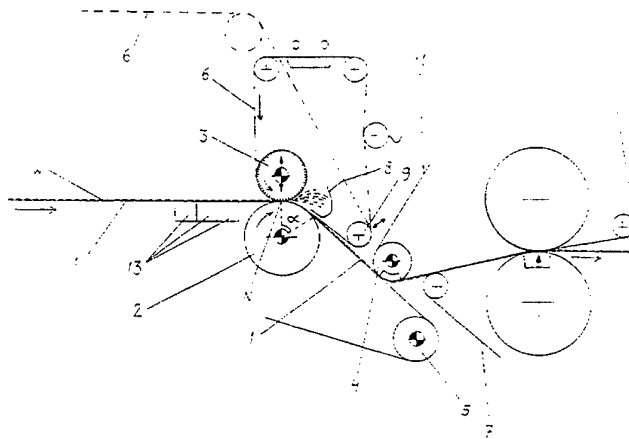




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification⁵ : D21F 1/00 // 9/00, 11/00</p>	A1	<p>(11) International Publication Number: WO 94/29519</p> <p>(43) International Publication Date: 22 December 1994 (22.12.94)</p>
<p>(21) International Application Number: PCT/FI94/00250</p> <p>(22) International Filing Date: 10 June 1994 (10.06.94)</p> <p>(30) Priority Data: 932671 11 June 1993 (11.06.93) FI</p> <p>(71) Applicant (for all designated States except US): VALMET-TAMPELLA INC. [FI/FI]; P.O. Box 267, FIN-33101 Tampere (FI).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): SÖDERHOLM, Nils [FI/FI]; Anjalanlahdentie 2, FIN-46910 Anjalankoski (FI).</p> <p>(74) Agents: HAKOLA, Unto et al.; Tampereen Patentitoimisto Oy, Kanslerinkatu 6, FIN-33720 Tampere (FI).</p>	<p>(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KG, KP, KR, KZ, LK, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, 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).</p> <p>Published With international search report. In English translation (filed in Finnish).</p>	

(54) Title: METHOD AND APPARATUS IN A PAPER OR BOARD MACHINE FOR DEWATERING THE WEB



(57) Abstract

The invention relates to a method in a paper or board machine for dewatering the web prior to its passage to a press section, the dewatering being effected by means of a pair of rolls, which is located at the end of a wire section upstream of a pick-up suction roll (4) or a like transfer device and through which a wire (1) of the wire section and a web (W) supported thereby travel, and one of whose rolls receives water from the web over its area of contact with a path of travel formed by the wire (1) and the web (W). The other roll of said pair of rolls is on the opposite side in contact within said area of contact with the path of travel formed by the wire and the web, whereafter the web (W) supported by the wire (1) of the wire section is guided to the pick-up suction roll (4) or a like. Water is removed from the web (W) by means of an open-surfaced roll (3) included in the pair of rolls by using the combined action of said roll (3) and a roll (2) in contact with the path of travel from the opposite side to apply pressure on the web (W), by collecting water from the web (W) by means of the pressure into the open places in the surface of said roll (3), and by removing the water from the roll (3) through the action of a centrifugal force produced by rotation of the same.

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Method and apparatus in a paper or board machine for dewatering the web

5 The present invention relates to a method as set forth in the preamble of the appended claim 1 for dewatering the web in a paper or board machine. The invention relates also to an apparatus as set forth in the preamble of the appended claim 7 for carrying out the method.

10

Within the end zone of a wire section upstream of a pick-up suction roll, the paper and board machines are generally provided with a wire suction roll in an effort to give the web a sufficiently high dry matter content upstream of the press section. This also creates a sufficiently strong web prior to the action occurring in the press section.

20 One such solution is disclosed in US-Patent 4,075,056, wherein the wire suction roll guides the wire and a web lying on top of it within the end zone of the wire section as they are curving upon said suction roll in a certain sector towards a pick-up suction roll. In line with the suction sector provided by the wire suction roll there is a press roll, a so-called lump-breaker roll, placed thereagainst from the side of a web in an effort to seal the web against the wire suction roll, to consolidate the forming web, and to reduce the amount of fibre lumps in the web.

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On the other hand, US-Patent 3,846,233 discloses a twin-wire papermaking machine wherein, within the end zone of a twin-wire dewatering zone, water is removed by means of a suction roll at which the lower wire deflects towards a pick-up suction roll while water is simultaneously removed through the upper wire as a result of tension of the wires as well as centrifugal force.

