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(54) **Method in a multiroll calender and a multiroll calender**

(57) The invention relates to a method in multiroll calender, in which method a fiber web, particularly a paper or board web (W) is calendered in a multiroll calender (10) comprising at least two stacks of calender rolls (20,

30), each stack comprising at least three calender rolls. In the multiroll calender running direction of the fiber web (W) to be calendered is changeable in at least one calender roll stack (20, 30) for calendering a different grade of fiber web.

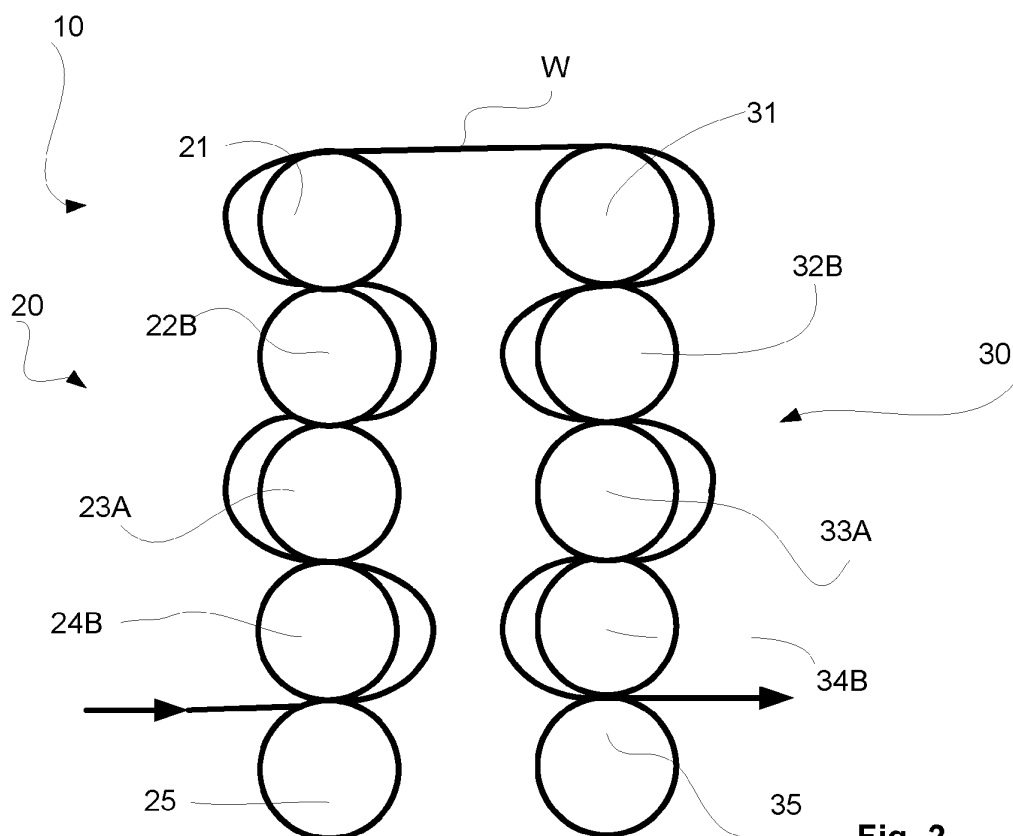


Fig. 2

Description

[0001] In general present invention relates to calendering of fiber web in a calender of a fiber web machine. More especially the present invention relates to a method according to preamble part of claim 1 and to a multiroll calender according to preamble part of claim 7.

