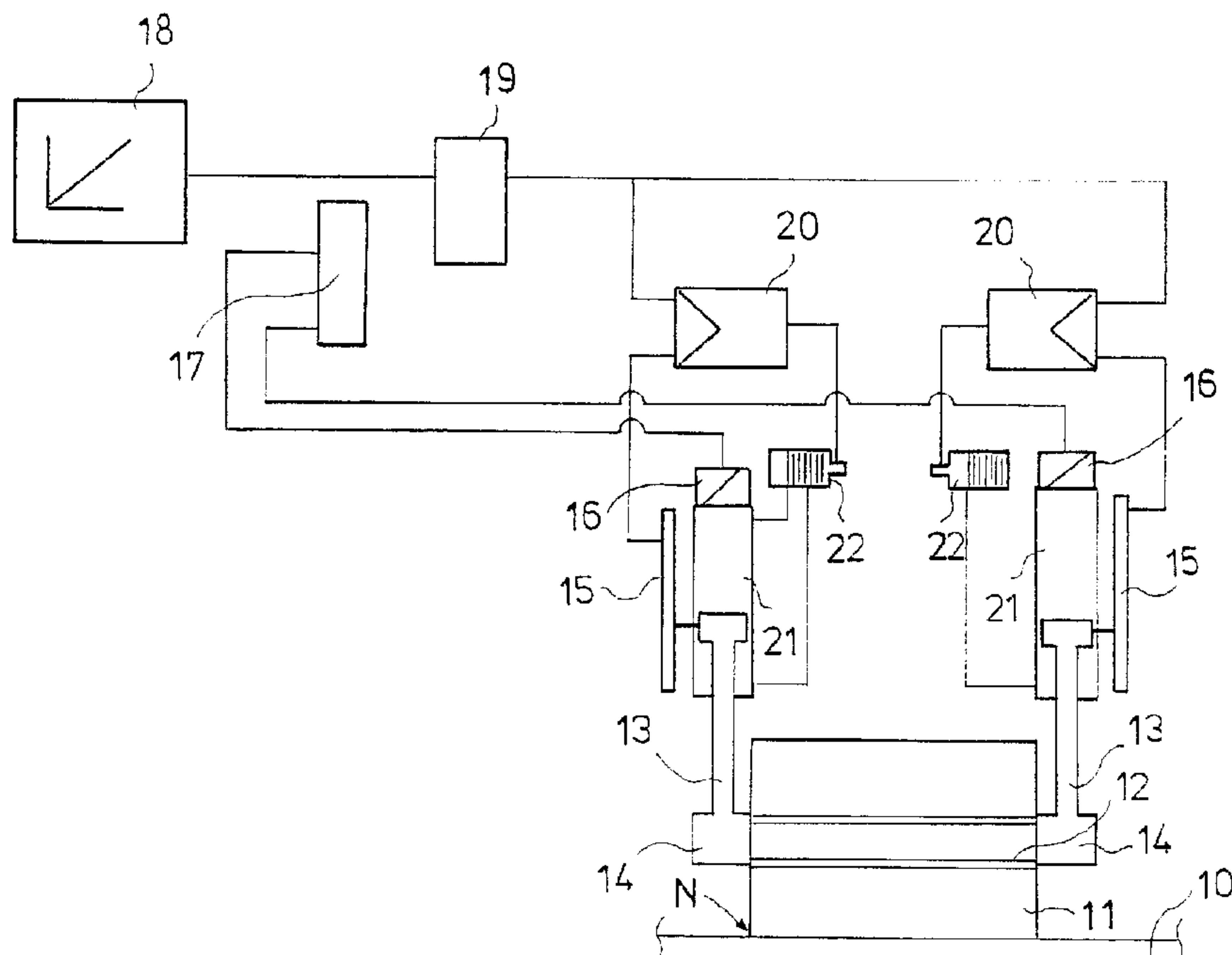




(86) Date de dépôt PCT/PCT Filing Date: 2000/03/16
(87) Date publication PCT/PCT Publication Date: 2000/09/21
(85) Entrée phase nationale/National Entry: 2001/09/14
(86) N° demande PCT/PCT Application No.: FI 2000/000211
(87) N° publication PCT/PCT Publication No.: 2000/055078
(30) Priorité/Priority: 1999/03/17 (990595) FI

