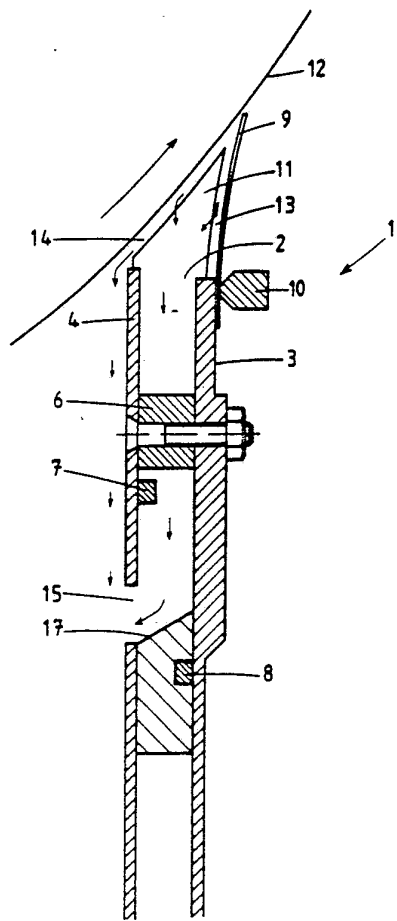


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p><b>(21) International Application Number:</b> PCT/FI88/00092</p> <p><b>(22) International Filing Date:</b> 10 June 1988 (10.06.88)</p> <p><b>(31) Priority Application Number:</b> 872616</p> <p><b>(32) Priority Date:</b> 12 June 1987 (12.06.87)</p> <p><b>(33) Priority Country:</b> FI</p> <p><b>(71) Applicant (for all designated States except US):</b> A. AHLSTROM CORPORATION [FI/FI]; SF-29600 Noormarkku (FI).</p> <p><b>(72) Inventor; and</b>  <b>(75) Inventor/Applicant (for US only) :</b> MEINANDER, Paul, Olof [FI/FI]; Bolagsgr. 2, SF-02700 Grankulla (FI).</p> <p><b>(74) Agent:</b> WESTERHOLM, Sven; A. Ahlstrom Corporation, Patent Department, P.O. Box 18, SF-48601 Karhula (FI).</p>		<p><b>(81) Designated States:</b> AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.</p> <p><b>Published</b>  <i>With international search report.</i></p>
<p><b>(54) Title:</b> METHOD AND APPARATUS FOR COATING A PAPER WEB</p> <p><b>(57) Abstract</b></p> <p>Method and apparatus for coating a paper or paper board web including preventing deposition and drying of the coating paste on the edge zones of the coating chamber by continuously causing a flow of coating paste from the coating chamber past the edge seal (2). Each edge seal is disposed in the space between the front and the rear walls (3, 4) of the coating apparatus, and the upper part (11) of each edge seal corresponds to the form of a wedge between the wiping member (9) of the coating apparatus and the web (12) to be coated. Coating paste flows through gaps (13, 14) between the edge seals and the wiping member and between the edge seals and the web, which gaps are 1-10 mm wide.</p> <div data-bbox="957 1187 1356 2105">  </div>		

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## METHOD AND APPARATUS FOR COATING A PAPER WEB

The present invention relates to a method of coating a paper web utilizing a coating apparatus, having a pressurized coating chamber in communication with the web to be coated.

The invention also relates to an apparatus for coating a moving paper web, including a pressurizable coating chamber to be filled with a coating paste, substantially of a width equal to that of the web, and which chamber, in use, communicates with said web. The coating chamber is defined by the web, on the inlet side by the rear wall of the coating apparatus and on the outlet side by the front wall of the coating apparatus as well as by a wiper arranged at the upper part of the front wall for removing excess coating paste.

Coating apparatuses with a pressurized coating chamber, e.g. so called short dwell coaters, have an elongate opening through which the coating paste comes into contact with the web. The coating zone is sealed on the inlet side of the web by the rear wall of the coating apparatus or by some other sealing wall. At the outlet side of the web the wiping member prevents the free flow of the coating paste from the coating zone. The edges of the coating zone are sealed by edge seals or edge limiters in order to prevent the coating paste from flowing out from the edges of the apparatus.