[0002] Calendering is generally carried out in order to improve the properties, like smoothness and gloss, of a web-like material such as a paper or board web. In calendering the web is passed into a nip, i.e. calendering nip, formed between rolls that are pressed against each other, in which nip the web becomes deformed as by the action of temperature, moisture and nip pressure. In the calender the nips are formed between a smooth-surfaced press roll such as metal roll and a roll coated with resilient material such as a polymer roll. The resilient-surfaced roll adjusts itself to the forms of the web surface and presses the opposite side of the web evenly against the smooth-surfaced press roll. Multinip, or multiroll calendering is calendering in a calendering unit, in which the nips are formed between a smooth-surfaced press roll such as metal roll and a roll coated with resilient material such as a polymer roll and the linear load increases in multinip calenders from the upper nip to the lower nip due to gravitation, unless roll relies systems are used. From prior art multiroll calenders are known, in which the set of rolls of which is formed of two stacks of rolls, each stack of rolls comprising at least two calender rolls. Multinip or multiroll calender are known for example by brand names OptiLoad and TwinLine. In FI patent 96334 is disclosed a method for calendering a paper or an equivalent web material in a calender in which method the web to be calendered is passed through nips formed by a deflection-compensated upper roll and a deflection-compensated lower roll, and by two or more intermediate rolls arranged between the upper and lower roll. The rolls are arranged as a substantially vertical stack of rolls.

[0003] As fiber web machine running speeds and the need for calendering increases, a possibility to carry out various types of calendering for calendering different fiber web grades by means of a calender is also needed, which can be carried out for example by means of running with fewer nips than all nips, in which the web is passed through a calender such that during calendering the web being calendered is calendered only in some of the possible nips of the calender. In prior art this is usually possible only by changing rolls of a calender for grade change. In WO publication 2006/051169 a method in a multiroll calender, a multiroll calender and a method for loading a calender roll of a multiroll calender is disclosed. In the method a fiber web is calendered in a multi roll calender comprising two stacks of rolls, both stacks comprising at least two calender rolls. In the multiroll calender at least one intermediate roll is locked to a lower position whereby loading the rolls above or below the locked roll, a required number of calendering nips can be provided for use. In this prior art publication also various ways of

guiding the web to be calendered through the calendering nips of the calender roll stacks is disclosed but the running direction of the web is always same in each stack of the calender during calendering in each configuration.

[0004] The line between paper and board is flexible and paper and board are available in a wide variety of grades and can be divided according to basis weight in two categories: papers with a single ply and a basis weight of 25 - 300 g/ m² and boards manufactured in multi-ply technology and having a basis weight of 150 - 600 g/m². It should be noted that the borderline between paper and board is flexible since board grades with lightest basis weights are lighter than the heaviest paper grades. Generally speaking, paper is used for printing and board for packaging.

[0005] The subsequent descriptions are examples of some values presently applied for fibrous webs, and there may be considerable variations from the disclosed values. The descriptions are mainly based on the source publication Papermaking Science and Technology, section Papermaking Part 3, edited by Jokio, M., published by Fapet Oy, Jyväskylä 1999, 362 pages.

[0006] Mechanical-pulp based, i.e. wood-containing printing papers include newsprint, uncoated magazine and coated magazine paper.

[0007] Newsprint is composed either completely of mechanical pulp or may contain some bleached softwood pulp (0 - 15 %) and/or recycled fiber to replace some of the mechanical pulp. General values for newsprint can be regarded as follows: basis weight 40 - 48,8 g/m², ash content (SCAN-P 5:63) 0 - 20 %, PPS s10 roughness (SCAN-P 76:95) 3,0 - 4,5 µm, Bendtsen roughness (SCAN-P 21:67) 100 - 200 ml/min, density 200 - 750 kg/m³, brightness (ISO 2470:1999) 57 - 63 %, and opacity (ISO 2470:1998) 90 - 96 %.

[0008] Uncoated magazine paper (SC=supercalendered) usually contains mechanical pulp to 50 - 70 %, bleached softwood pulp to 10 - 25 %, and fillers to 15 - 30%. Typical values for calendered SC paper (containing e.g. SC-C, SC-B, SC-A/A+) include basis weight 40 - 60 g/m², ash content (SCAN-P 5:63) 0 - 35 %, Hunter gloss (ISO/DIS 8254/1) < 20 - 50 %, PPS s10 roughness (SCAN-P 76:95) 1,2 - 2,5 µm, Bendtsen roughness (SCAN-P 21:67) 100 - 200 ml/min, density 700 - 1250 kg/m³, brightness (ISO 2470:1999) 62 - 70 %, and opacity (ISO 2470:1998) 90-95%.

