



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ :

D21B 1/32

A1

(11) International Publication Number:

WO 92/21812

(43) International Publication Date:

10 December 1992 (10.12.92)

(21) International Application Number: PCT/FI92/00172

(22) International Filing Date: 1 June 1992 (01.06.92)

(30) Priority data:

912745

7 June 1991 (07.06.91)

FI

(71) Applicants: A. AHLSTROM CORPORATION [FI/FI]; SF-29600 Noormarkku (FI). KAMYR, INC. [US/US]; Ridge Center, Glens Falls, NY 12801-3686 (US).

(72) Inventors: KEMPPINEN, Teuvo ; Kosselinkatu 6, SF-48600 Karhula (FI). OLKKONEN, Jorma ; Kihlinkatu 10 D, SF-48600 Karhula (FI).

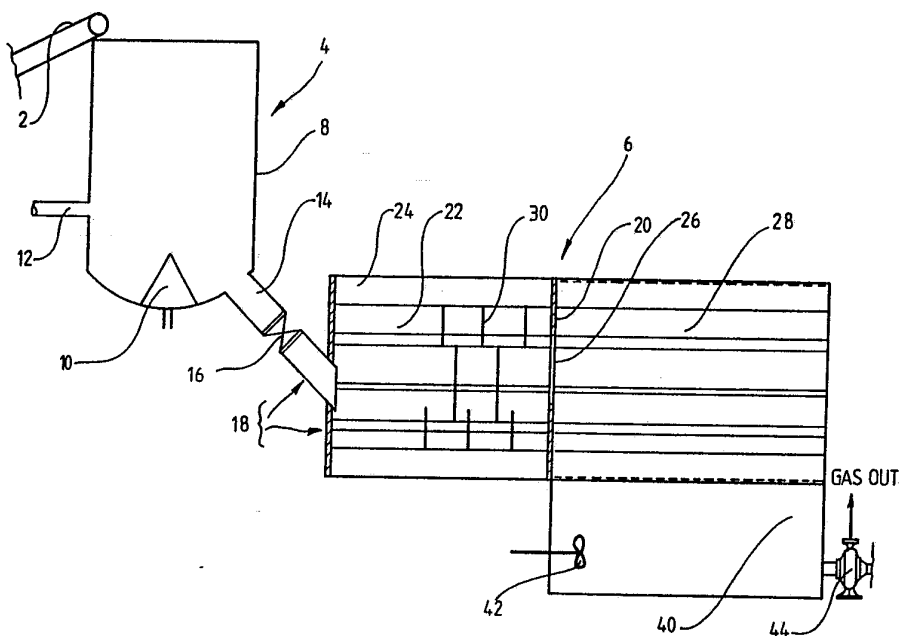
(74) Common Representative: A. AHLSTROM CORPORATION; Patent Department, P.O. Box 18, SF-48601 Karhula (FI).

(81) Designated States: AT (European patent), AU, BE (European patent), BR, CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), NO, RU, SE (European patent).

Published

With international search report.

(54) Title: A METHOD OF AND AN APPARATUS FOR TREATING WASTE PAPER



(57) Abstract

The present invention relates to a method of and apparatus for treating waste paper, the method and apparatus being especially suitable for treating difficultly comminutable waste paper and board. Different packing and wrapping papers, corrugated board, wrappings covered with polyethylene, other plastic-covered boards, Tetrapak[®] packings and other layered papers having a great amount of contaminants can be given as examples. In the method according to the invention the material to be treated is initially comminuted, comminuted further and screened so that in the initial comminuting stage the fibrous material is separated from the plastic, foils, etc. rejects and that in the further comminuting stage the fibrous material is defibrized to the extent that it can be screened. The apparatus for realizing the method comprises an HC-pulper (4), material inlet means into the HC-pulper (2), material discharge means (14) from the HC-pulper, a defibrizing drum (6) having a defibrizing portion (22), and accept and reject discharge means (40, 44).