The edge seals in the pressurized coating apparatuses cause problems. It has been found difficult to provide sealing devices which operate satisfactorily and reliably. Some of the coating paste remains on the edge zones, dries and causes running problems in the coating, breaks and cleaning operations. Additionally, the coated paper in the edge zones is of bad quality and cannot, therefore, be fully utilized.

The main direction of developments in attempting to deal with

the problems has been to minimize the leakages of coating paste at the edge seals. For example, Finnish patent 72902 discloses a throttling member arranged to improve the sealing effect of the edge seal. As a consequence of this, the coating paste which has reached the coating zone does not immediately meet the edge seal, the result of which is that the coating pulp at the edge seal remains substantially stationary and the leak of coating paste through the edge seal is minimized.

Finnish patent application 854053 discloses an arrangement which tends to minimize the overflow of the coating paste with a two-piece edge seal. The overflow gap can thus be reduced to considerably less than 1.5-2 mm so that only little paste escapes from the overflow gap.

US patent 4,354,452 discloses a soft edge seal, which eliminates or minimizes the overflow of the coating paste. The edge seal comprises a soft member, which when filled with air or liquid seals the end area of the coating zone.

The elimination of the problems has not been entirely successful in the above-mentioned mechanical constructions. The solutions have proved less successful in practice, while the basic problems, i.e. uneven coating at the edge areas and disturbances in the coating process still remain unsolved, because in the coating chamber, in the edge zone of the freely flowing coating paste and the slow coating paste at the edges, deposition of paste, thickening and drying take place.

The application of coatings to paper webs of different width has also been difficult.

One object of the present invention is to avoid or minimize the above-mentioned deficiencies and to provide even better coating conditions, by means of which the slowing down of the coating paste flow at the edge areas and problems caused by

the slower, thicker paste are avoided or minimized.

Another object of the invention is to provide an improved coating apparatus with better operating qualities, wherein the coating paste flows optimally also at its edge zones.

Yet another object of the invention is to provide a coating apparatus which is applicable according to the width of the web and with which variations in the width of the web can be taken into account and the web can be optimally utilized .

Recently it has been discovered that too careful a sealing of the coating chamber is harmful. The invention presents a method and apparatus which can prevent or minimize the thickening of the coating paste and the deposition of the coating paste caused by drying on the edge zones.

The aims of the invention, i.e. better coating conditions, can be achieved by adjusting the coating chamber according to the width of the paper web by arranging an edge seal at both edge zones of the coating chamber and preventing the deposition and drying of the coating paste at the edge zones of the coating chamber by means of a continuous outflow of coating paste from the coating chamber, through the gap between the edge seal and the web and/or the edge seal and the wiping member.

A coating apparatus according to the invention is characterized in that at both edge zones of the coating chamber there is an edge seal substantially of the same thickness as the space between the front and the edge wall. The upper part of the edge seal is designed substantially in the form of a wedge between the wiping member and the web and disposed in the coating area so as to form a preferably 1 - 10 mm gap between both the wedge-like upper part and the web and the wedge-like upper part and the wiping member to enable a continuous flow of coating paste from the coating chamber to the outside of

the edge seal. At least one end seal is preferably adjustably displaceable sideways in the lateral direction of the web to provide the optimal coating according to the width of each paper web.

A continuous flow of coating paste past the edge seal creates a flushing effect at the edge zones and prevents the drying of the coating paste in the coating chamber.

The invention is described in detail, by way of example, below with reference to the accompanying drawings, in which:

Fig. 1 is a fragmentary illustration of the left-hand edge zone as viewed of part of a coating apparatus with edge seal means according to the invention at each edge; and

Fig. 2 is a sectional view of the edge zone shown in Fig. 1 along the line A-A — the other edge zone of the coating apparatus corresponds.

