

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
6 March 2003 (06.03.2003)

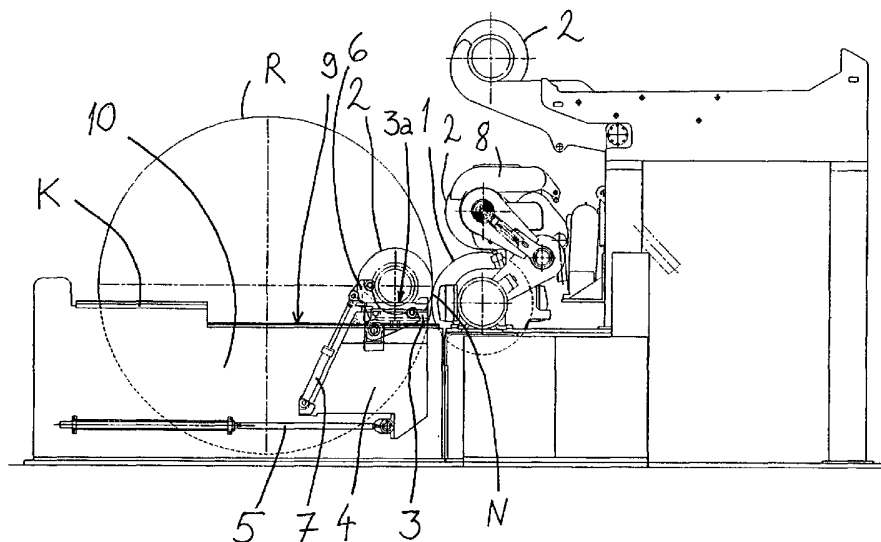
PCT

(10) International Publication Number  
**WO 03/018455 A1**

- (51) International Patent Classification<sup>7</sup>: **B65H 19/22**
- (21) International Application Number: PCT/FI02/00694
- (22) International Filing Date: 27 August 2002 (27.08.2002)
- (25) Filing Language: Finnish
- (26) Publication Language: English
- (30) Priority Data:  
20011710 27 August 2001 (27.08.2001) FI
- (71) Applicant (for all designated States except US): **METSO PAPER, INC.** [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **KOJO, Teppo** [FI/FI]; Alhontie 10, FIN-04600 Mäntsälä (FI). **MÄKI-NEN, Risto** [FI/FI]; Sointulantie 2, FIN-04600 Mäntsälä (FI).
- (74) Agent: **TAMPEREEN PATENTTITOIMISTO OY**; Hermiankatu 12B, FIN-33720 Tampere (FI).
- (81) Designated States (*national*): AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK (utility model), SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**  
— with international search report

[Continued on next page]

(54) Title: METHOD FOR TRANSFERRING A REEL, AND A REEL-UP



(57) Abstract: In the method for transferring a reel in a reel-up for paper or paperboard, a continuous paper or paperboard web (W) is guided via a reeling member (1) to form a machine reel (R) around a reel spool (2), the ends of which are supported on top of supporting surfaces that move in relation to the reeling member (1) in the radial direction of the machine reel under the guidance of a supporting frame (10) located on both sides of the reel, in accordance with the change of position of the reel spool (2). The supporting surfaces (3a) are transferred as a part of the motion of the transfer devices moved by means of force devices (5), such as reeling carriages (4) while the supporting surfaces are coupled to the transfer devices and are supported by tracks, the height position of which is between the supporting base for the supporting frame (10), such as the floor level, and the supporting surfaces (3a).



WO 03/018455 A1



---

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

## Method for transferring a reel, and a reel-up

The invention relates to a method for transferring a reel which is of the type presented in the preamble of the appended claim 1. The invention  
5 also relates to a reel-up which is of the type presented in the preamble of the appended claim 5.

In the final end of a paper machine or finishing apparatus for paper a paper web, typically of several meters in width which has been  
10 produced and/or treated in earlier machine sections, is reeled around a reel spool to form a machine reel. In this reeling up process a reeling cylinder that is journaled rotatable is typically used for guiding the paper web on the machine reel, wherein the nip contact between the reeling cylinder and the machine reel is utilized to influence the quality  
15 of the reel produced thereby. A conventional solution is the one in which the reeling cylinder remains stationary and the reel spool around which the reel is accumulated in nip contact is moved during reeling in the supporting structure, for example by supporting the ends of the reel spool on reeling rails. The ends of the reel spool are acted upon with a  
20 suitable loading mechanism to adjust the nip contact between the machine reel that is being formed and the reeling cylinder. Such reeling concepts and loading methods related thereto are disclosed for example in the Finnish patent 91383 and in the corresponding US patent 5,251,835, as well as in the Finnish patent application 950274  
25 and in the corresponding US patent 5,690,298.

