Claim 2, characterised in that said screen (2A), which preferably is assembled by means of welding, is fitted into the digester shell by means of welding.

4. A digester according to Claim 1, characterised in that said screen (2A) is arranged within the lowermost widened portion, the so-called lowest step-out, of the digester (1A).

5. A digester according to Claim 4, characterised in that a number of said screen element (2A) are positioned within said portion of the digester (1).

6. A digester according to Claim 5, characterised in that said number of screens (2A) comprises two cylindrical rows wherein the screens (2A) are positioned in order to form a chess like pattern.

7. A digester according to Claim 5, characterised in that said number of screens (2A) are connected to a back flushing system (7), by means of which a limited number of screens (2A), preferably four, could be back flushed within a determined time interval, whereas the remaining screens (2A), preferably 20, withdraw liquid form the digester (1).

8. A digester according to Claim 1, characterised in that the said digester screening arrangement (2) consists of a number of screen (2A) designed to withdraw displaced liquid for supply to a central pipe (5B), which discharges adjacent, preferably immediately above, said screening arrangement (2).

9. A digester according to Claim 8, characterised in that the distance between the upper edge of the lowest digester screening arrangement (1B) and the lower edge of the newly fitted digester screening arrangement (2) is less than 5 m, preferably less than 2 m and most

preferred less than 1 m.

10. A digester according to Claim 8, characterised in that the temperature of the fibre material and upwardly flowing liquid which is located at or above the upper edge of the from the bottom counted second digester screening arrangement (2A) deviates from the temperature in the remaining cooking zone or cooking zones by at most +4°C, preferably +2°C, most preferred +1°C.