(51) Cl.Int.⁷/Int.Cl.⁷ B65H 18/00
(71) Demandeur/Applicant:
METSO PAPER, INC., FI
(72) Inventeur/Inventor:
LESKINEN, ARTO, FI
(74) Agent: SIM & MCBURNEY

(54) Titre : PROCEDE ET DISPOSITIF D'ENROULEMENT D'UNE BANDE
(54) Title: METHOD AND DEVICE IN WINDING OF A WEB



(57) **Abrégé/Abstract:**

The invention relates to a method for winding a web, said method comprising the steps of winding a web roll (11) by passing the web onto a core (12) or the like via a pressure nip (N) formed between a winding drum (10) and the roll (11), whereby the core (12) or the like element is supported by means of chucks (14) or the like mounted on roll support arms (13). In the method, the pressing-nip force in the nip (N) formed between the roll (11) and the winding drum (10) is controlled using a position-feedback technique in which the movements of the roll support arms (13) are synchronized. The invention also relates to a device for winding a web, said device being intended for use in conjunction with winding a web roll (11) onto a core (12) or the like via a pressure nip (N) formed between a winding drum (10) and the roll (11), whereby the core (12) or the like element is supported by means of chucks (14) or the like mounted on roll support arms (13). The device includes means (15, 16, 17, 18, 19, 20, 21, 22) for controlling the pressing-nip force in the nip (N) formed between the roll (11) and the winding drum (10) using a position-feedback technique in which the movements of the roll support arms (13) are synchronized.



**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : B65H 18/00	A1	(11) International Publication Number: WO 00/55078 (43) International Publication Date: 21 September 2000 (21.09.00)		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; padding: 5px;"> (21) International Application Number: PCT/FI00/00211 (22) International Filing Date: 16 March 2000 (16.03.00) (30) Priority Data: 990595 17 March 1999 (17.03.99) FI (71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): LESKINEN, Arto [FI/FI]; Vanha Hämeentie 892, FIN-05450 Nukari (FI). (74) Agent: FORSSÉN & SALOMAA OY; Yrjönkatu 30, FIN-00100 Helsinki (FI). </td> <td style="width: 50%; vertical-align: top; padding: 5px;"> (81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, DZ, EE, EE (Utility model), ES, FI, FI (Utility model), 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, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> </td> </tr> </table>			(21) International Application Number: PCT/FI00/00211 (22) International Filing Date: 16 March 2000 (16.03.00) (30) Priority Data: 990595 17 March 1999 (17.03.99) FI (71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): LESKINEN, Arto [FI/FI]; Vanha Hämeentie 892, FIN-05450 Nukari (FI). (74) Agent: FORSSÉN & SALOMAA OY; Yrjönkatu 30, FIN-00100 Helsinki (FI).	(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, DZ, EE, EE (Utility model), ES, FI, FI (Utility model), 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, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(21) International Application Number: PCT/FI00/00211 (22) International Filing Date: 16 March 2000 (16.03.00) (30) Priority Data: 990595 17 March 1999 (17.03.99) FI (71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): LESKINEN, Arto [FI/FI]; Vanha Hämeentie 892, FIN-05450 Nukari (FI). (74) Agent: FORSSÉN & SALOMAA OY; Yrjönkatu 30, FIN-00100 Helsinki (FI).	(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, DZ, EE, EE (Utility model), ES, FI, FI (Utility model), 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, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>			
(54) Title: METHOD AND DEVICE IN WINDING OF A WEB				
(57) Abstract The invention relates to a method for winding a web, said method comprising the steps of winding a web roll (11) by passing the web onto a core (12) or the like via a pressure nip (N) formed between a winding drum (10) and the roll (11), whereby the core (12) or the like element is supported by means of chucks (14) or the like mounted on roll support arms (13). In the method, the pressing-nip force in the nip (N) formed between the roll (11) and the winding drum (10) is controlled using a position-feedback technique in which the movements of the roll support arms (13) are synchronized. The invention also relates to a device for winding a web, said device being intended for use in conjunction with winding a web roll (11) onto a core (12) or the like via a pressure nip (N) formed between a winding drum (10) and the roll (11), whereby the core (12) or the like element is supported by means of chucks (14) or the like mounted on roll support arms (13). The device includes means (15, 16, 17, 18, 19, 20, 21, 22) for controlling the pressing-nip force in the nip (N) formed between the roll (11) and the winding drum (10) using a position-feedback technique in which the movements of the roll support arms (13) are synchronized.				