Publication WO 99/57048 discloses a reeling carriage on the upper part of which there are supporting surfaces supporting the ends of the reel spool and separate force devices for loading the reel against the  
30 reeling cylinder via the ends of the reel spool. The carriage is arranged to move on wheels on a floor, and to be positioned by means of a transfer device, such as a conveyor screw.

Finnish patent application 981427 and the corresponding international  
35 publication WO 99/65806 disclose a solution in which both ends of the reel spool are placed on a supporting surface, which is located in a sledge arranged, movable on the frame of the reel-up by means of

linear guides. The new reel spool is lowered on the support of these sledges by means of a primary reeling device, and after a reel change the reeling carriages that have delivered a full reel are brought in contact with the end of the reel spool and the jaws are locked around the bearing housing in the end of the reel spool. The loading and the transfer of the reel spool as the reel grows is implemented by means of reeling carriages to which force devices such as hydraulic cylinders have been connected. Both sledges move along with the movement of the reeling carriages along the linear guides, and the sledges support the reel and receive the weight of the reel. Thus it is possible to avoid the disturbances caused by the friction between the bearing housings of the ends of the reel spool and the reeling rails in the control of the nip load. In the end of the reeling process it is possible to transfer the ends of the reel spool by means of the carriages from the top of the supporting surfaces to a change station on stationary reeling rails functioning as an extension to said supporting surfaces, and the sledges can be driven to a change station in the vicinity of the reeling cylinder by means of actuators of their own to receive a new reel spool from the primary reeling device. The web is changed onto the reel spool located on top of the sledges by means of a suitable change method.

By means of the above-mentioned solution it is possible to control the structure of the reel produced during the reeling in a very precise manner, because the loading and thereby the nip load can be adjusted accurately. It is an aim of the invention to present a method by means of which the same advantages can be attained more easily than before with less amount of control and smaller number of actuators. To attain this purpose, the method according to the invention is primarily characterized in what will be presented in the characterizing part of the appended claim 1. The sledge and the reeling carriage are connected to each other, wherein it is possible to move them together with the same actuator by means of which the reel spool can be transferred in the direction of the radius of the reel, in other words in accordance with the growth of the reel. As is characteristic to said known solution, in this solution the ends of the reel spool also rest on the supporting surfaces of the sledges and they do not roll on stationary reeling rails during a

nip-closed reeling process. The sledge is supported from underneath by a supporting surface, such as a guide that is located in a supporting frame above the floor level.

5 By means of the invention the same advantages are attained than in the solution presented in the above-mentioned international publication WO 99/65806, i.e. the ends of the reel spool rest on supporting surfaces that are arranged in sledges moving on linear guides, and thus the friction between the ends of the reel spool and the reeling rails  
10 is eliminated. All the factors affecting the friction are stable during the entire reeling process, and thus they do not cause changes in the loading in the reeling nip. The reeling carriage and the sledge can be moved as one single kinetic entity by means of one actuator on both sides of the reel-up, and thus the sledge does not require an actuator  
15 of its own to transfer the sledge to receive the new reel spool.

Because the sledge and the reeling carriage are connected to each other to form an entity in which they can be moved together, the sledge is in the change station located in connection with the reel spool of the  
20 full reel. The change to the empty reel spool is conducted when the reel spool is supported by the primary reeling device. When the change has been conducted, the reeling carriages and sledges are driven underneath the ends of the new reel spool, and the new reel spool around which the formation of the new reel has begun, is lowered on  
25 the sledges.

The reel-up according to the invention, in turn, is primarily characterized in what will be presented in the characterizing part of the appended claim 5.

30

In the following, the invention will be described in more detail with reference to the appended drawings, in which

Fig. 1 shows a side-view of a reel-up according to the invention,  
35

Figs. 2a to 2d illustrate the different stages of the reeling process, and

5 Fig. 3 shows the sledge and the carriage when seen in the travel direction of the sledge.

Fig. 1 shows the reel-up according to the invention in a side view. It comprises a stationary reeling cylinder 1 that is journaled rotatable, via which reeling cylinder the paper web coming from a paper machine or a finishing apparatus for paper is reeled on a machine reel R. The full machine reel R is outlined in the drawing. In the drawing, the reel-up type is a continuous reel-up in which the paper web is changed to travel on a new reel at the running speed. The reel-up can also be a re-reeler.