[0009] Coated magazine paper (LWC = light weight coated) contains mechanical pulp to 40 - 60 %, bleached softwood pulp to 25 - 40 %, and fillers and coaters to 20 - 35 %. General values for LWC paper can be regarded as follows: basis weight 40 - 70 g/m², Hunter gloss 50 - 65 %, PPS s10 roughness 0,8 - 1,5 µm (offset), 0,6 - 1,0 µm (roto), density 1100 - 1250 kg/m³, brightness 70 - 75 %, and opacity 89 -94%.

[0010] General values for MFC (machine finished coated) can be regarded as follows: basis weight 50 - 70 g/m², Hunter gloss 25 - 70 %, PPS s10 roughness 2,2 - 2,8 µm, density 900 - 950 kg/m³, brightness 70 - 75 %, and opacity 89 -94%.

and opacity 91 - 95 %.

[0011] General values for FCO (film coated offset) can be regarded as follows: basis weight 40 - 70 g/m², Hunter gloss 45 - 55 %, PPS s10 roughness 1,5 - 2,0 μm, density 1000 - 1050 kg/m³, brightness 70 - 75 %, and opacity 91 - 95 %.

[0012] General values for MWC (medium weight coated) can be regarded as follows: basis weight 70 - 90 g/m², Hunter gloss 65 - 75 %, PPS s10 roughness 0,6 - 1,0 μm, density 1150 - 1250 kg/m³, brightness 70 - 75 %, and opacity 89 - 94 %.

[0013] HWC (heavy weight coated) has a basis weight of 100 - 135 g/m² and can be coated even more than twice.

[0014] Pulp-produced, wood free printing papers or fine papers include uncoated - and coated - pulp-based printing papers, in which the portion of mechanical pulp is less than 10 %.

[0015] Uncoated pulp-based printing papers (WFU) contain bleached birchwood pulp to 55 - 80 %, bleached softwood pulp 0 - 30 %, and fillers to 10 - 30 %. The values with WFU have a large variation: basis weight 50 - 90 g/m², Bendtsen roughness 250 - 400 ml/min, brightness 86 - 92 %, and opacity 83 - 98 %.

[0016] In coated pulp-based printing papers (WFC), the amounts of coating vary widely in accordance with requirements and intended application. the following are typical values for once- and twice-coated, pulp-based printing paper: once-coated basis weight 90 g/m², Hunter gloss 65 - 80 %, PPS s10 roughness 0,75 - 2,2 μm, brightness 80 - 88 %, and opacity 91 - 94 %, and twice-coated basis weight 130 g/m², Hunter gloss 70 - 80 %, PPS s10 roughness 0,65 - 0,95 μm, brightness 83 - 90 %, and opacity 95 - 97 %.

[0017] Release papers have a basis weight within the range of 25 - 150 g/m².

[0018] Other papers include e.g. sackkraft papers, tissues, and wallpaper bases.

[0019] Board making makes use of chemical pulp, mechanical pulp and/or recycled pulp. Boards can be divided e.g. in the following main groups according to applications thereof: Corrugated board, comprising a liner and fluting; Boxboards, used for making boxes, cases, which boxboards include e.g. liquid packaging boards (FBB = folding boxboard, LPB = liquid packaging board, WLC = white-lined chipboard, SBX = solid bleached sulfite, SUS = solid unbleached sulfite); Graphic boards, used for making e.g. cards, files, folders, cases, covers, etc. and Wallpaper bases.

[0020] An object of the present invention is to create a method in a multiroll calender and to a multiroll calender in which grade change of fiber web is easily applicable.

[0021] In fiber web production one aim is to achieve high capacity of the production line thus it is very important to minimize down times of machinery of the line. One object of the invention is providing means for minimizing maintenance time of a multiroll calender.

[0022] Another object of the present invention is to

achieve a method and a multiroll calender in which possible disadvantages and problems of known methods and calenders are eliminated or at least minimized.

[0023] To achieve the objects mentioned above and later the method according to the invention is mainly characterized by the features of the characterizing part of claim 1.

[0024] The multiroll calender according to the invention is mainly characterized by the features of the characterizing part of claim 7.

[0025] Further advantageous features of the invention will be disclosed in the dependent claims.