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	FI	Finland	ML	Mali
AU	Australia	FR	France	MN	Mongolia
BB	Barbados	GA	Gabon	MR	Mauritania
BE	Belgium	GB	United Kingdom	MW	Malawi
BF	Burkina Faso	GN	Guinea	NL	Netherlands
BG	Bulgaria	GR	Greece	NO	Norway
BJ	Benin	HU	Hungary	PL	Poland
BR	Brazil	IE	Ireland	RO	Romania
CA	Canada	IT	Italy	RU	Russian Federation
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark	MG	Madagascar		
ES	Spain				

A METHOD OF AND AN APPARATUS FOR TREATING WASTE PAPER

The present invention relates to a method of and an apparatus for treating waste paper, the method and apparatus being specially suitable for comminuting those kinds of paper and board which are difficult to comminute, e.g. different packing and wrapping papers, corrugated boards, polyethylene-covered wrappings, other plastic-covered boards, TetrapakTM-packings and other layered papers with a great amount of contaminants.

The so-called FibreflowTM-drum is previously known from, e.g., US Patents 4,518,500 and 4,687,146, and is a drum which is capable of defibrizing easily comminutable waste paper, such as newsprint or the like. Both the construction and operating principle of the FibreflowTM-drum are relatively simple. The drum comprises two zones, separated by a partition wall, the first zone, the so-called comminuting zone, receives the material to be treated and is provided with a non-perforated mantle having ribs extending radially towards the axis of the drum. The ribs are to lift the material to be defibrized upwards and then to allow the material to fall down against the bottom of the drum, the impact comminuting the waste paper into fiber flocks. The flocculated fiber pulp is then led through an opening in the partition wall to the second, perforated, portion of the drum, where the accepted pulp particles are screened through the openings and the reject, such as pieces of plastic, thread, wire etc. are directed to a discharge via an outlet at the end of the drum. A characteristic feature of a drum such as this is that the more difficult the material is to defibrize, the longer it will be allowed to be tumbled in the drum. Another characteristic feature of a drum such as this is that difficult materials cannot be treated, as the operation of the drum is very gentle, which as itself saves the fibres.

Further, DE patent publication 32 25 538 discloses an apparatus for treating waste paper or the like, in which apparatus a drum-like screening device is in communication with a high consistency pulper comprising a cylindrical vessel and a high speed rotor arranged at the bottom thereof, the rotor subjecting the pulp to strong shearing forces and naturally, to some extent, also physically cutting the pieces on its way, thus also physically cutting the fibres. According to said DE publication, pulp initially comminuted in a batch-type pulper is discharged at a consistency of a little over 10% to an intermediate or buffer vessel arranged on a horizontal axis, the wall of the vessel being provided with a screw feeding the pulp towards a coaxial screen drum. The consistency of the pulp in the intermediate vessel is, as mentioned, about 10%, from which value the consistency is diluted to about 4-5% while the pulp is being conducted towards the screen drum. The screen drum comprises two zones, a first, very short, non-perforated portion, into which the liquid needed for diluting the pulp is directed via a concentric duct, and a second, long, conventional screening portion provided with relatively large (15 mm) perforations, in which portion the fibrous material is separated from the material to be rejected.

EP specification 194 332 discloses another prior art solution in which waste paper is treated in two subsequent drums arranged to rotate on separate shafts. In a way, in this solution the above-mentioned FibreflowTM-drum is divided in two. In the EP specification, nevertheless, the pulp pre-treated in the first drum is discharged via a connecting tube to the inlet end of the second, mainly perforated, drum. Nozzles for introducing dilution liquid are arranged at the connecting tube. The inlet end of the perforated drum comprises a so-called mixing zone, where the pre-comminuted pulp is diluted and mixed with water for the consistency to suit the screening. The mixing zone

of the drum is provided with internal ribs like the FibreflowTM-drum.

Both the FibreflowTM-drums and the defibrizer according to the EP application have the disadvantage that they are hardly or not at all suitable for treating difficultly comminutable materials. In order to achieve satisfactory results with the above defibrizers, the temperature of the treated suspension has to be as high as 90°C and chemicals have to be fed into the suspension so as to make the suspension heavily alkaline. Nevertheless, because of both the temperature and the alkalinity of the suspension the reject is also comminuted, dissolved or melted into the suspension, thus leaving the result far from optimal. In addition to this, treatment times are long and energy consumption accordingly high. Further, if a defibrizing drum only is used for treating difficultly comminutable waste paper, there will be problems with de-inking, as the drum does not physically stress the secondary material so as to cause the ink etc. particles to be easily separable from the suspension in the screening/washing stage.