15

The web is reeled to form a machine reel around a reel spool 2 equipped with a centre drive of its own. The drawing shows a reel spool at the initial stage of the reeling (paper web not shown). Thus, the web enters the reel via a reeling nip N located between the reeling cylinder 1 and the reel, the linear load prevailing in said reeling nip being controlled by means of force devices according to a principle known as such.

20

Both ends of the reel spool 2, more precisely the peripheral surface of their bearing housings is supported by a sledge 3. Fig. 1 shows a sledge located on one side of the reel-up, and a corresponding sledge as well as other structures located in conjunction therewith also on the opposite side. The upper surface of the sledge 3 forms an approximately horizontal supporting surface 3a, the bearing housing located at the end of the reel spool 2 resting on top of the surface. This sledge 3 is arranged movable under the control of at least one linear guide 9 in the growth direction of the reel, i.e. in the radial direction of the reel. The linear guide 9 is positioned in a supporting frame 10 above the floor level. Thus, the sledge 3 replaces the stationary reeling rail on top of which the reel spool has rolled forward according to prior art during the nip-closed reeling. The supporting surface 3a is located at the same height than the stationary reeling rail K located at the end

25

30

35

of its track of movement and belonging to the supporting frame 10. In the end of the track of movement of the sledge 3 the upper surface of the reeling rail K functions as an extension to the supporting surface 3a, and the end of the reel spool 2 can roll from the supporting surface 3a to the upper surface of the reeling rail K.

Fig. 1 also shows a reeling carriage 4, which is moved in the growth direction of the reel with a force device 5, and which also determines the linear load in the reeling nip N. The force device is typically a pressure medium operated actuator, such as a hydraulic cylinder. The carriage 4 also contains a locking jaw 6 that is journaled pivotable in the vertical plane, said locking jaw entering on the opposite side of the nip N in contact with the peripheral surface of the bearing housing in the end of the reel spool, as well as a corresponding actuator 7 that turns the locking jaw.

The sledge 3 that moves under the guidance of the linear guide as well as the carriage 4 that is moved by means of the force device 5 are connected together in such a manner that they can be moved as a single entity. By moving the carriage 4 by means of the force device 5 it is at the same time possible to move the sledge 3. A separate actuator is not needed for the movement of the sledge 3. However, by replacing the stationary reeling rail with a moving element, the same advantages are attained in the precision of the control of the reeling parameters as presented earlier in the publication WO 99/65806.

The track that supports the sledge 3 during its movement, such as a linear guide, is located in the supporting frame 10, which, in turn, is supported by the floor level or a corresponding horizontal supporting base. The track of the sledge is located between the supporting base (floor) and the supporting surface 3a in the height direction, and advantageously closer to the supporting surface 3a than to the supporting base of the supporting frame, in other words, the sledge 3 is relatively low and easy to move.

Figs 2a to 2d show the different stages of the reeling process implemented by means of the invention. The drawings show the reel-

up schematically from one side and the corresponding parts on the other side of the reel-up are at the same stage, whereby the movements of the moving parts located on different sides occur in a synchronized manner.

5

Fig. 2a shows the reeling carriage 4 and the sledge 3 in the final station in which the sledge 3 has been brought against a shoulder located between the horizontal supporting surface of the supporting frame bearing the linear guide 9 and the upper surface of the reeling rail K.

10 This final station is attained when the machine reel R has reached its final diameter, and it has been driven off the reeling cylinder 1 by means of the carriages 4, wherein the reeling nip N opens. Before the reeling nip is opened, a separate press device 11 that can be a rotating roll or a brush device, has been transferred against the peripheral  
15 surface of the reel to prevent access of air to the reel between the topmost paper layers still entering the reel. Fig. 2a also shows a new, empty reel spool 2 brought to the change station. The new reel spool is transferred and rotated by means of a primary reeling device 8 that is capable of transferring the reel spool in the direction of the peripheral  
20 surface of the reeling cylinder 1. The change around the new reel spool 2 of the web W entering the reel-up via the reeling cylinder 1 is conducted by means of a known change method. During the change the reel spool is supported by the primary reeling device 8 in a position in which its bearing housings are located above the level defined by the  
25 track of movement of the supporting surface 3a.

In Fig. 2b the change has been conducted and the full machine reel R has been transferred from the support of the supporting surfaces 3a to the stationary reeling rails K to a discharge station, from which it can be  
30 transferred off the reel-up for example by means of a crane. The reeling carriage 4 along with the sledge 3 are transferred towards the reeling cylinder 1 to receive the new reel spool 2, around which the formation of a new machine reel R has begun. The sledge 3 is driven to a suitable position in relation to the new reel spool 2 by means of the  
35 carriage 4.