[0026] According to the invention a method in a multiroll calender and a multiroll calender is provided wherein the running direction of the fiber web to be calendered can be changed in at least one calender roll stack for calendering a different grade of fiber web.

[0027] According to an advantageous feature of the invention in the method in first running direction of the at least one stack of calender rolls the upper side of the web to be calendered is in contact with a thermo roll in the first stack of calender rolls and the lower side of the web is in contact with a thermo roll in the second stack of calender rolls and in second running direction of the at least one stack of calender rolls the upper side of the web to be calendered is in contact with a thermo roll in the first stack of calender rolls and the upper side of the web is in contact with a thermo roll in the second stack of calender rolls so that by using the first running direction two-sided fiber web grade can be produced and by using the second running direction one-sided fiber web grade can be produced.

[0028] According to an advantageous feature of the invention in the method in first running direction of the at least one stack of calender rolls the lower side of the web to be calendered is in contact with a thermo roll in the first stack of calender rolls and the upper side of the web is in contact with a thermo roll in the second stack of calender rolls and in second running direction of the at least one stack of calender rolls the lower side of the web to be calendered is in contact with a thermo roll in the first stack of calender rolls and the lower side of the web is in contact with a thermo roll in the second stack of calender rolls so that by using the first running direction two-sided fiber web grade can be produced and by using the second running direction one-sided fiber web grade can be produced.

[0029] The invention also provides for possibility of using one stack of calender rolls for production while other stack of calender stack is under maintenance.

[0030] Advantageously in the method a fiber web grade that has basis weight of 40 - 150 g/m² is calendered and advantageously in the method fiber web is calendered to surface roughness of 0,6 - 4,5 μm PPs.

[0031] According to an advantageous feature of the invention in the method the fiber web is calendered in a multiroll calender comprising at least two stacks of at least four calender rolls.

[0032] In this connecting the calender roll refers to rolls that form the calendering nip, upper roll refers to the uppermost roll in a stack of rolls, upper nip refers to the uppermost calendering nip, formed between the upper roll and the calender roll below the upper roll, lower roll refers to the lowest roll in a stack of rolls and lower nip refers to the lowest calendering nip in a stack of rolls, which lowest calendering nip is formed between the lower roll and the calender roll above the lower roll. Intermediate nips refer to calender nips formed by means of calender rolls between the rolls between the upper nip and the lower nip of a calender. In case of horizontal calender stack upper roll / uppermost calendering nip refers to first nip roll / first nip of the calendering process and the lower roll / lowest calendering nip to the last roll / last nip of the calendering process. The stack of rolls can be vertical or inclined or horizontal. The calender can comprise one stack of rolls or more stacks of rolls, for example two stacks of rolls. The stacks of rolls may or may not have common support frame. The running direction of the web defines the side of the web to be calendered in the calendering nips i.e. which side of the web will be in contact with the smooth-surfaced calender rolls.

[0033] Further advantageous features of the invention will be disclosed in the dependent claims.

[0034] In the following the invention is discussed in more detail by reference to figures of accompanying drawings.

[0035] In figure 1 one example of a multiroll calender according to the invention is schematically shown with one example of running direction.

[0036] In the schematic example shown in figure 2 fiber web W is guided in the multiroll calender example of figure 1 with another running direction in second stack of calender rolls.

[0037] In the schematic example shown in figure 3 a further example of a multiroll calender according to the invention is schematically shown.

[0038] In the schematic example shown in figure 4 fiber web W is guided in the multiroll calender example of figure 3 with another running direction in second stack of calender rolls.

[0039] In the following description same reference signs designate for respective components etc. unless otherwise mentioned and it should be understood that the examples are susceptible of modification in order to adapt to different usages and conditions within the frames of the multiroll calender.