The combination of a high consistency pulper and a screen drum as described in the above DE publication is not optimal, because the material is comminuted solely in the so-called HC-pulper, which, of course, capable of performing that task, but which in the process of comminuting the material also cuts the fibres and consumes large quantities of energy. As is known, the motors used in HC-pulpers are of the order of 1000 kW, and in this case all the energy consumption of the waste paper treatment process can be considered to be due to the HC-pulper. A typical treatment time in a batch pulper is about 15-30 minutes, and thus the energy consumption is about 250-350 kWh/batch.

35

The object of the method and apparatus according to the invention is to optimize the treatment of waste paper, the optimal treatment including

- reduced energy consumption
- reduced amount of impurities and cut fibres
- improved screening results
- efficient deinking
- 5 - efficient removal of stickies.

A characteristic feature of the method according to the invention is that the treatment time in the HC-pulper has been considerably reduced, the time now being about 8-15
10 minutes. Accordingly, the screen drum has been provided with a further defibrizing zone, not only for diluting and evenly mixing the suspension, but also for further defibrizing the suspension, the defibrizing being assisted by the initial comminution in the HC-pulper. The bonds, whether
15 glue- or other bonds, between the particles of the pulp discharged from the HC-pulper have been loosened to the extent that even the relatively gentle operation of the screen drum will attain practically the same result as an HC-repulpung lasting twice as long, but without violently
20 cutting the fibres the way an HC-pulper would do.

The characteristic features of the apparatus and method according to the invention will become clear from the accompanying claims.

25

In the following, the invention will be described by way of example in closer detail with reference to the accompanying drawings, in which

Fig. 1 is a schematic cross-section of an apparatus
30 according to the invention, and

Fig. 2 is a fragmentary elevation of an advantageous construction of a defibrizing drum of an apparatus according to the invention.

35 As illustrated in Figure 1, the apparatus according to the invention generally comprises a conveyor 2 or the like, by means of which the material to be treated is introduced into a high consistency pulper 4, wherefrom the partly

comminuted material is discharged into the defibrizing drum 6. The high consistency pulper or, in short, the HC-pulper, comprises an actual pulper vessel 8, a rotor 10 arranged at the bottom thereof, advantageously in the central part of the bottom, a liquid inlet 12, and an outlet 14 for the initially comminuted material, advantageously arranged at an angle of about 35-60°, preferably at an angle of about 45°. The outlet 14 is provided with a valve 16 for closing the outlet during the initial comminution in the pulper 4. A dilution liquid inlet 18 for controlling the consistency of the material to be treated further is arranged to communicate with either the outlet 14 or the first end of the defibrizing drum 6. The inlet 18 can be replaced by a plurality of inlet nozzles connected to an annular dilution liquid inlet duct, the nozzles being arranged around the outlet and possibly slanted to the direction of the flow of pulp. The defibrizing drum 6 comprises parts described in the above-mentioned US patents, in other words the drum 6 is divided into two parts by a partition wall 20, the receiving, first end 22 of which is non-perforated and provided with substantially axial interior ribs 24 for lifting the pulp as the drum rotates, after which the pulp is allowed to fall down against the bottom of the drum, thus comminuting the low-consistency pulp further. This so-called further comminution zone is provided with either adjustable or fixed baffles 30 for retaining the pulp in the zone long enough to achieve the desired degree of defibrizing. As the material is treated in the defibrizing drum its consistency becomes that of being homogenized, after which it can be discharged by a feed scoop or the like through an opening 26 in the partition wall 20 into the screening portion 28 of the defibrizing drum. The screening portion 28 is perforated, thus enabling all the pulp particles smaller than the openings to be accepted through the openings while the larger particles remain inside the drum, wherefrom they are discharged via the second end of the drum to the rejects and for further treatment. The screening portion can be

provided with, as illustrated in Fig. 2, a two-stage screening portion 28' consisting of two perforated drums 32 and 34, one within the other, the inner drum 32 of which is provided with larger openings (7-10 mm) for separating the largest contaminant particles, whereas the outer drum 34 is provided with the actual screening openings (4-6 mm) for withdrawing the accept.