Figs. 1 and 2 show the left-hand edge zone as viewed of a coating apparatus 1 (only a part of which is shown), wherein an edge seal 2 according to the invention is arranged in a coating chamber 5 between front wall 3 and rear wall 4. The edge seal divides the coating chamber into inlet duct 5a for the coating paste and a return duct 5b for the coating paste. The edge seal is substantially of the same thickness as the distance between the front wall 3 and the rear wall 4. An intermediate adjusting element 6 determines the distance between the front wall and the rear wall. Each edge seal can be moved in the lateral direction supported by a bar like guiding member 7 arranged on the rear wall and another bar like guiding member 8 arranged on the front wall.

A blade 9 extending across the machine is attached on the upper part of front wall 3 of the coating apparatus to wipe away excess coating paste. An adjustable pressure element 10

fixes the wiping blade to the front wall.

The upper part 11 of the edge seal 2 is formed corresponding to the wedge-like space between the web 12 to be coated (and an edge of which is indicated) and the wiper blade 9. Gaps 13 and 14 are formed between the wiper blade 9 and the upper part of the edge seal 11 and between the moving web 12 and the upper part of the edge seal to enable a continuous flow of coating paste from the inlet duct 5a of the coating chamber to the return duct 5b of the coating chamber. A gap of 1 - 10 mm enables sufficient overflow of coating paste according to the coating material from the coating duct to the return section.

The upper part of the edge seal is advantageously of such width that the gaps 13, 14 will not be too long, whereby the returning coating paste flow would slow down too much or moreover be entirely hindered. The lower part of the edge seal advantageously widens changing the originally vertical outer surface 16 of its lower part to a substantially horizontal surface, as can be seen in the drawing. The coating paste returning from the gaps 13,14 is led along the outer surface 16 of the edge seal firstly flowing down and thereafter out of the coating apparatus. At its lowest part the outer surface of the edge seal changes to a surface 17 inclined down towards the rear wall. In the rear wall 4 there is an opening 15 at the level of the inclined part of the edge seal to lead the returning coating paste out of the coating apparatus. Coating paste can be led through a paste container back to the coating duct 5a; this is not shown in the drawings. Drying of the coating paste can easily be avoided in an open return section by injecting water to the coating paste flowing down along the outer surface 16 of the edge seal.

In the coating process an even coating paste flow meets the moving paper, or e.g. paper board, web. The paste follows the web. The wiper blade, bar or like wiping device wipes off

excess coating paste from the web. Coating paste is discharged over the whole width of the web and also through the gap between the web and the coating apparatus. Additionally, coating paste flows out at the edges through the gaps between the edge seals and the web and between the edge seals and the wiping member. The coating paste flow in the coating duct is even and the coating result is therefore also even throughout the whole width of the web.

The invention is not restricted to the above shown embodiment, but several variations of it are possible within the scope of the accompanying claims. The invention can be applied to different types of coating apparatuses, also to two-sided coating.



We claim:

1. A method of coating a paper web using an apparatus including a pressurized coating paste chamber in communication with the web to be coated, characterized in that deposition and drying of coating paste at the edge zones of the coating chamber is inhibited by causing the coating paste to continuously flow out of the coating chamber at both edge zones through a gap provided between an edge seal and the web and between the web and/or an edge seal and a wiping member.

2. In a coating apparatus, especially for coating a paper web (12), including a pressurizable coating chamber (5) substantially of the same width as the web, which chamber is to be filled with coating paste and communicates with the web, which coating chamber is defined by the web, a rear wall (4) of the coating apparatus at the inlet side of the web and a front wall (3) of the coating apparatus at the discharge side of the web and a wiping member (9) mounted on the upper part of the front wall removing excess coating paste, characterized in that at both edge zones of the coating chamber there is an edge seal (2) substantially of the same thickness as the space between the front wall and the rear wall, the upper part of each edge seal is substantially in the form of a wedge located between the wiping member (9) and the web (12) and disposed in the coating chamber so as to form a gap (13, 14) of, for example, 1 - 10 mm both between the wedge-like upper part (11) and the web (12) and between the wedge-like upper part and the wiping member (9) to enable, in use, the continuous flow of coating paste from the coating chamber to the outside (5b) of each edge seal, at least one of which edge seal can be moved sideways in the lateral direction of the web to provide an optimal coating according to the width of each paper web.