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In modern paper and board machines, however, the wire suction roll is one of the major consumers of energy as it requires a vacuum system. It is also expensive in terms of its construction. The wire suction roll creates also a noise problem during operation of the machine. In addition, the use of vacuum reduces the web temperature, which is harmful in the press section. All the above problems associated with suction are further emphasized due to the fact that the increasing machine speeds require an increased vacuum capacity.

An object of the invention is to eliminate the above drawbacks and to introduce a method for dewatering the web prior to its passage to the press section without a wire suction roll, i.e. without the need for creating a vacuum at this point. In view of fulfilling this object, a method of the invention is principally characterized by what is set forth in the characterizing section of the appended claim 1. Water is removed from the web by means of a open-surfaced roll included in a pair of rolls, said roll and a roll mounted on the opposite side being used to develop such a pressing on the web that water squeezes out of the web into the open places in the roll surface and discharges from the roll by being hurled by centrifugal force. Thus, neither of the rolls included in the pair of rolls need be provided with suction and all the problems associated with a suction roll will be eliminated.

Another object of the invention is to introduce an apparatus which does not involve the above drawbacks. In view of fulfilling this object an apparatus of the invention is principally characterized by what is set forth in the characterizing section of the appended claim 7. The pair of rolls provides a press nip, wherein one of the rolls is an open-surfaced roll for

effecting the dewatering into the open places in its surface.

5 The appended non-independent claims 2 - 6 disclose a few preferred alternative embodiments for a method of the invention and the appended non-independent claims 8 - 14 disclose a few preferred alternative embodiments for an apparatus of the invention.

10 The invention will now be described in more detail with reference made to the accompanying drawings, in which

Fig. 1 shows an apparatus of the invention in a side view,

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Fig. 2 shows a second embodiment for an apparatus of the invention in a side view,

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Fig. 3 shows a third embodiment for an apparatus of the invention in a side view, and

Fig. 4 shows a fourth embodiment for an apparatus of the invention in a side view.

25 Fig. 1 depicts the end zone of a Fourdrinier wire section in a papermaking machine, that is, a point at which a web W is transferred from a wire 1, upon which it has formed, into a press section. The end section includes a roll 2, guiding the wire 1 of a
30 wire section in such a manner that the wire 1 and the web W lying on top of it are curving or deflecting in a certain sector α towards a drive roll 5, which at the same time serves as a reversing roll for the wire 1. Over the section between the above rolls,
35 said web W is transferred onto an upper press-section felt 7 by means of a pick-up suction roll 4, the felt running therearound and coming to contact with the web W.

Opposite to the wire guiding roll 2 lies an additional roll 3, which is in contact with the web so as to produce a press nip N with the wire guiding roll. The additional roll 3, which thus replaces a previously used lump-breaker roll, is provided with an open surface, whereby the pressing between rolls 2, 3 included in the pair of rolls results in the transfer of water from the web W into the open places included in the surface of additional roll 3. Since the wire and web downstream of the press nip are curving away under the guidance of roll 2, this is a good location for a water receptacle 8 into which the water is hurled from the surface recesses of additional roll 3 by virtue of a centrifugal force produced by rotation of the same.

The additional roll 3 can be a standard roll having preferably a hard and open surface (either a blind-drilled or through-drilled roll fitted with a wire sock or a smooth roll possibly fitted with a coarse wire sock). The wire guiding roll 2 is set in a location previously occupied by a wire suction roll and, in turn, must have a type of surface which does not collect water from the web. In practice, the wire guiding roll 2 is a smooth-surface roll, having a surface hardness value of at least 50 PJ, preferably 50-200 PJ. The unit PJ is generally used for indicating the hardnesses of roll coatings in papermaking machines. Thus, there is a suitably long nip N formed between the rolls with the applied loading values which may vary between 10 - 100 kN/m. The surface hardness and applied loading rate for the roll depend on the dry matter content of the web upstream of the nip N.

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The open surface of additional roll 3 is in a dewatering contact with the web W through the intermediary of a suitably finely-meshed, water-permeable fabric.