From the either single- or two-stage screening portion 28 the accepted pulp is discharged through the perforated drum to a vessel 40 preferably having a mixer 42 for keeping the pulp moving and preventing the pulp from settling down on the bottom of the vessel. Dilution liquid can additionally be mixed into the pulp with the mixer, if needed. The pulp is discharged from the vessel by a pump 44, preferably a degassing centrifugal pump. Connecting such a pump to the process according to the invention will further optimize the above-described process and contribute to the total economy thereof. At least some gas will in any case be mixed with the pulp during the repulping, while it is known that gas is disadvantageous to subsequent pulp treatment stages.

An apparatus according to the invention operates so that the secondary material to be defibrized is firstly conveyed to the pulper vessel 8 by conveyor 2, the pulper vessel being separated from the defibrizing drum 6 by a valve 16. The consistency of the material is adjusted to the desired level, e.g. 12-18%, by feeding dilution liquid into the pulper via duct 12. The material is comminuted in the pulper by rotor 10. The rotor is rotated for, e.g., 8-15 minutes at 140-160 rpm, depending on the material to be defibrized. Subsequent to that, the material initially comminuted by the HC-pulper is periodically discharged un-screened to the defibrizing drum 6 by opening the valve 16, thus enabling the material to flow under gravity to the further comminuting/homogenizing portion 22. It is also possible, if the operation of the pulper and the construc-

tion of the HC-pulper are optimized to the limit, to continuously discharge the HC-pulper by keeping the valve fully open or partly throttled. Liquid is introduced either into outlet 14 or to the further comminuting zone of the defibrizing drum for diluting the consistency of the initially comminuted material to about 8-12% prior to further treatment, a consistency suitable for the screening portion. The material is treated in the further comminuting zone of the drum as long as necessary to achieve the desired defibrizing efficiency. The pulp is thereafter allowed to be discharged into the screening portion, where the pulp is further diluted. In the screening portion the accepts fraction is separated from the pulp through the drum openings at a consistency of about 3-4%, while the rest of the material is discharged through the second end of the drum. The accepts fraction is withdrawn for further processing by a degassing centrifugal pump, thus eliminating the disadvantages caused by gas in further processing.

It can exemplarily be stated that the length of the drum treatment zone is desirably about the same as the diameter of the drum or maybe even slightly more than that. The exact dimensions of the drum do naturally depend on how difficult the material is to treat. The diameter of the drum will usually be between 2-4 m, depending on the exact application, whereas a typical retention time, when utilizing the method according to the invention, is about 20-30 minutes, and the power consumption is 15-25kW/ton of pulp. If the same amount of pulp were to be defibrized utilizing a conventional FibreflowTM-drum only, the retention time would be about 40-60 minutes, the treatment result, as far as yield is concerned, would be lower, and the consumption of hot water and chemicals would be remarkably higher. In addition to this, the process conditions in general would in most cases be negative to the total process.

As can be seen from the above, the method of defibrizing according to the invention clearly differs from the prior

art solutions. Previously the material was completely
comminuted in either a HC-pulper or a defibrizing drum. The
violent treatment subjected to the fibres by the HC-pulper
results in a great amount of chopped fibres and contami-
5 nants, thus causing the pulp to include a great amount of
very short fibres and small contaminants, e.g. plastic, but
only a small amount of long fibres. Further, the HC-pulper
had to be larger than that of the present invention, because
it had, in a way, to perform the tasks of two different
10 apparatuses. On the other hand, the defibrizing drums
previously used for defibrizing difficult materials were
large, gave a poor yield and the retention times were
long. Thus our invention has solved the disadvantages of
the prior art and thereby enables the defibrizing to be
15 optimized, with the result that the length of the fibres
is not reduced during the treatment, energy consumption
and the size of the necessary machinery have been reduced
and treatment times have been shortened. Further, removal
of stickies and ink from the pulp is now considerably more
20 efficient, as well as the removal of fibres from plastic
and foils. In addition to that, the controllability and
economy of the process of comminuting difficult materials
has been substantially increased, because there no more is
a need for a high temperature or for the process to be
25 strongly alkaline, but the pH of the process can as well
be neutral.