FIG. 1

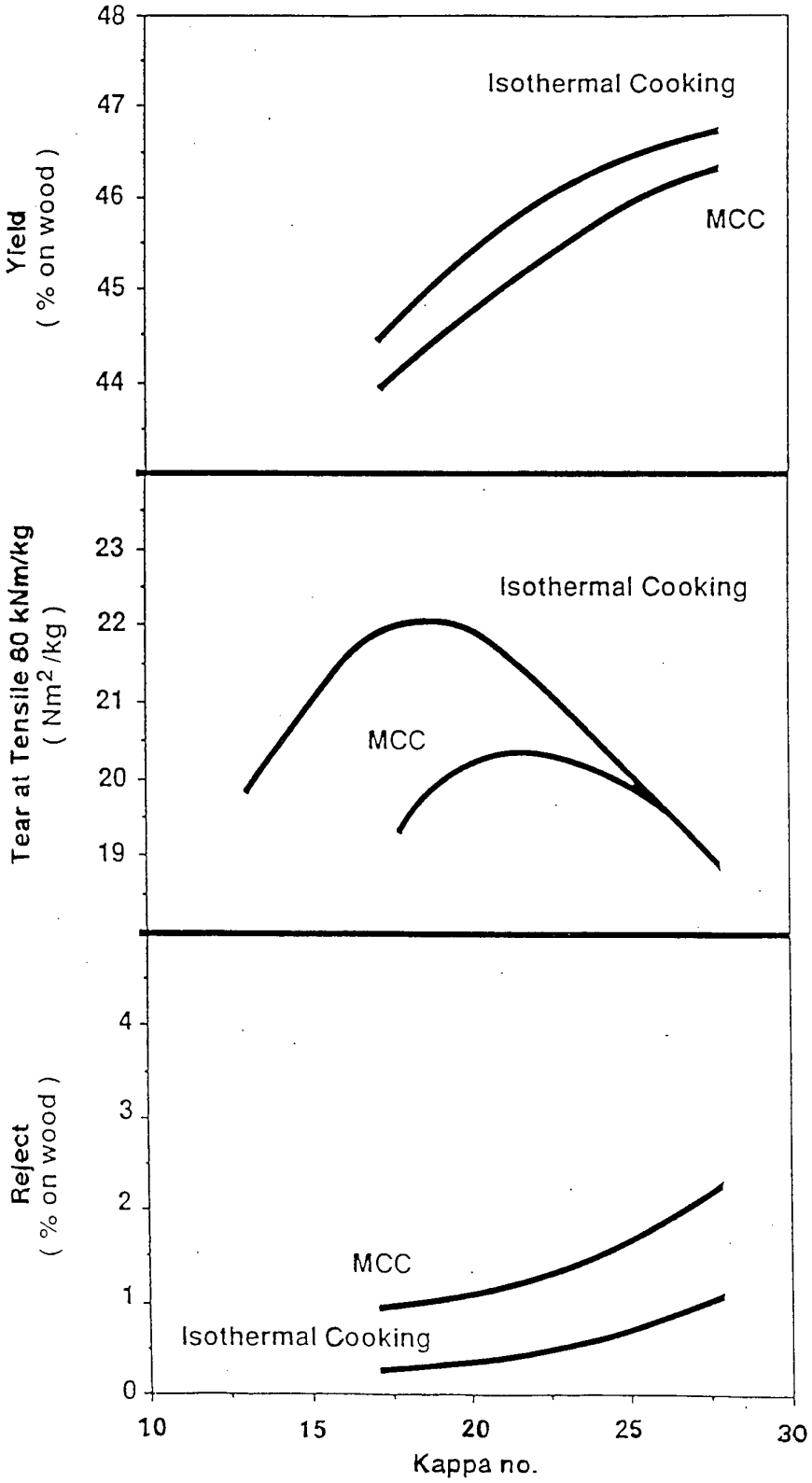
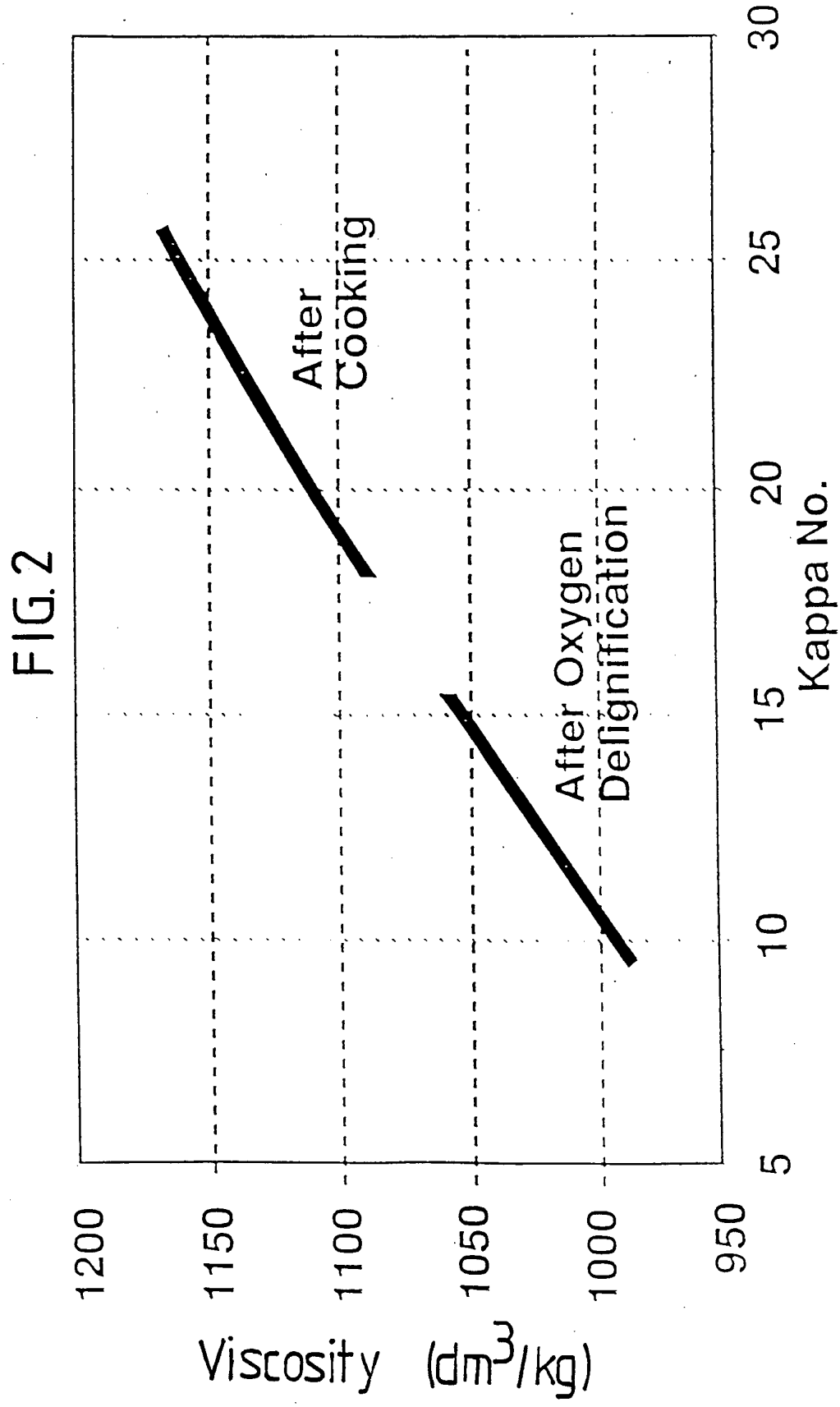

Yield
(% on wood)
48
47
46
45
44
Isothermal Cooking
MCC
Tear at Tensile 80 kNm/kg
(Nm2 /kg)
23
22
21
20
19
Isothermal Cooking
MCC
Reject
(% on wood)
4
3
2
1
0
MCC
Isothermal Cooking
10
15
20
25
30
Kappa no.

FIG.2


After Cooking
After Oxygen Delignification
Kappa No.
5
10
15
20
25
30
Viscosity (dm3/kg)
1200
1150
1100
1050
1000
950