Fig. 2c shows a situation in which the new reel spool 2 has been lowered down by means of the primary reeling device 8 in nip contact with the reeling cylinder 1 to such an extent that the bearing housing in the end of the reel spool 2 is brought on top of the supporting surface 3a of the sledge 3. The locking jaw of the carriage 4 is turned into contact with the bearing housing, and at this stage the torque is also changed from the drive of the primary reeling device 8, i.e. from the primary drive, to the drive by means of which the reel spool 2 and the machine reel R are rotated until the end of the reeling, i.e. to the secondary drive.

Fig. 2d shows a situation in which the reel has grown into its full size and the reeling carriage 4 and the sledge 3 have been transferred further away from the reeling cylinder 1 according to the change of position of the reel spool 2. Thereafter the above-described press device is driven into contact with the reel, and the reel can be transferred by means of carriages 4 to the position shown in Fig. 2a.

The change can also be conducted in such a manner that during the change the full reel is in nip contact with the reeling cylinder, a new empty reel spool 2 is transferred to the change station by means of the primary reeling device, the paper web W is changed by means of some change method to travel around a new reel spool 2, and the full reel is thereafter released from the nip contact and transferred onto the support of the stationary reeling rails K by means of the carriages 4, and finally, the carriages 4 are driven to the reeling cylinder 1 to a receiving station so that the reel spool 2 around which the formation of a new reel has begun, can be lowered on the support of the supporting surfaces 3a of the carriages 3. Thus, during the change the full reel R is in the position shown by Fig. 2d.

Fig. 3 shows the carriage 4 and the sledge 3 when seen in the direction of the reeling rails and the guide. The carriage 4 is primarily located in a position lower than the guide 9, next to the supporting frame 10, and it contains an actuator 7 for turning the locking jaw 6. The force device 5 for moving the carriage 4 is attached at one end to the supporting frame 10 at the other end to the carriage 4 below the guide 9. The

sledge 3 is fixedly connected to the carriage 4 in its upper part, and the sledge is located directly on top of the guide 9. The sledge 3 and the reeling carriage 4 form an integrated entity, comprising a substantially vertical carriage 4 located outside the supporting frame 10 and a  
5 sledge 3 connected to the upper part of the carriage and directed to the side of the carriage to lie on top of the supporting frame 10. The sledge 3 is advantageously arranged to move on top of a track formed by the guide 9, by means of adjacent roller means such as rolls 3b that have been journalled rotatable in the lower part of the sledge.

10

The invention is not restricted to the embodiments described above, but it can be modified within the scope of the inventive idea presented in the claims. For example the method is not restricted only to the above-presented change methods, but other change methods enabled  
15 by the reeling structure can also be possible. In addition to reel-ups, the invention can also be applied in re-reelers. Re-reelers in which machine reels are re-reeled to improve their quality, also contain a reeling member which is in nip contact with a growing machine reel, as well as a reel spool moving as a result of the growth of the diameter of  
20 the machine reel.

Claims:

1. A method for transferring a reel in a reel-up for paper or paperboard web, in which a continuous paper or paperboard web (W) is guided via a reeling member (1) to form a machine reel (R) around a reel spool (2) the ends of which are supported on top of supporting surfaces that move in relation to the reeling member (1) in the radial direction of the machine reel under the guidance of a supporting frame (10) located on both sides of the reel, in accordance with the change of position of the reel spool (2), **characterized** in that the supporting surfaces (3a) are transferred as a part of the motion of transfer devices moved by means of force devices (5), such as reeling carriages (4), while the supporting surfaces (3a) are coupled to the transfer devices and are supported by tracks, the height position of which is between the supporting base of the supporting frame (10), such as the floor level, and the supporting surfaces (3a).
2. The method according to claim 1, **characterized** in that during the reeling, the machine reel is transferred while on top of the supporting surfaces (3a) by means of transfer devices into the vicinity of reeling rails (K), and from the supporting surfaces (3a) on the support of fixed reeling rails (K).
3. The method according to claim 1 or 2, **characterized** in that the change of the web to a new reel spool (2) is conducted when the reel spool is separated from the supporting surfaces (3a) and a new reel spool (2) around which the web (W) has been changed to travel is transferred onto the support of supporting surfaces (3a) brought to the change station in such a manner that the ends of the reel spool (2) are positioned on top of the supporting surfaces.
4. The method according to claim 3, **characterized** in that the following steps are taken in connection with the final stage of the reeling and the reel change:

10

- 1) transferring the machine reel (R) that is becoming full while on the support of the supporting surfaces (3a) by means of a transfer device in accordance with the growth of the diameter of the machine reel,
- 5 2) delivering the full machine reel (R) from the support of the supporting surfaces (3a) to a discharge station,
- 3) cutting the web (W) and changing the web around the reel spool (2) brought to the change station,
- 4) transferring the supporting surfaces (3a) to a change station by means of the transfer devices, and
- 10 5) transferring the new reel spool (2) and an initial reel (R) onto the support of support surfaces (3a) in the change station.