Finally, please note that the above is a description of only
one embodiment of the method and apparatus according to
30 the invention, with no intention whatsoever of limiting
the scope of protection from that described in the accom-
panying claims.

We claim:

1. A method of treating waste paper and board, especially
5 material that is difficult to defibrize, such as different
packings and wrappings, corrugated boards, polyethylene-
covered wrappings, other plastic-covered boards, Tetra-
pak-packings and other difficultly treatable layered papers,
the method being characterized in that the material to be
10 treated is initially comminuted, comminuted further and
screened such that in the initial comminuting stage the
fibrous material is separated from the plastic, foils,
and other reject material and that in the further com-
minuting zone the fibrous material is defibrized to the
15 extent that it can be screened.
2. The method as recited in claim 1, characterized in that
- the material to be defibrized is introduced into an HC-
pulper,
 - 20 - dilution liquid is introduced into the pulper,
 - the initial comminution is performed in the HC-pulper,
 - the unscreened initially comminuted material is dis-
charged into the defibrizing drum for further comminution,
 - the consistency of the material is diluted so as to be
25 suitable for the further comminution,
 - the material is comminuted further in the further
comminuting zone of the defibrizing drum,
 - the consistency of the material is homogenized in the
further comminuting zone,
 - 30 - the material is discharged into the screening zone,
 - the accepted fibrous material is separated into the
accepts, and
 - the reject is discharged from the defibrizing drum.
- 35 3. The method as recited in claim 2, characterized in that
gas is separated from accept by a degassing pump.

4. The method as recited in claim 2, characterized in that the consistency of the material is diluted in the HC-pulper to between 12 and 18%.

5 5. The method as recited in claim 2, characterized in that the consistency of the material is diluted in the defibrizing drum to between 8 and 12%.

10 6. The method as recited in claim 2, characterized in that the duration of the initial comminution is about 8-15 minutes.

7. The method as recited in claim 2, characterized in that the screening is performed in two stages.

15

8. The method as recited in claim 2, characterized in that the initially comminuted material is discharged into the defibrizing drum in a continuous flow.

20 9. An apparatus for treating waste paper and board, especially material that is difficult to defibrize, such as Tetrapak or like polyethylene-covered wrapping papers, characterized in that it comprises

- an initial comminutor (4), or a so-called HC-pulper,
- 25 - material inlet means (2) to the HC-pulper,
- material discharge means (14) from the HC-pulper,
- a defibrizing drum (6) with a further comminuting portion (22) and a screening portion (28, 28') arranged therein, and
- 30 - accept and reject discharge means (40, 44).

10. The apparatus as recited in claim 9, characterized in that the material discharge means (14) is a tube arranged at an angle of 35-60° with a valve (16) arranged therein.

35

11. The apparatus as recited in claim 9, characterized in that the further comminuting portion (22) of the defibrizing drum (6) is non-perforated and provided with substantially

axial ribs (24) and baffles (30) for improving the homogenization of the pulp, the ribs and baffles both being inside the drum (6).

- 5 12. The apparatus as recited in claim 9, characterized in that the length of the further comminuting portion (22) of the defibrizing drum (6) is at least equal to the diameter of the drum (6).
- 10 13. The apparatus as recited in claim 9, characterized in that the screening portion (28') of the drum comprises two perforated drums (32, 34), one located within the other.
- 15 14. The apparatus as recited in claim 9, characterized in that there is a partition wall (20) inside the drum (6), located between the further comminuting portion (22) and the screening portion (28, 28'), the partition wall being provided with an opening (26) and a lifting scoop or the like for discharging the material from the further comminuting portion (22) to the screening portion (28, 28').
- 20 15. The apparatus as recited in claim 9, characterized in that the accept discharge means is a vessel (40) located below the screening portion (28, 28') with a degassing
- 25 centrifugal pump (44) connected thereto.