CA 02367687 2001-09-14

WO 00/55078

PCT/FI00/00211

1

Method and device in winding of a web

5 ~~The present invention relates to a method in winding a web, in which method a~~
roll is wound by passing the web onto a core or the like via a pressure nip formed
between a winding drum and the web roll being wound, whereby the core or the
like element is supported by means of chucks or the like mounted on the web roll
~~support arms.~~

1a
A1

10

~~The invention also concerns a device for winding a web, said device being~~
designed for use in winding the web into a roll onto a core or the like via a
pressure nip formed between a winding drum and the web roll being wound,
whereby the core or the like element is supported by means of chucks or the like
15 ~~mounted on the web roll support arms.~~

1a
A5

As known in the art, the web roll is supported in center-driven winders by chucks
inserted in the center of the core. The chucks are mounted on the web roll support
arms that are adapted laterally movable into preset positions. In some winder
20 designs, the winding nip pressure is controlled by applying to both of the
cylinders that support the web roll from its ends an equal line pressure, that is,
having the cylinders connected in parallel, while in certain other designs each
winder arm is controlled separately based on feedback signals obtained from sen-
sors. A problem hampering these conventional winder constructions is that a
25 bump forming on the web roll causes lateral inclination of the roll, whereby a
pressure- or force-controlled feedback arrangement may result in telescoping of
the roll. Obviously, this results in an unbalanced roll.

As known by those skilled in the art, this complication occurs chiefly so that the
30 bump gradually forming on the roll causes the roll to tilt so that the pressure nip
opens at one end while the other end is subjected to a high nip pressure, whereby

1a

A1

- 5 The present invention relates to a method for winding a web, said method comprising the steps of winding a web roll by passing the web onto a core via a pressure nip (N) formed between a winding drum and the roll being wound, whereby the core is supported by means of chucks mounted on roll support arms, in which method the pressing-nip force in the nip formed between the roll and the winding drum is
10 controlled.

A5

- The invention also relates to a device for winding a web, said device being intended
15 for use in conjunction with winding a web roll onto a core via a pressure nip formed between a winding drum and the roll, whereby the core is supported by means of chucks mounted on roll support arms, which device includes means for controlling the pressing-nip force in the nip formed between the roll and the winding drum.

WO 00/55078

PCT/FI00/00211

2

one of the roll support arms remains higher from the roll than the other one when the winding operation is completed.

5 In regard to the prior art, reference is made to FI Pat. No. 100467, owned by the applicant, wherein a method is disclosed for use in winding a web, in which method the winding of the web takes place supported on a carrier roll onto a core via a pressure nip formed between the carrier roll and the paper roll being wound. In this prior-art method, the core rotates at least partially supportedly and the core/roll is supported and/or loaded by a device whose position is arranged
10 movable. During the initial stage of winding, the loading/support element(s) of the device is/are transferred by an essentially linear movement in a plane substantially passing through the axes of the carrier roll and the paper roll being wound thus accomplishing the loading and/or supporting of the roll being wound up in the winding station. With the progress of the winding operation, the loading/support
15 element(s) is/are moved downwardly along a trajectory which is substantially compliant with the perimeter of the roll being wound and, at the final stage of winding, the roll being finished is supported from below by said element(s). By virtue of said element(s), the loading and/or support force imposed on the roll being wound is controlled chiefly by the pressure nip force and the surface-drive
20 force.

It is an object of the invention to provide a method and a device capable of overcoming the complications caused by a bump possibly forming on a web roll being wound.

25

It is a further object of the invention to provide a method and a device offering easier and more accurate control of the web roll structure resulting from a winding operation.