Fig. 1 illustrates a separate wire loop or run, provided by an additional wire 6 and extending from the side of additional roll 3 through the press nip N. The additional roll 3 is in contact with the web W through the intermediary of additional wire 6, which arrives in the press nip N under the guidance of additional roll 3 and curves thereafter under the guidance of roll 2 in sector α and separates from top of the web W lying on the wire 1 downstream of said sector. Water presses from the nip N through the additional wire 6 into the additional roll 3. The winding of wire 6 at the roll 2 is controlled by means of a wire guide roll 9 included in the wire loop downstream of the additional roll 3. The separate wire loop provided by the additional wire 6 further includes normal tension rolls and washing sprays. Also the water receptacle 8 fits comfortably within the wire loop.

Alternatively, the additional wire 6 can be a second wire included in a two-part dewatering zone for removing water from the web therethrough in the opposite direction relative to the dewatering direction of wire 1. This wire is shown in fig. 1 by a dash-and-dot line and it can extend around a wire guide roll 9 located downstream of the nip N.

Fig. 2 depicts a second alternative, wherein a wire loop created by the above-mentioned additional wire 6 travels on top of a web W all the way to a pick-up suction roll 4, whereby the web W is transferred from the wire 1 onto the additional wire 6 on the pick-up suction roll 4 and from the additional wire 6 by means of a suction box 10 onto a lower press felt 11.

35

Although the additional wire 6 in figs. 1 and 2 travels on top of the web W downstream of the press nip N, it can separate from the web immediately after the press

nip since the smooth-surfaced roll 2 guiding the wire 1 produces a vacuum downstream of the nip for holding the web W on said wire 1.

5 The additional wire 6 is mainly significant in making sure that the web W travels in the right direction downstream of the nip N. The additional wire 6 is preferably a wire having a surface identical to that of the wire 1.

10

Another objective with respect to the additional wire 6 is that it should be relatively thin, i.e. it should have a low water holding capacity. The main benefit of the idea is an insignificant re-wetting, since a major portion of the water in the pressing action is forced to transfer into the wires and to the open roll. The lower the water holding capacity of the wires, the more water transfers into the open roll and thereby the centrifugal force slings or hurls the water into an external receptacle. The lower water holding capacity of the wires also results in a higher dry matter content for the web downstream of the nip, and a positive effect will be apparent even at lower sheet grammages.

25

The open-surfaced additional roll 3 can be covered not only by the additional wire 6 but also by a wire sock, which is not necessarily, however, needed, but its bare jacket surface can only be covered by the additional wire 6 at the nip N. It is also possible to employ an open-surfaced roll 3, wherein the bare jacket surface is covered by a coarse wire sleeve topped by a fine wire sock, without a separate additional wire 6. The open pattern of the roll surface can also be produced by means of a coarse wire sock, pulled over a smooth surface and provided with a sufficiently high water holding capacity.

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Fig. 3 depicts an alternative, wherein a nip N created by rolls 2 and 3 is preceded by a second pair of rolls including rolls 2' and 3', which are of the same type as the rolls 2 and 3 included in the downstream pair of rolls but arranged in a reversed order, the open-surfaced dewatering roll 3' against the wire 1 and the opposite roll 2' in contact with the web W through the intermediary of an additional wire 6 extending both through a press nip N' created by the rolls 2' and 3' and through a press nip N of the rolls 2 and 3. The water escaped from the web W at press nip N' through wire 1 into the open places of the surface of roll 3' and hurled from the roll by the action of a centrifugal force is collected in a water receptacle 8' located below the wire 1. Thus, the successive nips N', N result in the dewatering on both sides of the web W.

Fig. 4 depicts a pair of rolls provided by rolls 2', 3' which is otherwise similar to that shown in fig. 3 except that the sector α , in which the wire 1 and the web W supported thereby are curving towards a pick-up suction roll, does not include an additional roll against the roll 2. In this case, the roll 2 may be a regular hard and smooth roll, which has an intact surface or possibly also an open surface. Between the rolls ' and Z against the wire 1 lies a transfer suction box 14 for making sure that the web W holds firmly against the wire while the additional wire 6 separates from top of the web W downstream of the nip N'.

All the above-mentioned rolls 2, 2' having a surface hardness of 50-200 PJ can also be replaced with a prior known shoe press loading roll for creating a smooth long nip with a low pressure, the smooth surface of a roll 2 or 2' having a hardness of 0 PJ.