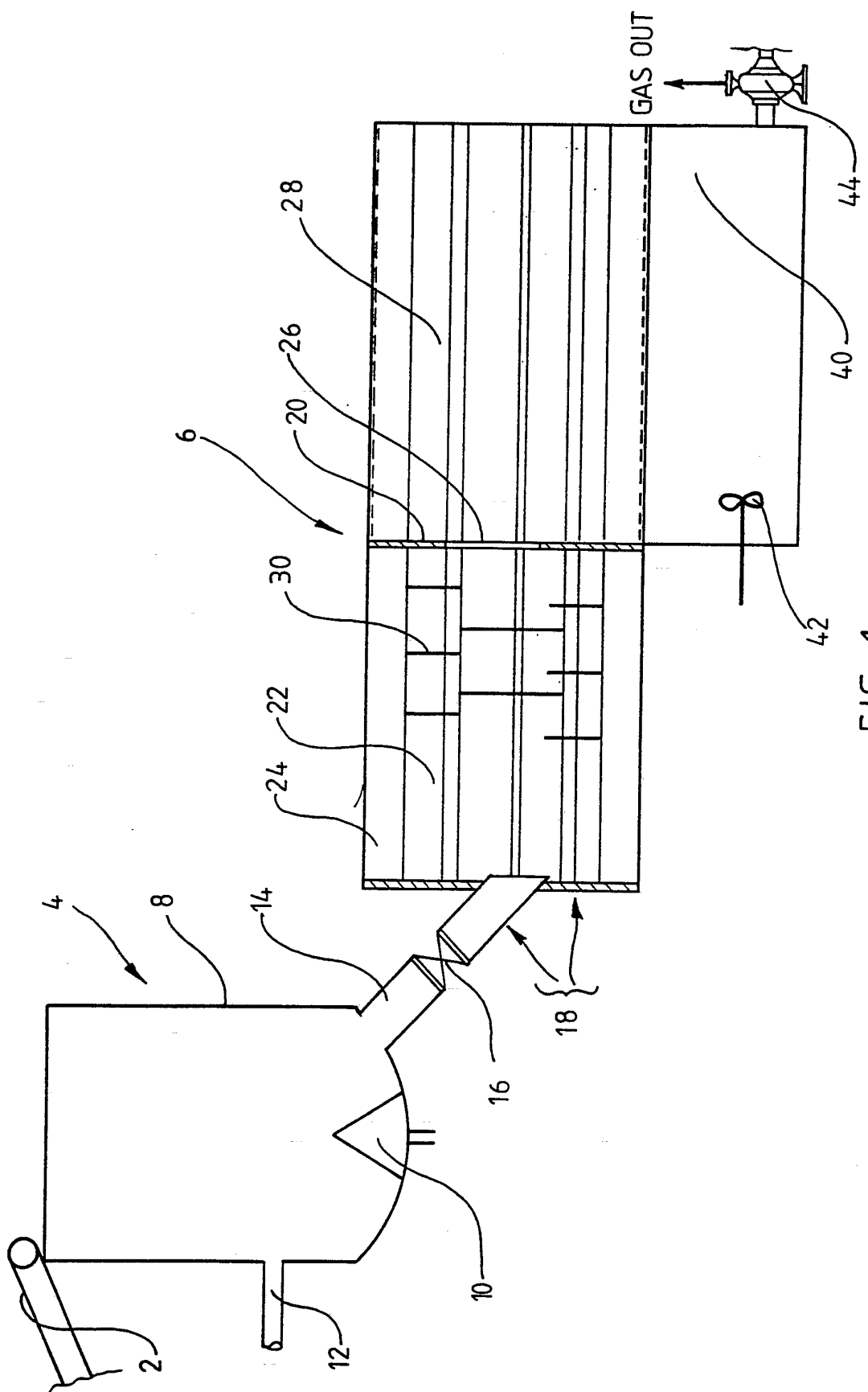


FIG 1.