30

To achieve the above-stated goal and others to be described later in the text, the method according to the invention is generally characterized in that ~~the pressing~~

← 2a
DI

2a

D1

- 5 With respect to the prior art relating to the invention, reference is also made to US Pat. No. 3,568,944, in which a power mechanism and control circuit provide a continuously and automatically variable force lifting a part of the weight of a mill roll being wound on the core shaft to maintain optimum pressure on the incoming web travelling between the mill roll and a winding drum supporting the roll.
- 10 Another aspect of this prior art arrangement is that the power mechanism unrolls a length of web from a finished roll so that the web can be severed from a convenient location and still leave ample free web to start the next roll. A further feature is an automatic nip guard when the machine is used in a winding operation.

15

WO 00/55078

PCT/FI00/00211

3

~~force of the nip formed between the web roll being wound according to the method and the winding drum is controlled by a position-feedback technique based on synchronized movements of the roll support arms~~

3a
B1

- 5 Furthermore, the device according to the invention is generally characterized in that said device includes ~~means for controlling the pressing nip force in the nip formed between the roll and the winding drum using a position-feedback technique in which the movements of the roll support arms are synchronized~~

3a
B2

- 10 According to the invention, the pressing-nip force is controlled using a position-feedback technique in which the movement of the roll support arms is synchronized with the help of, e.g., electrical, mechanical or hydraulic means. Mechanical synchronization can take place via, e.g., the core or the chucks, while hydraulic synchronization can be implemented using series-connected cylinders.
- 15 Electrical synchronization in turn, however, has been found the most cost-efficient technique of implementing such a synchronization. According to a preferred embodiment of the invention, the implementation can be such that, e.g., one of the roll support arms is controlled by a force-feedback loop, while the other arm controlled by a position-feedback loop follows the movement of the force-controlled
- 20 arm. This arrangement represents a simple electrical synchronization. Herein arises a minor risk from the possible occurrence of the bump on the side of the position-controlled arm, whereby the structure of the wound roll may remain inferior. It is, however, possible to eliminate this risk. According to a preferred embodiment of the invention, the implementation of the electrical synchronization
- 25 can be such that both arms are controlled in parallel by a position-feedback loop as a function of the roll diameter increase rate and the pressing force of the nip is taken into account as a correction term in the control loop. Advantageously, the pressing force of the nip is measured at both arms and the correction term can be formed as, e.g., the sum, maximum or average value of both measurement signals.
- 30 Thus, an increase of the nip force causes the center of the roll being wound to be offset from the nip at a faster rate. Resultingly, disturbances will be effectively

3a

B1

- 5 the pressing-nip force in the nip formed between the roll and the winding drum is controlled by a position-feedback loop using a position-feedback technique in which the movements of the roll support arms are synchronized by electrical means.

10 **B2**

means for controlling the pressing-nip force in the nip formed between the roll and the winding drum is a position-feedback loop using a position-feedback technique in which the movements of the roll support arms are synchronized by electrical means.

15

compensated for on either side of the roll being wound.

According to the invention, both of the roll support arms can be mechanically synchronized to each other via, e.g., the core or, alternatively, by electrical means
5 such as a control loop in which one of the arms is controlled by a force-feedback loop and the other is synchronized to move therewith controlled by a position-feedback loop. By virtue of the control arrangement according to the invention, the structure of the roll being wound becomes easily manageable due to the above-described synchronized control of the roll support arms that allows the pressing-
10 nip force to be controlled by a position-feedback loop.

Particularly advantageously, the invention is suited for use in conjunction with the method and apparatus disclosed in cited FI Pat. No. 100,468 owned by the applicant, wherein the prior-art loading/supporting arrangement can be
15 complemented with the position-controlled center-loading technique according to the present invention for controlling the pressing-nip force.

In the following the invention will be described in greater detail with reference to the figure of appended drawing to the details of which the invention is not by any
20 means intended to be narrowly confined.

Referring to the figure, therein is schematically illustrated a winder having an embodiment of a control arrangement according to the invention adapted to function therewith.