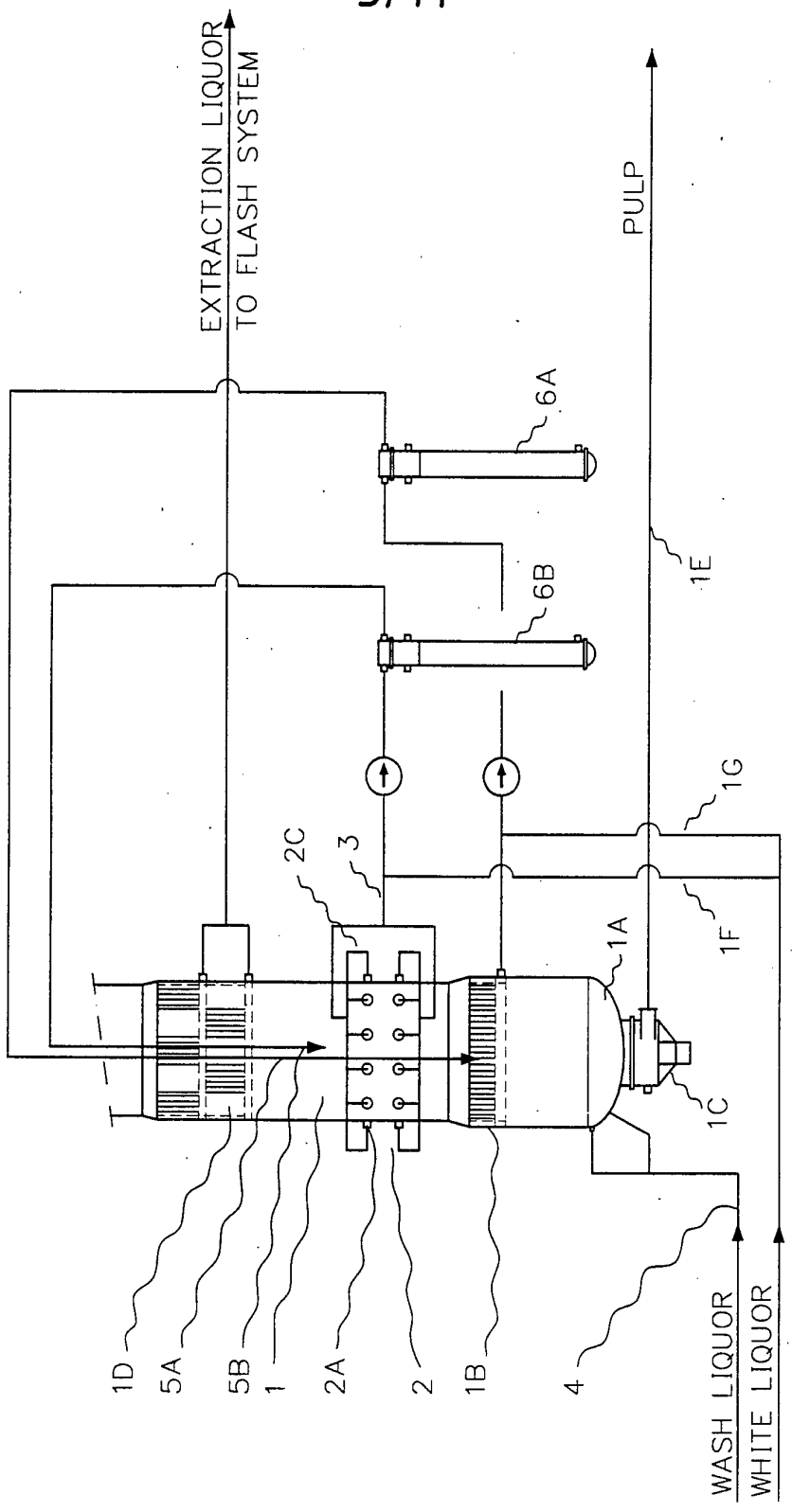

EXTRACTION LIQUOR
TO FLASH SYSTEM
PULP
6A
6B
1E
1G
2C
3
1A
1F
1C
1D
5A
5B
1
2A
2
1B
4
WASH LIQUOR
WHITE LIQUOR

FIG. 3A

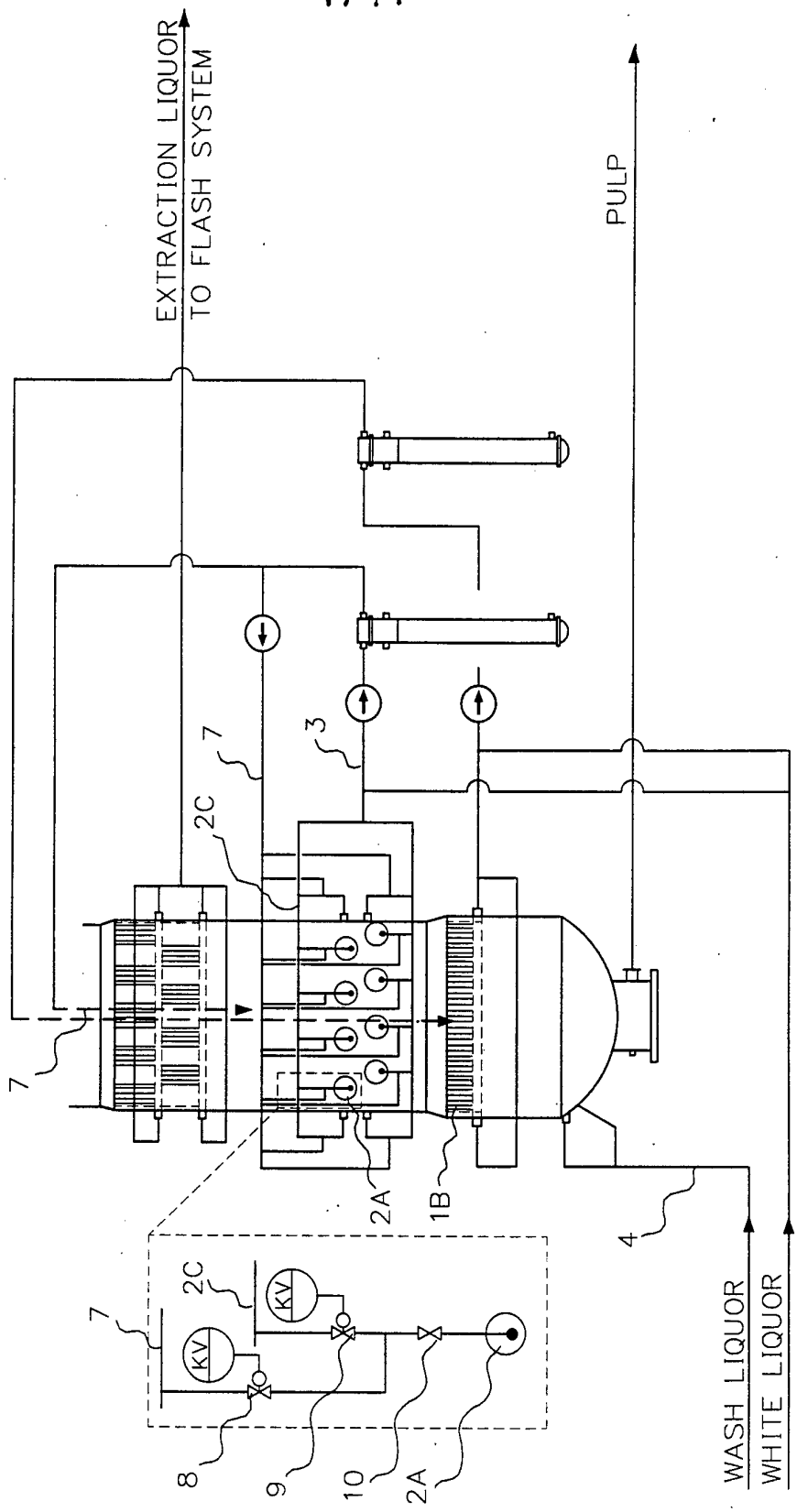

EXTRACTION LIQUOR
TO FLASH SYSTEM
PULP
7
3
2C
7
2A
1B
4
WASH LIQUOR
WHITE LIQUOR
KV
KV
2C
7
8
9
10
2A

FIG. 3B

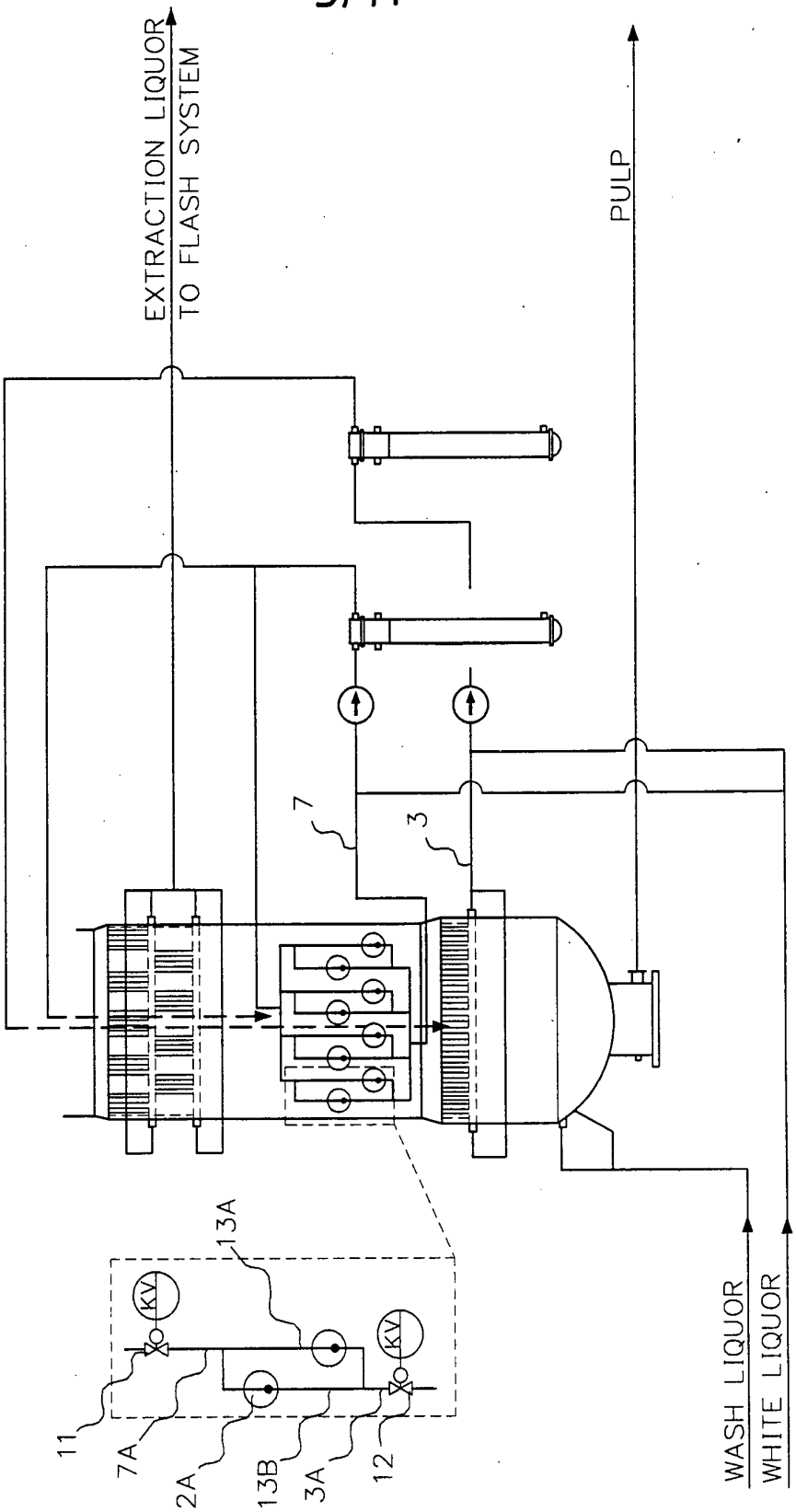

EXTRACTION LIQUOR
TO FLASH SYSTEM