The first press nip N created by a pair of rolls must be located at the end zone of a wire section downstream of the last dewatering suction boxes at the point where the web has a dry matter content of at least 13
5 % . Such boxes are indicated in the figures with reference numeral 13. The applied solution reduces the re-wetting of the web substantially as only some of the water contained in the wires will be capable of returning into the wire. In addition, the sig-
10 nificance of re-wetting becomes less and less as the grammage of the web increases.

The invention can be used for considerable savings of energy and for reducing noise problems experienced in
15 the machines. In addition, the press section downstream of the equipment operates more effectively since the decrease of web temperature caused by the vacuum of a suction roll will be avoided. Furthermore, the invention can be used within a plurality of speed and
20 grammage ranges. As a matter of fact, as the machine speeds are increasing, the functioning of the invention will be improved even further by virtue of an increased centrifugal force.

25 Moreover, the invention is applicable in machines having a configuration that is different from that of a Fourdrinier machine shown in figs. 1 and 2 wherein the wire 1 is a lower wire and the additional wire 6 is a short overhead wire loop or the upper wire of a
30 twin-wire machine. The invention can be applied e.g. in twin-wire machines wherein, at the end of a vertical dewatering zone, one of the wires and the web supported thereby are guided by means of a suction roll towards a pick-up suction roll.

Claims

1. A method in a paper or board machine for dewatering the web prior to its passage to a press section, the dewatering being effected by means of a pair of rolls, which is located at the end of a wire section upstream of a pick-up suction roll (4) or a like transfer device and through which a wire (1) of the wire section and a web (W) supported thereby travel and one of whose rolls receives water from the web over its area of contact with a path of travel formed by the wire (1) and the web (W), the other roll of said pair of rolls being on the opposite side in contact within said area of contact with the path of travel formed by the wire and the web, whereafter the web (W) supported by the wire (1) of the wire section is guided to the pick-up suction roll (4) or a like, **characterized** in that water is removed from the web (W) by means of an open-surfaced roll (3) included in the pair of rolls by using the combined action of said roll (3) and a roll (2) in contact with the path of travel from the opposite side to apply pressure on the web (W), by collecting water from the web (W) by means of the pressure into the open places in the surface of said roll (3), and by removing the water from the roll (3) through the action of a centrifugal force produced by rotation of the same.
2. A method as set forth in claim 1, **characterized** in that the roll (2) in contact with the path of travel from the opposite side is a smooth-surfaced roll.
3. A method as set forth in claim 2, **characterized** in that the smooth-surfaced roll has a surface hardness of at least 50 PJ, preferably 50 - 200 PJ, and the rolls included in the pair of rolls are loaded against each other with a force of 10 - 100 kN/m.

4. A method as set forth in any of claims 1 - 3, **characterized** in that an additional wire (6) coming to contact with the web (W) is passed through the pair of rolls.

5. A method as set forth in any of the preceding claims, **characterized** in that water is removed within a sector (α), in which the roll (2) located at the end of the wire section guides the wire (1) and the web (W) supported thereby towards the pick-up suction roll (4) or a like, said open-surfaced roll (3) being in contact with the web (W) within said sector (α).

6. A method as set forth in claim 5, **characterized** in that upstream of the pair of rolls located within said sector (α) water is removed by means of another pair of rolls, wherein an open-surfaced roll (3') is in contact with the wire (1) and a second roll (2') is in contact with the web (W) on the opposite side, the rolls together applying pressure on the web (W), as a result of which the water collects from the web in the open places in the surface of the roll (3') and escapes from the roll through the action of a centrifugal force produced by rotation of the same.

7. An apparatus in a paper or board machine for dewatering the web prior to its passage to a press section, said apparatus comprising a pair of rolls located upstream of a pick-up suction roll (4) or a like transfer device in the traveling direction of the web and including rolls (2, 3), through which a wire (1) of the wire section and a web (W) supported thereby are passed, one of the rolls (2, 3) being receive to accept water from the web over the area of its contact with a path of travel formed by the wire (1) and the web (W) and the other roll being in contact

within said area of contact with the path of travel on the opposite side, **characterized** in that the water receiving roll is an open-surfaced roll (3) which, together with a roll (2) mounted on the opposite
5 side, produces a press nip (N) for the removal of water from the web (W), the open places in the surface of said roll (3) being adapted to receive and hold the water escaping from the web for the removal thereof through the action of a centrifugal force produced by
10 rotation of the roll (3).