3. The coating apparatus according to claim 2, characterized in that an opening (15) is disposed in the rear wall (4) of the coating apparatus to lead the coating paste from the outside of the edge seal (2) back to the coating paste circulation.

4. The coating apparatus according to claim 2 or 3, characterized in that at least two adjustable intermediate elements (6) are disposed between the front and the rear walls of the coating apparatus to maintain the walls (3,4) at a certain distance from each other.

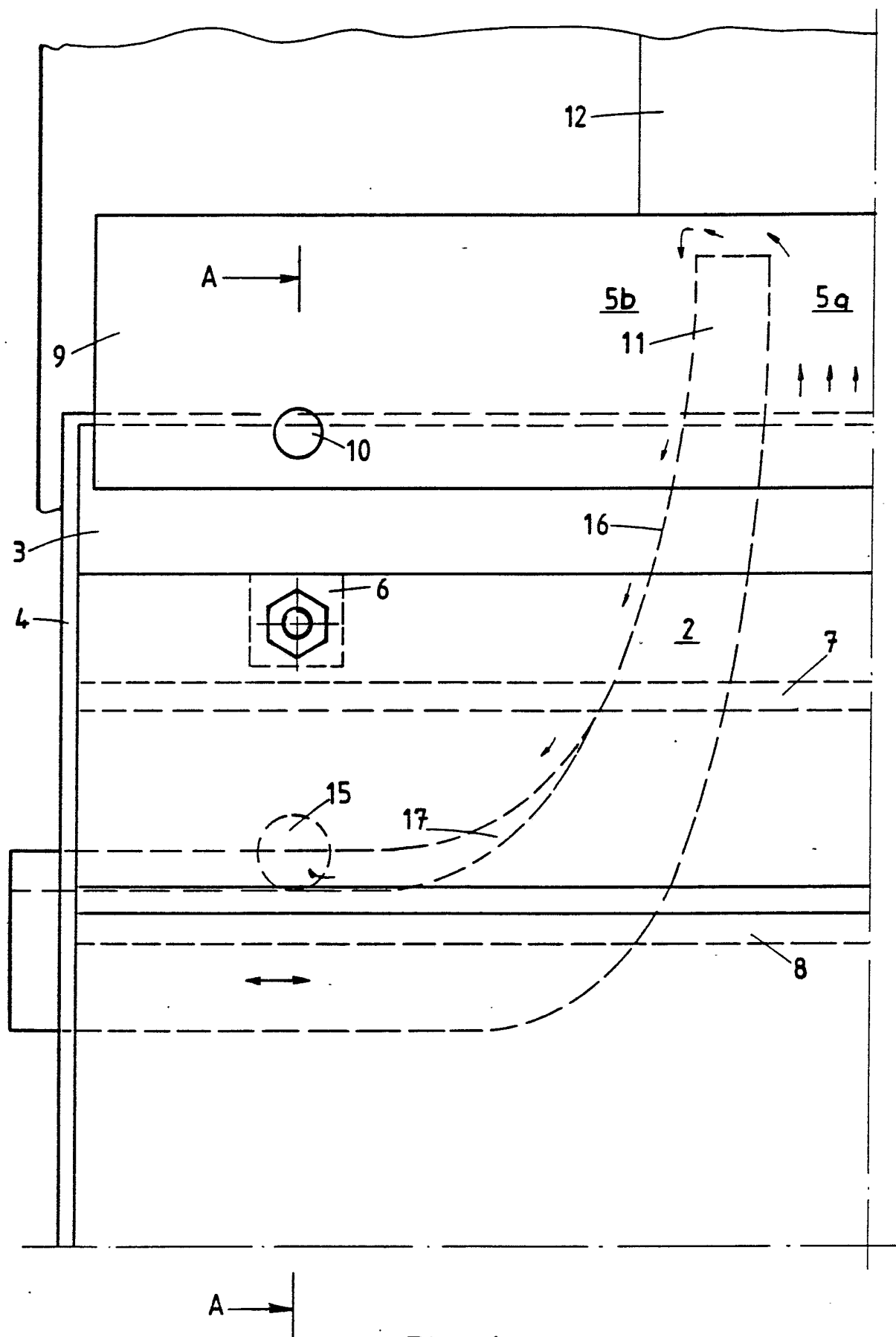
5. The coating apparatus according to one of the claims 2 - 4, characterized in that at least one guide element (8) parallel to the width of the web is disposed on the front wall (3) to guide the transverse movement of the edge seal (2).