PULP
7
3
13A
KV
KV
11
7A
2A
13B
3A
12
WASH LIQUOR
WHITE LIQUOR

FIG. 3C

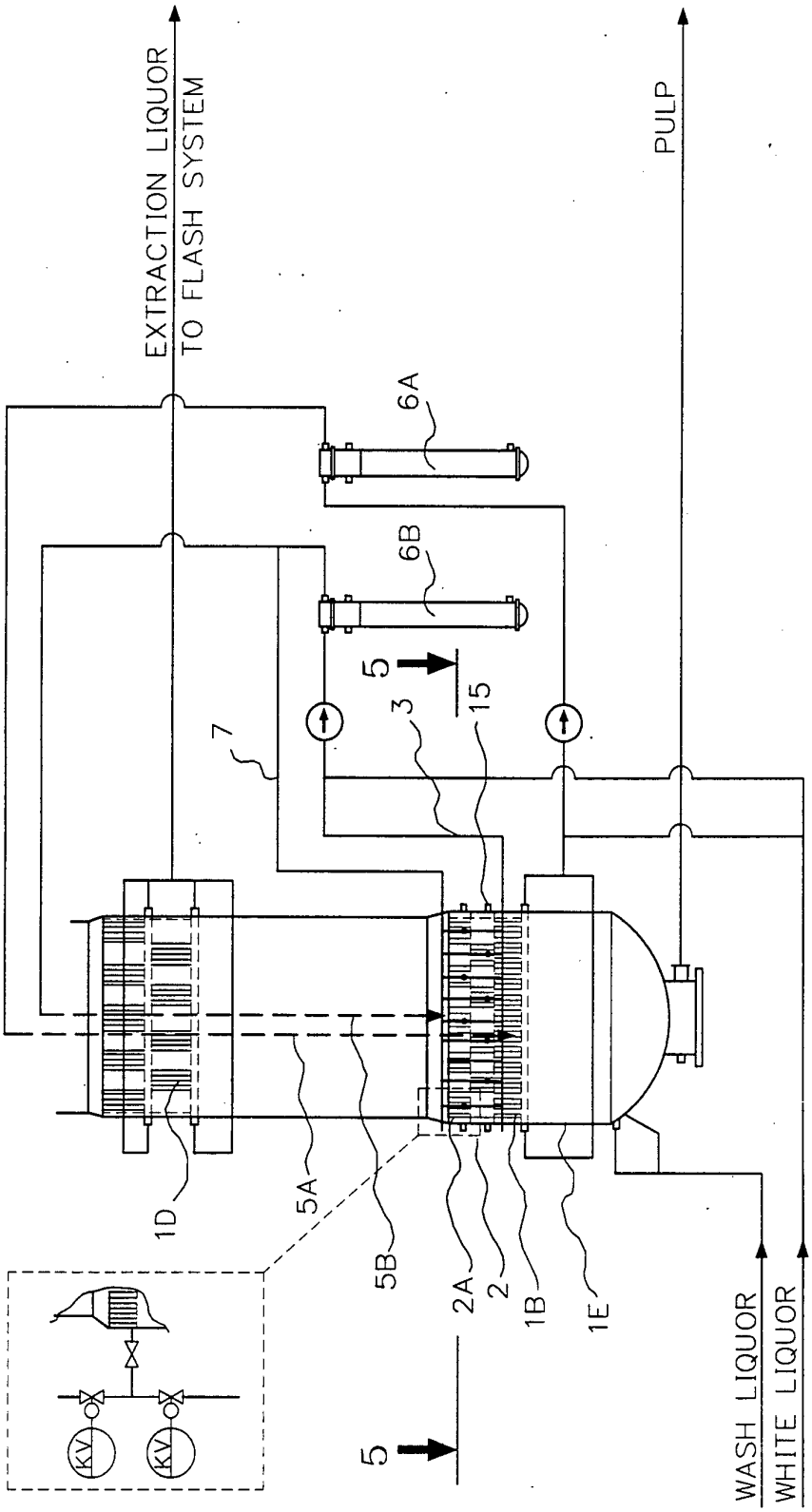

EXTRACTION LIQUOR
TO FLASH SYSTEM
PULP
6A
6B
5
15
3
7
1D
5A
5B
2A
2
1B
1E
5
KV
KV
WASH LIQUOR
WHITE LIQUOR

FIG. 4

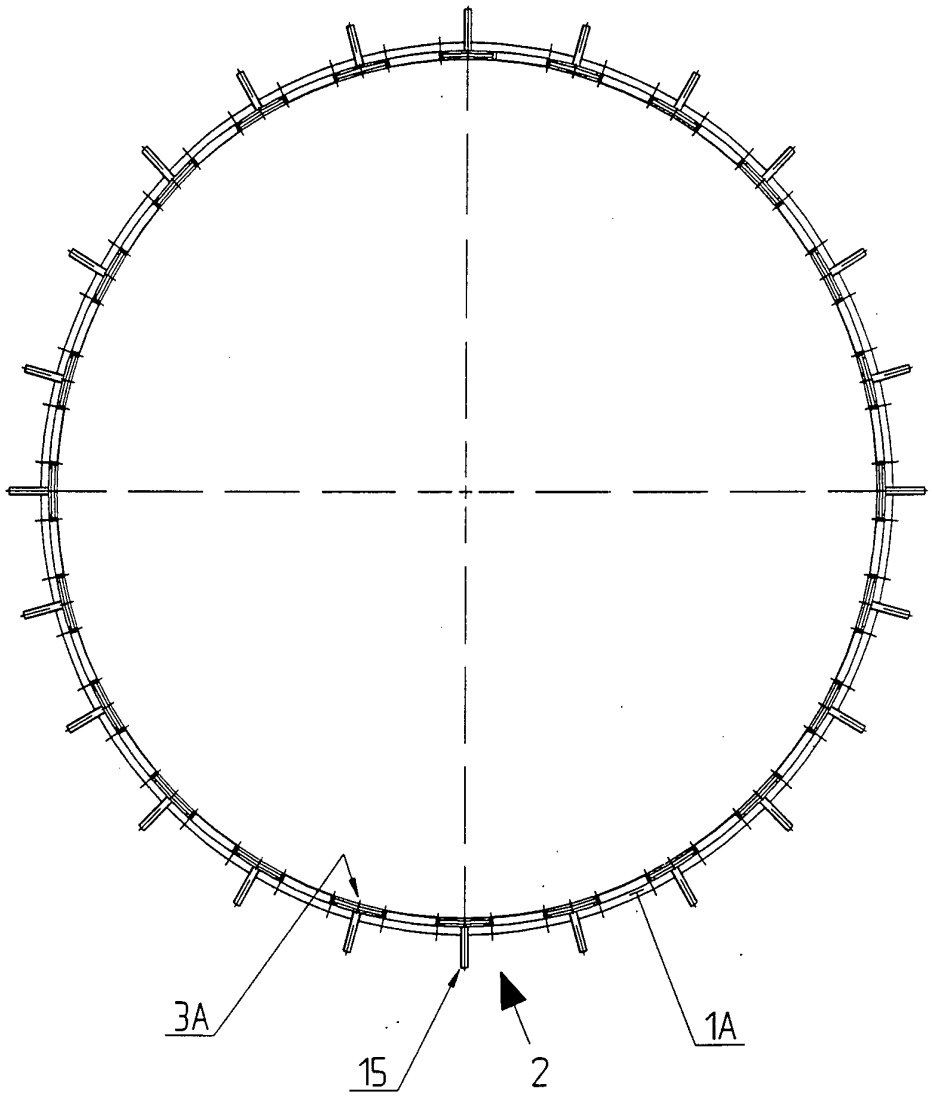


FIG. 5

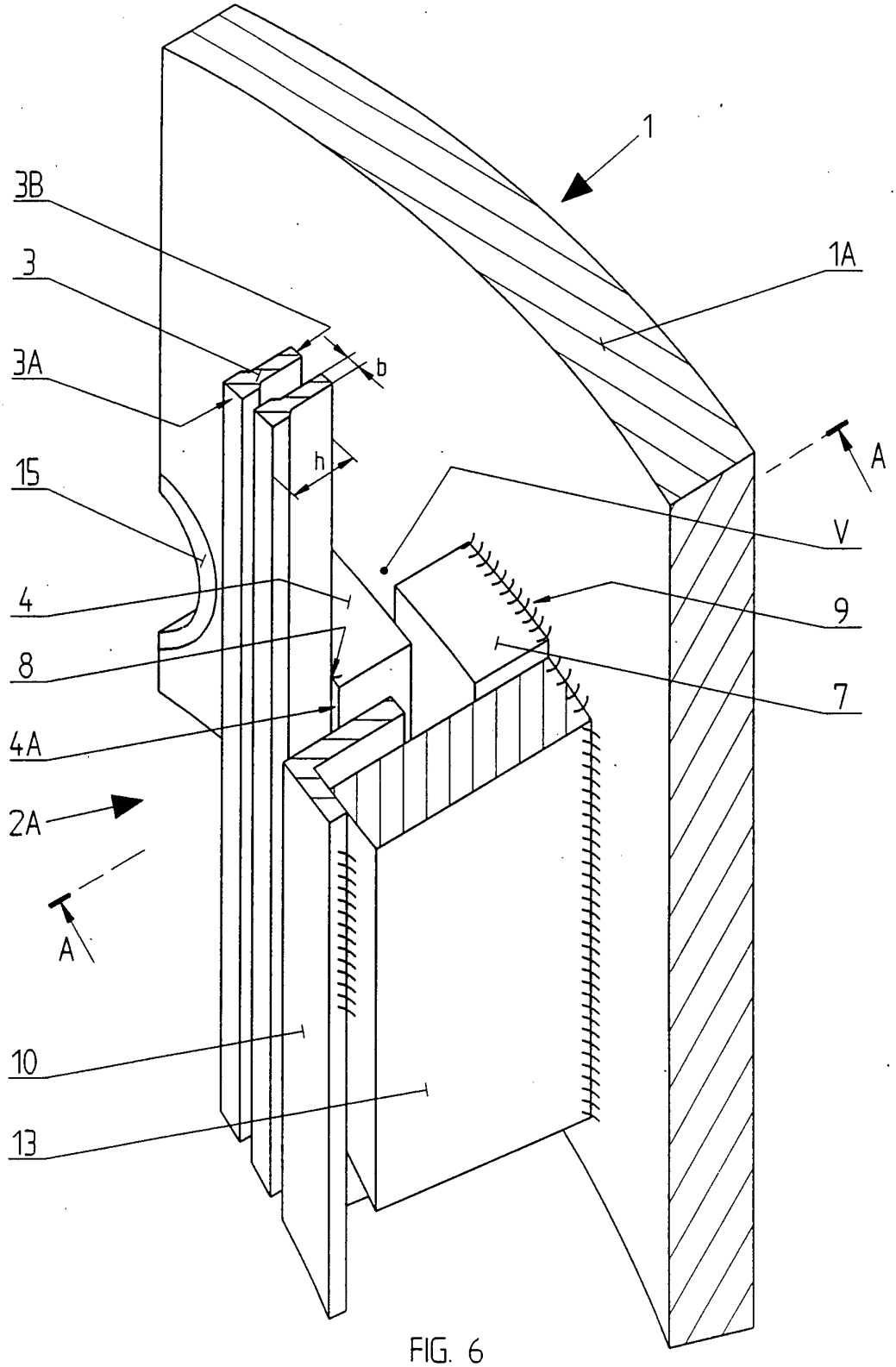


FIG. 6

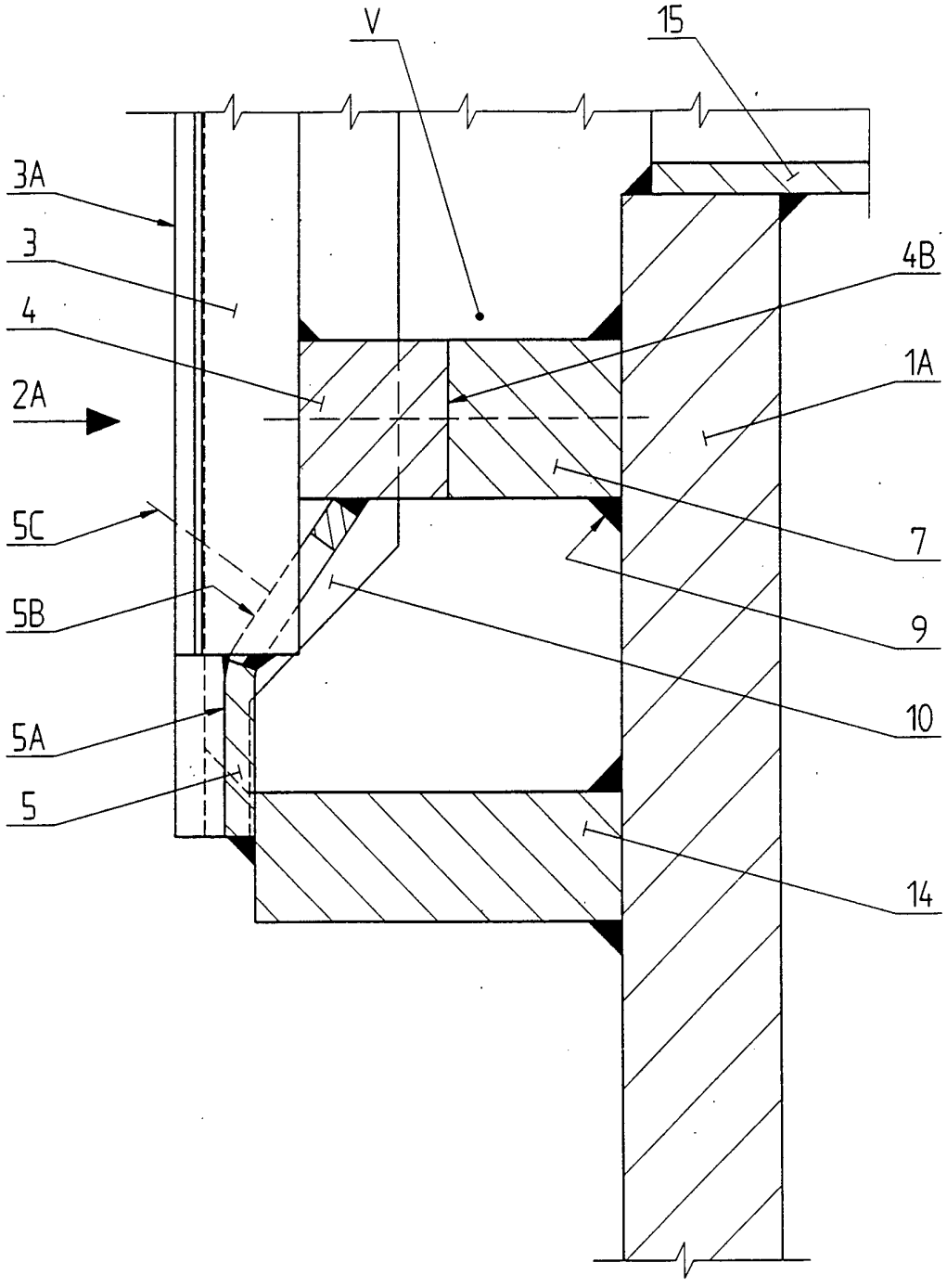