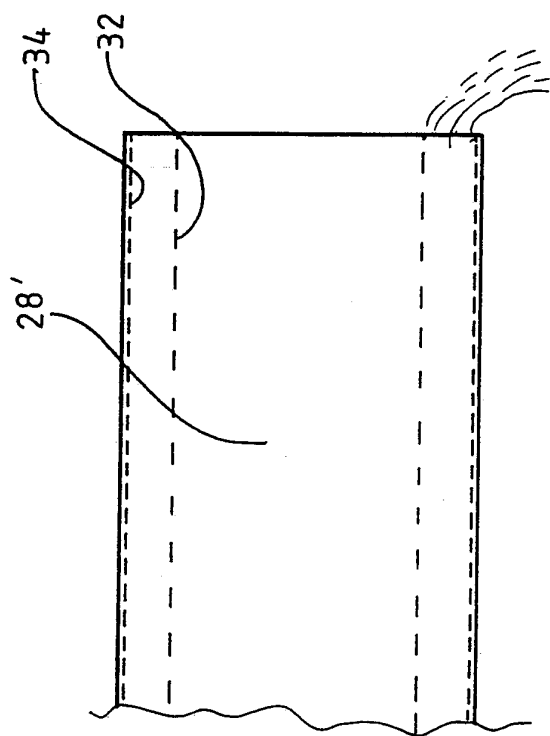


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00172

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: D 21 B 1/32											
II. FIELDS SEARCHED Minimum Documentation Searched⁷ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; padding: 5px;">Classification System</td> <td style="padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;">IPC5</td> <td style="padding: 5px;">D 21 B; D 21 D</td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸ SE,DK,FI,NO classes as above			Classification System	Classification Symbols	IPC5	D 21 B; D 21 D					
Classification System	Classification Symbols										
IPC5	D 21 B; D 21 D										
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; padding: 5px;">Category *</th> <th style="width: 60%; padding: 5px;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%; padding: 5px;">Relevant to Claim No.¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">DE, C1, 3225538 (J.M. VOITH GMBH) 22 December 1983, see column 2, line 66 - column 4, line 31; figure 1 -- </td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,2,9, 10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">DE, C2, 2941898 (HERMANN FINCKH MASCHINENFABRIK GMBH & CO) 19 May 1988, see column 4, line 29 - column 5, line 56; claim 1 the figure -- ----- </td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,6</td> </tr> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	DE, C1, 3225538 (J.M. VOITH GMBH) 22 December 1983, see column 2, line 66 - column 4, line 31; figure 1 --	1,2,9, 10	X	DE, C2, 2941898 (HERMANN FINCKH MASCHINENFABRIK GMBH & CO) 19 May 1988, see column 4, line 29 - column 5, line 56; claim 1 the figure -- -----	1,6
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³									
X	DE, C1, 3225538 (J.M. VOITH GMBH) 22 December 1983, see column 2, line 66 - column 4, line 31; figure 1 --	1,2,9, 10									
X	DE, C2, 2941898 (HERMANN FINCKH MASCHINENFABRIK GMBH & CO) 19 May 1988, see column 4, line 29 - column 5, line 56; claim 1 the figure -- -----	1,6									
* Special categories of cited documents:¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier 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 "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											
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="padding: 5px;">28th August 1992</td> <td style="text-align: center; padding: 5px;">1992 -09- 10</td> </tr> <tr> <td style="padding: 5px;">International Searching Authority</td> <td style="padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;">SWEDISH PATENT OFFICE</td> <td style="text-align: center; padding: 5px;"> Wiva Asplund </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	28th August 1992	1992 -09- 10	International Searching Authority	Signature of Authorized Officer	SWEDISH PATENT OFFICE	 Wiva Asplund	
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report										
28th August 1992	1992 -09- 10										
International Searching Authority	Signature of Authorized Officer										
SWEDISH PATENT OFFICE	 Wiva Asplund										

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 92/00172

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 31/07/92
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-C1- 3225538	83-12-22	JP-A- 59009294	84-01-18
DE-C2- 2941898	88-05-19	AT-B- 375691	84-08-27
		FR-A-B- 2467911	81-04-30
		GB-A-B- 2063325	81-06-03
		US-A- 4465591	84-08-14
		US-A- 4566942	86-01-28