8. An apparatus as set forth in claim 7, **characterized** in that the roll (2) in contact with the path of travel from the opposite side is a smooth-surfaced
15 roll.

9. An apparatus as set forth in claim 8, **characterized** in that the smooth-surfaced roll (2) has a surface hardness value of at least 50 PJ, preferably
20 50 - 200 PJ.

10. An apparatus as set forth in claim 8, **characterized** in that the smooth-surfaced roll (2) is a per se known shoe press loading roll.
25

11. An apparatus as set forth in any of claims 7-10, **characterized** in that it includes an additional wire (6) which travels through the press nip (N) from the opposite side of the web (W) relative to the wire
30 (1).

12. An apparatus as set forth in claim 11, **characterized** in that the additional wire (6) consists of a second wire, included in the twin-wire dewatering
35 zone of a wire section and located on the opposite side of the web (W) relative to the wire (1).

13. An apparatus as set forth in claim 11, **characterized** in that the additional wire (6) is passed through the pick-up suction roll (4) or a like.

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14. An apparatus as set forth in any of preceding claims 7 - 13, **characterized** in that the pair of rolls has its press nip (N) within the sector (α), wherein the roll (2) mounted at the end of the wire section guides the wire (1) and the web (W) supported thereby towards the pick-up suction roll (4) or a like, the press nip being formed by means of an open-surfaced roll (3) which is in contact with the web (W) on the opposite side.

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15. An apparatus as set forth in claim 13, **characterized** in that upstream of said press nip (N) of the pair of rolls there is another pair of rolls including an open-surfaced roll (3') which, together with a roll (2') mounted on the opposite side, forms a press nip (N') for dewatering the web (W), the open places in the surface of the roll (3') being adapted to receive and hold the water escaping from the web for the removal thereof through the action of a centrifugal force produced by the rotating motion of the roll (3').

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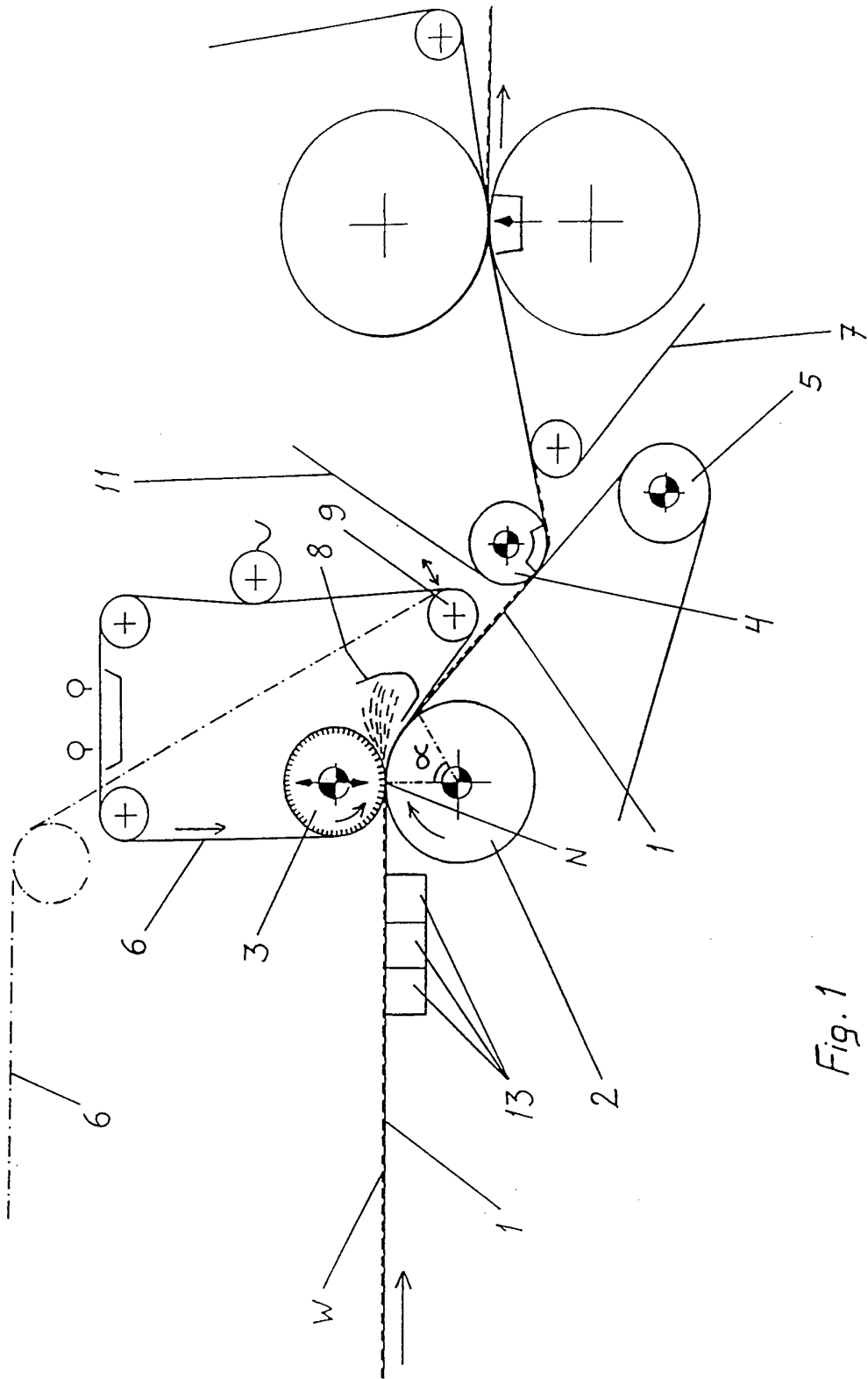