FIG. 7

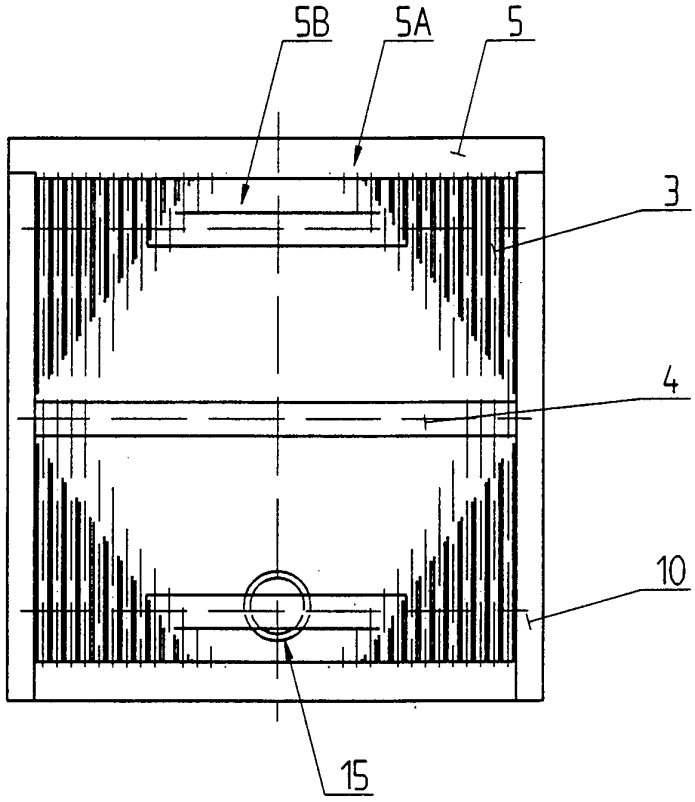


FIG. 8

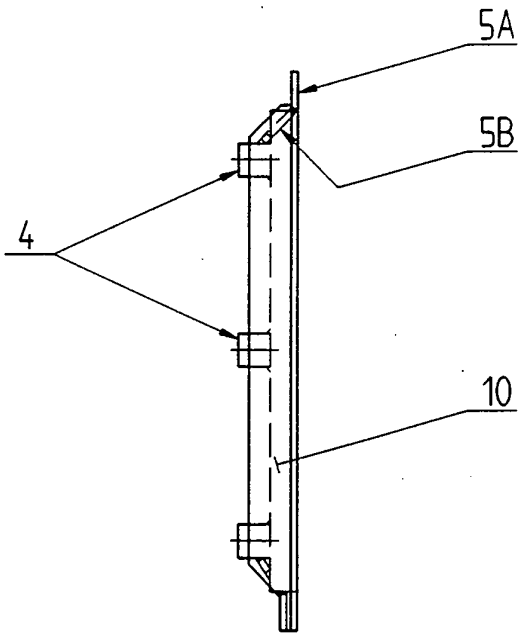


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 93/00311

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: D21C 3/24, D21C 7/00, D21C 7/14
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)

IPC5: 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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE, C, 211196 (AB KAMYR), 25 July 1966 (25.07.66), page 1, column 2, line 19 - page 2, column 2, line 33, the figure --	1-10
A	EP, A2, 0476230 (KAMYR, INC.), 25 March 1992 (25.03.92), page 3, line 24 - page 4, line 5, figure 1 --	1-10
A	NO, C, 92578 (HUGH JOSEPH BYRNE), 6 October 1958 (06.10.58), page 3, column 2, line 48 - page 4, column 1, line 57; page 5, column 1, line 31 - column 1, line 58, figures 1-6 --	1-10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 July 1993	13 -07- 1993
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Wiva Asplund Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 93/00311

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	NO, B, 130485 (KAMYR AKTIEBOLAG), 9 Sept 1974 (09.09.74), page 2, line 18 - line 30, figures 1,2	1-10

--

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/05/93

International application No.
PCT/SE 93/00311

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-C- 211196	25/07/66	NONE	
EP-A2- 0476230	25/03/92	AU-A- 7830591	19/03/92
		CA-A- 2037717	18/03/92
		JP-A- 4300378	23/10/92
NO- C- 92578	06/10/58	NONE	
NO-B- 130485	09/09/74	NONE	