6. The coating apparatus according to one of the claims 2 - 5, characterized in that at least one guide element (7) extending parallel to the width of the web is disposed on the rear wall (4) to guide the transverse movement of the edge seal (2).

7. The coating apparatus according to one of the claims 2 - 6, characterized in that at least one guide element (7,8) is disposed both in the rear wall (4) and the front wall (3) to permit the transverse movement of the edge seal (2).

8. The coating apparatus according to one of the claims 2 - 4, characterized in that each edge seal can be moved substantially in the vertical direction to determine the gap (14) between the web (12) and the wedge-like upper part (11).

9. The coating apparatus according to one of the claims 2 - 8, characterized in that the position of the wiping member (9) is adjustable to determine the gap (13) between the wedge-like upper part (11) and the wiping member.



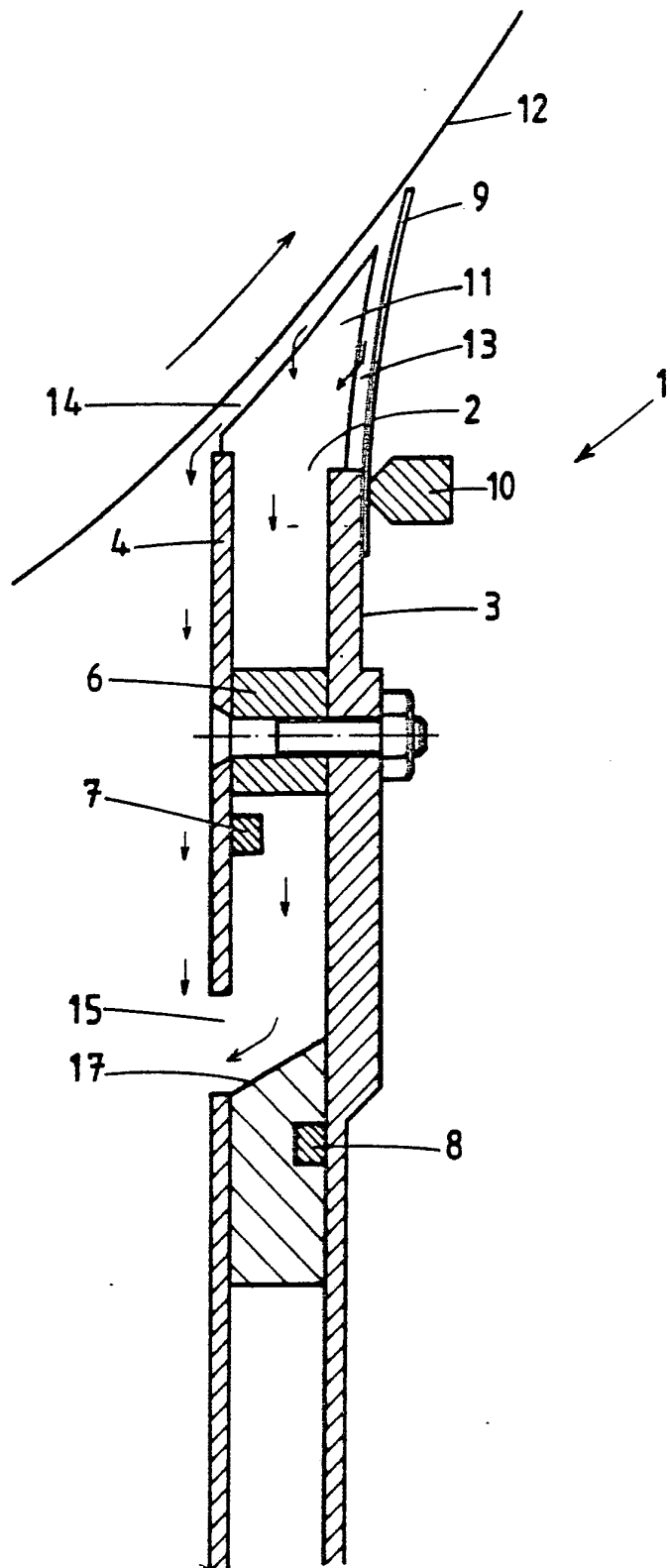


Fig 2

# INTERNATIONAL SEARCH REPORT

PCT/FI88/00092

International Application No

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC 4 B 05 C 5/02, B 05 C 11/04																	
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched 7</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; text-align: left; border-bottom: 1px solid black;">Classification System</th> <th style="width: 70%; text-align: left; border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px;">IPC 4</td> <td style="padding: 5px;">B 05 C 3/00, 5/02, 11/04;</td> </tr> <tr> <td style="padding: 5px;">US C1</td> <td style="padding: 5px;">118: 407, 410-413; 422: 423, 427-356</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8</div> <p style="padding: 5px;">SE, NO, DK, FI classes as above</p>			Classification System	Classification Symbols	IPC 4	B 05 C 3/00, 5/02, 11/04;	US C1	118: 407, 410-413; 422: 423, 427-356									
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; text-align: left; padding: 5px;">Category *</th> <th style="width: 70%; text-align: left; padding: 5px;">Citation of Document, 11 with indication, where appropriate, of the relevant passages 12</th> <th style="width: 20%; text-align: left; padding: 5px;">Relevant to Claim No. 13</th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">X</td> <td style="vertical-align: top; padding: 5px;">           US, A, 4 440 809 (VREELAND)            3 April 1984            &amp; SE, 8400064            FR, 2539334            DE, 3347735            GB, 2135216            JP, 60068075         </td> <td style="vertical-align: top; padding: 5px;">1</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">X</td> <td style="vertical-align: top; padding: 5px;">           US, A, 4 503 804 (DAMRAU)            12 March 1985            See column 5, line 55 -            column 6, line 25            &amp; SE, 8305856            GB, 2133322            FR, 2539335            DE, 3336552            JP, 59225766         </td> <td style="vertical-align: top; padding: 5px;">1-3</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">           US, A, 4 354 452 (PATTERSON)            19 October 1982         </td> <td></td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">           DE, A1, 3 438 181 (J M VOITH GMBH)            24 April 1986  <div style="text-align: right;">.../...</div> </td> <td></td> </tr> </table>			Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13	X	US, A, 4 440 809 (VREELAND) 3 April 1984 & SE, 8400064 FR, 2539334 DE, 3347735 GB, 2135216 JP, 60068075	1	X	US, A, 4 503 804 (DAMRAU) 12 March 1985 See column 5, line 55 - column 6, line 25 & SE, 8305856 GB, 2133322 FR, 2539335 DE, 3336552 JP, 59225766	1-3	A	US, A, 4 354 452 (PATTERSON) 19 October 1982		A	DE, A1, 3 438 181 (J M VOITH GMBH) 24 April 1986 <div style="text-align: right;">.../...</div>	
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: 10</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"Δ" document member of the same patent family</p> </div> </div>																	
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of the Actual Completion of the International Search            1988-08-18         </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of Mailing of this International Search Report            1988 -09- 09         </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">           International Searching Authority            Swedish Patent Office         </td> <td style="border-bottom: 1px solid black; padding: 5px;">           Signature of Authorized Officer             Johan von Döbeln         </td> </tr> </table>			Date of the Actual Completion of the International Search 1988-08-18	Date of Mailing of this International Search Report 1988 -09- 09	International Searching Authority Swedish Patent Office	Signature of Authorized Officer Johan von Döbeln											
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International Searching Authority Swedish Patent Office	Signature of Authorized Officer Johan von Döbeln																

## III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	WO, A, 87/00091 (OY WÄRTSILÄ AB) 15 January 1987	