5. Reel-up comprising a reeling member (1) that is arranged to guide a continuous paper or paperboard web on a machine reel (R) around a rotating reel spool (2), and at both ends of the reel spool a supporting frame (10) that is arranged to guide the supporting surfaces (3a) that support the ends of the reel spool and are arranged movable, as well as a transfer device, such as reeling carriages (4), that are arranged to move by means of force devices (5) substantially in the direction of the track of movement of the supporting surfaces (3a), **characterized** in that the supporting surfaces (3a) are coupled to the transfer devices in such a manner that they can be transferred as one entity, and they are supported by tracks, the height position of which is between the supporting base for the supporting frame (10), such as the floor level, and the supporting surfaces (3a).

6. The reel-up according to claim 5, **characterized** in that the supporting surface (3a) is located in a sledge (3) that is arranged to move in the supporting frame (10) by means of one or several linear guides (9).

7. The reel-up according to claim 5 or 6, **characterized** in that in the end of the track of movement of the supporting surface (3a) there is a stationary reeling rail (K) whose supporting surface forms an extension to the moving supporting surface (3a).

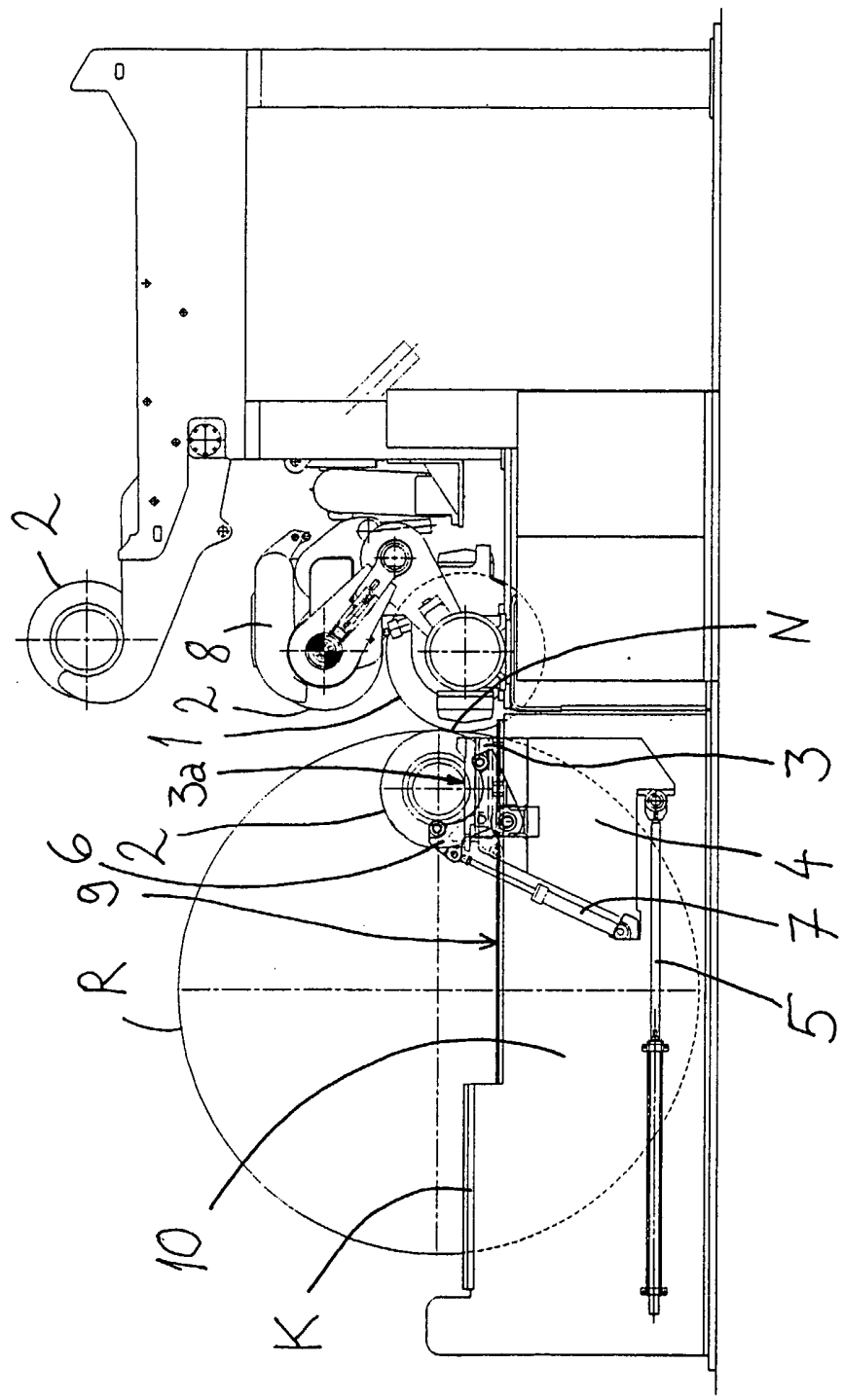
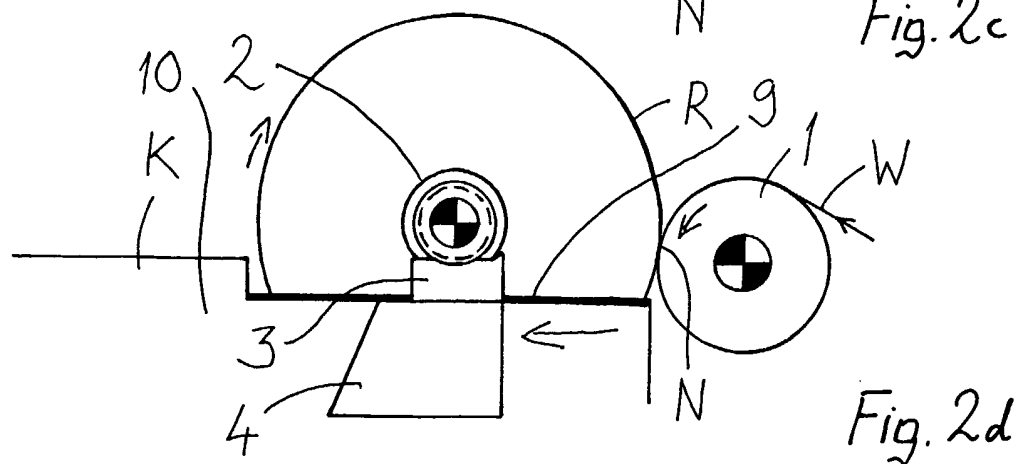
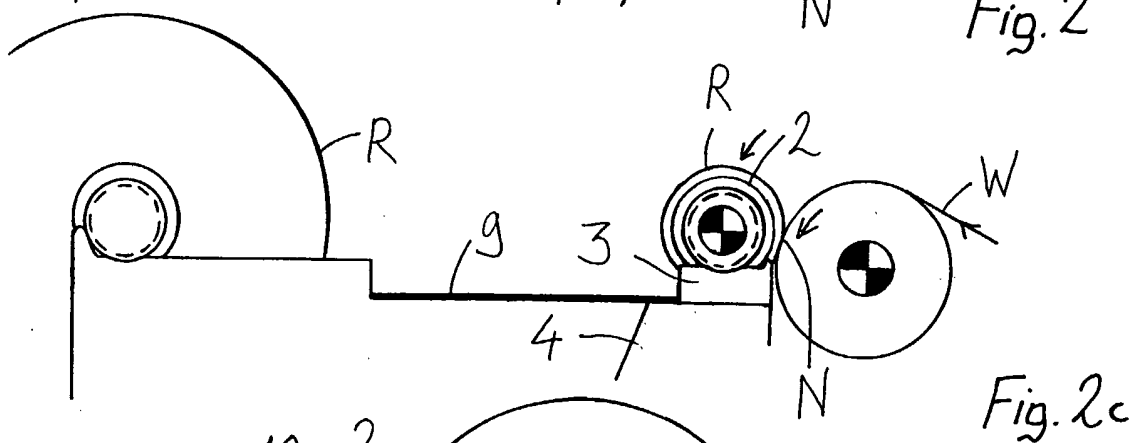
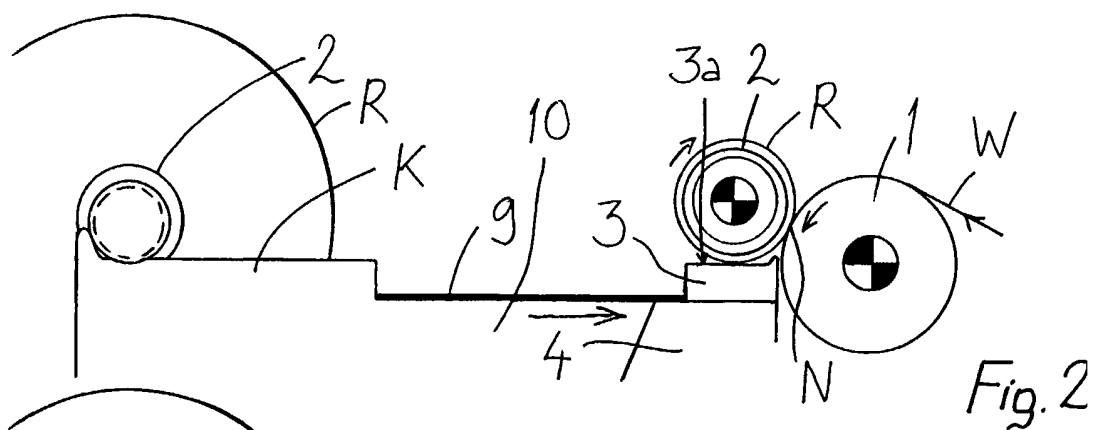
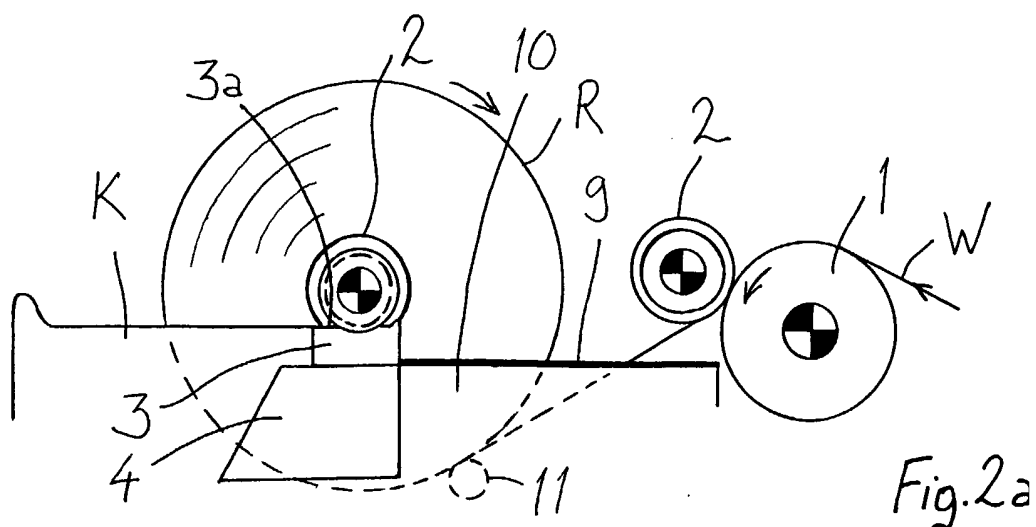
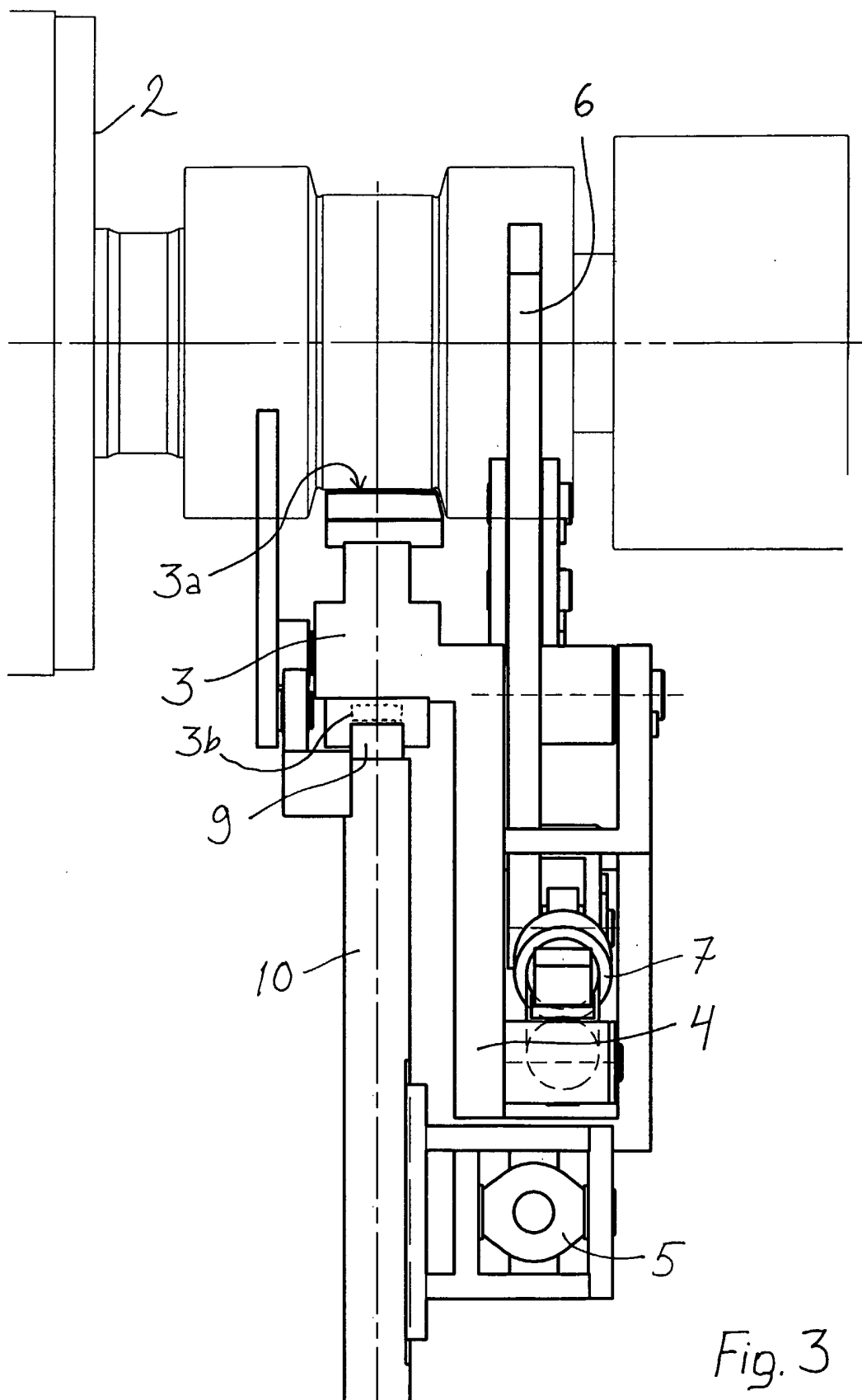