25

As shown in the figure, a paper roll 11 is being wound via a nip N formed between a winding drum 10 and the web roll 11 and the roll 11 is supportedly being wound about a core 12 that is mounted via chucks 14 or the like on roll support arms 13. To the roll support arms 13 are attached position and force
30 measuring sensors 15,16 from which the measurement signals are taken to a force-feedback circuit 17 whose output is monitored in a feed back control unit 19

WO 00/55078

PCT/FI00/00211

5

together with the signal of roll diameter increase obtained from a control unit 18. Subsequently, the information is passed to parallel-operating position controllers 20 that control the position of the roll support arms 13 via a control unit 22 steering the loading of the roll with the help of, e.g., hydraulic cylinders 21. The
5 movements of the roll support arms 13 are electrically synchronized to each other so that both roll support arms 13 are driven in parallel by a position-feedback loop as a function of the roll diameter increase rate and the pressing force of the nip is taken into account as a correction term in the control loop.

10 According to the invention, the pressing-nip force is controlled by a position-feedback loop in which the movements of the roll support arms 13 are synchronized. Mechanical synchronization is implemented via, e.g., the core 12 or the chucks 14, while hydraulic synchronization is accomplished with the help of series-connected cylinders, differential gearbox motors or the like. When electrical
15 synchronization is used, e.g., one roll support arm 13 is controlled by a force-feedback loop, while the other arm 13 is controlled by a position-feedback loop to follow the movement of the force-controlled arm. This arrangement accomplishes the electrical synchronization.

20 ~~While the invention has been described with references to a few preferred exemplifying embodiments only, it is understood that the details thereof are not limiting to the scope of the invention. To those skilled in the art, a plurality of modifications and adaptations are obvious within the inventive spirit of the appended claims~~

25

Amended Claims

1. Method for winding a web, said method comprising the steps of winding a web roll (11) by passing the web onto a core (12) via a pressure nip (N) formed
5 between a winding drum (10) and the roll (11) being wound, whereby the core (12) is supported by means of chucks (14) mounted on roll support arms (13), in which method the pressing-nip force in the nip (N) formed between the roll (11) and the winding drum (10) is controlled, characterized in that the pressing-nip force in the nip (N) formed between the roll (11) and the winding drum (10) is
10 controlled by a position-feedback loop using a position-feedback technique in which the movements of the roll support arms (13) are synchronized by electrical means.
2. Method according to claim 1, characterized in that the movements of said roll support arms (13) are driven in parallel by a position-feedback loop as a function
15 of the rate of increase of the diameter of the roll (11), while the pressing nip force is used as a correction term.
3. Method according to claim 2, characterized in that the pressing-nip force is
20 measured at both roll support arms (13).
4. Method according to claim 1, characterized in that the movements of said roll support arms (13) are synchronized by electrical means so that one roll support arm is controlled by a force-feedback loop, while the other arm is controlled by a
25 position-feedback loop to follow the movement of the force-controlled arm.
5. Device for winding a web, said device being intended for use in conjunction with winding a web roll (11) onto a core (12) via a pressure nip (N) formed between a winding drum (10) and the roll (11), whereby the core (12) is supported
30 by means of chucks (14) mounted on roll support arms (13), which device includes means (15,16,17,18,19,20,21,22) for controlling the pressing-nip force in

the nip (N) formed between the roll (11) and the winding drum (10),
characterized in that said means (15,16,17,18,19,20,21,22) for controlling the
pressing-nip force in the nip (N) formed between the roll (11) and the winding
drum (10) is a position-feedback loop using a position-feedback technique in
5 which the movements of the roll support arms (13) are synchronized by electrical
means.

6. Device according to claim 5, characterized in that the device includes position
and force measurement means (15,16).

10

7. Device according to claim 5 or 6, characterized in that the device includes a
pressing-nip force control unit (17) for processing the signals obtained from said
measurement means (15,16).

15 8. Device according to claim 5, 6 or 7, characterized in that the device includes a
control unit (18) for monitoring the rate of increase of the diameter of the roll (11)
being wound.

20 9. Device according to claim 5, 6 or 7, characterized in that the device includes a
feedback control unit (19) for processing the signals obtained from said pressing-
nip force control unit (17) and said control unit.

25 10. Device according to any of claims 5 to 9, characterized in that the device
includes a position control units (20) for controlling the position of said roll
support arms (13).

11. Device according to any of claims 5 to 10, characterized in that the device
includes a control elements (22) for driving the loading elements (21) of said roll
support arms (13).

30