Fig. 1

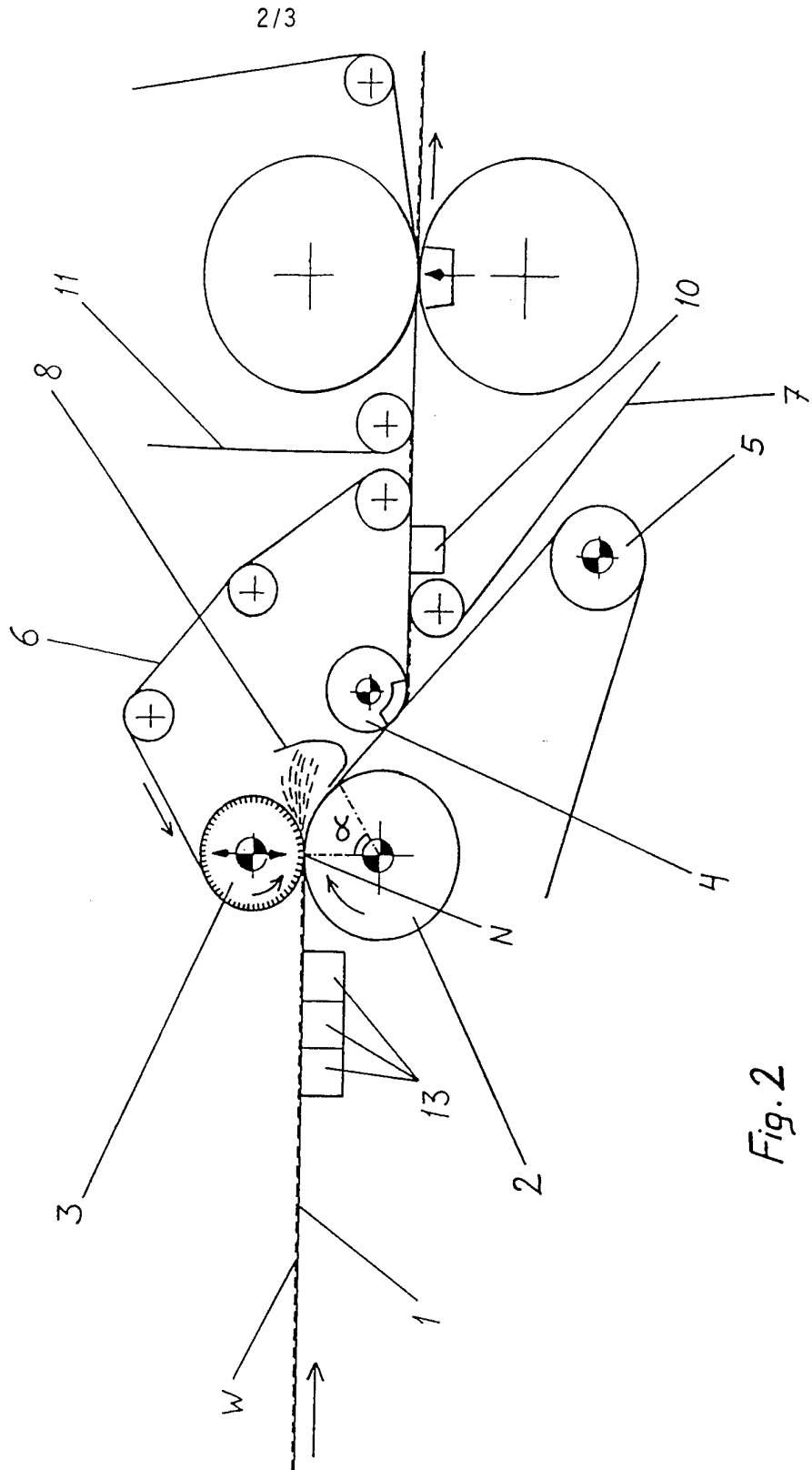


Fig. 2

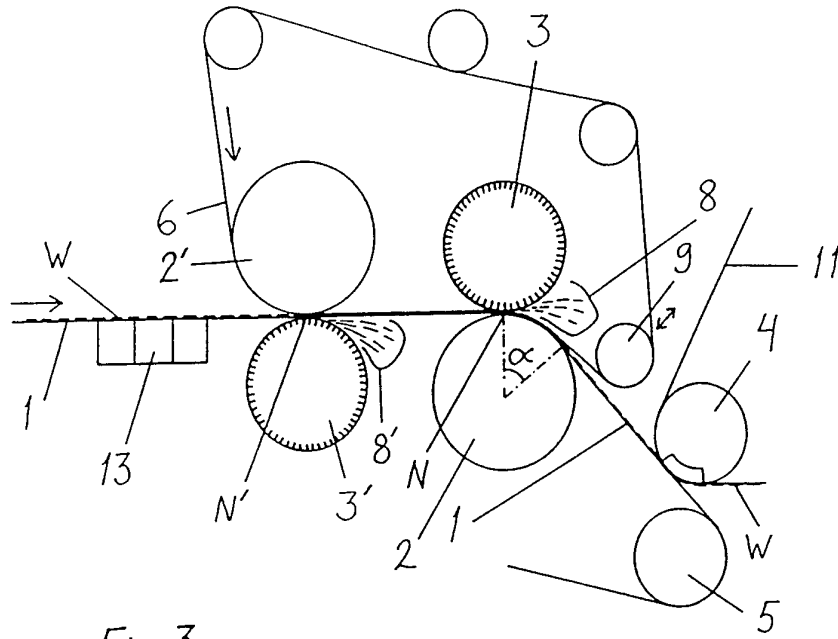


Fig. 3

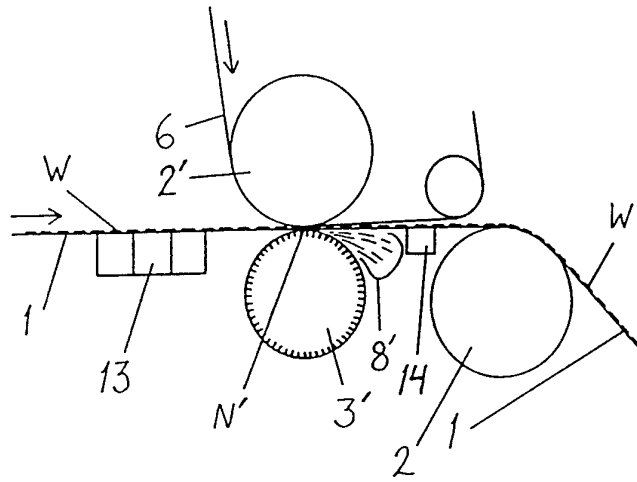


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 94/00250

A. CLASSIFICATION OF SUBJECT MATTER

IPC 5: D21F 1/00 // D21F 9/00, D21F 11/00
According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

IPC 5: D21F

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.
X	DE, A1, 3107730 (J.M. VOITH GMBH), 16 Sept 1982 (16.09.82), page 9, line 1 - page 10, line 8, figure 1, claims 1,17	1,2,4,7,8, 11,12
A	-- -----	5,13,14

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 See patent family annex.

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15 Sept 1994

Date of mailing of the international search report

20-09-1994

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