Fig. 1

2/3





## INTERNATIONAL SEARCH REPORT

International Application No

PCT/FI 02/00694

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B65H19/22

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)

IPC 7 B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages                                                                               | Relevant to claim No. |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A          | WO 99 65806 A (VALMET CORP ; LUNDBERG JUSSI (FI); RAETY JARKKO (FI); RUHA PEKKA (F)<br>23 December 1999 (1999-12-23)<br>page 11, line 26 -page 14, line 2<br>--- | 1-7                   |
| A          | US 6 186 437 B1 (RANTANEN JOUNI ET AL)<br>13 February 2001 (2001-02-13)<br>abstract<br>---                                                                       | 1-7                   |
| A          | WO 00 66471 A (VALMET CORP ; KOJO TEPPU (FI); VERAJEJENKORVA JANNE (FI))<br>9 November 2000 (2000-11-09)<br>page 7, line 12-37<br>-----                          | 1-7                   |

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in 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" 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 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.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

14 November 2002

Date of mailing of the international search report

05.12.02

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

TOMMY BLOMBERG/JA A

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/FI 02/00694

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|----|---------------------|----------------------------|---------------------|
| WO 9965806                                | A  | 23-12-1999          | FI 981427 A                | 19-12-1999          |
|                                           |    |                     | AU 4911999 A               | 05-01-2000          |
|                                           |    |                     | CA 2334834 A1              | 23-12-1999          |
|                                           |    |                     | CN 1305430 T               | 25-07-2001          |
|                                           |    |                     | EP 1135316 A1              | 26-09-2001          |
|                                           |    |                     | WO 9965806 A1              | 23-12-1999          |
|                                           |    |                     | JP 2002518272 T            | 25-06-2002          |
| -----                                     |    |                     |                            |                     |
| US 6186437                                | B1 | 13-02-2001          | FI 981013 A                | 08-11-1999          |
|                                           |    |                     | AU 3934899 A               | 23-11-1999          |
|                                           |    |                     | CA 2331402 A1              | 11-11-1999          |
|                                           |    |                     | EP 1075444 A1              | 14-02-2001          |
|                                           |    |                     | WO 9957048 A1              | 11-11-1999          |
| -----                                     |    |                     |                            |                     |
| WO 0066471                                | A  | 09-11-2000          | AU 4300100 A               | 17-11-2000          |
|                                           |    |                     | EP 1206405 A1              | 22-05-2002          |
|                                           |    |                     | WO 0066471 A1              | 09-11-2000          |
| -----                                     |    |                     |                            |                     |