[0040] Figures 1 - 4 schematically show examples of multiroll calenders with two stacks of calender rolls. Multiroll calender 10 shown in figures comprises two stacks of calender rolls 20, 30, in which a fiber web W is calendered in the calendering nips between the calender rolls of the stacks of calender rolls. Reference numerals 21 - 25 refer to those of first stack of calender rolls and reference numerals 31 - 35 to those of second stack of calender rolls. By reference sign A after the reference numeral a calender roll that is a resilient-surfaced calender

roll is indicated and by reference sign B after the reference numeral a calender roll that is a smooth-surfaced calender roll. Resilient-surfaced calender rolls are soft-surfaced, for example polymer-surfaced deflection, rolls and smooth-surfaced rolls are metal rolls, or thermo rolls either heatable and/or coolable rolls.

[0041] In figures 1 and 2 a multiroll calender 10 with two stacks of calender rolls 20, 30 is shown. The two stacks 20, 30 are located next to each other and a multiroll calender corresponding to the brand TwinLine is presented. The upper rolls 21, 31 of each stack are deflection compensated rolls. Rolls 22B, 32B, 24B, 25B are thermo rolls and rolls 23A, 33A are resilient-surfaced polymer rolls. Lower roll 25, 35 of each stack is a deflection compensated roll.

[0042] As shown in the example of figures 1 and 2 the running direction of the web has been changed for grade change of fiber web. In the figure 1 a two-sided fiber web grade, for example wood free coated (WFC), is calendered and in the figure a one-sided fiber web grade, for example release, is calendered. In figure 1 the upper side of the web W is in contact with thermo rolls 22B, 24B in the first stack of calender rolls 20 and the lower side of the web is in contact with thermo rolls 32B, 34B in the second stack of calender rolls 30. In figure 2 the running direction has been changed for grade change and in the first stack of calender rolls 20 and again the upper side of the web is in contact with thermo rolls 32B, 34B in the second stack of calender rolls 30.

[0043] In figures 3 and 4 a multiroll calender 10 with two stacks of calender rolls 20, 30 is shown. The two stacks 20, 30 are located on top of each other and a multiroll calender corresponding to the brand OptiLoad is presented. The upper rolls 21, 31 of each stack are deflection compensated rolls. Rolls 22B, 32B, 24B, 25B are thermo rolls and rolls 23A, 33A are resilient-surfaced polymer rolls. Lower rolls 25, 35 of each stack are deflection compensated rolls.

[0044] As shown in the example of figures 3 and 4 the running direction of the web has been changed for grade change of fiber web. In the figure 3 a two-sided fiber web grade, for example wood free coated (WFC), is calendered and in the figure 4 a one-sided fiber web grade, for example release, is calendered. In figure 3 the web is calendered from top to bottom via calendering nips of both stacks of calendering rolls 20, 30 and the lower side of the web W is in contact with thermo rolls 22B, 24B in the first stack of calender rolls 20 and the upper side of the web is in contact with thermo rolls 32B, 34B in the second stack of calender rolls 30. In figure 4 the running direction has been changed for grade change, the web is guided from the lower roll 25 of the first stack of calender rolls 20 directly to the bottom of the calender and the web is guided through the second stack of calender rolls 30 from bottom to top and in the first stack of calender rolls 20 and again the lower side of the web is in contact with thermo rolls 32B, 34B in the second stack of calender rolls 30.

[0045] In the above the invention has been described by way of example with reference to the figures of the accompanying drawing. However many modifications and variations are possible within the inventive idea.

Claims

1. Method in multiroll calender, in which method a fiber web, particularly a paper or board web (W) is calendered in a multiroll calender (10) comprising at least two stacks of calender rolls (20, 30), each stack comprising at least three calender rolls, **characterized in that** in the multiroll calender running direction of the fiber web (W) to be calendered is changeable in at least one calender roll stack (20, 30) for calendering a different grade of fiber web. 10

2. Method according to claim 1, **characterized in that** in the method the fiber web (W) is calendered in a multiroll calender (10) comprising at least two stacks of at least four calender rolls (20, 30). 20

3. Method according to claim 1 or 2, **characterized in that** in first running direction of the at least one stack of calender rolls (20) the upper side of the web (W) to be calendered is in contact with a thermo roll/thermo rolls (22B, 24B) in the first stack of calender rolls (20) and the lower side of the web (W) is in contact with a thermo roll/thermo rolls (22B, 24B) in the second stack of calender rolls (30) and in second running direction of the at least one stack of calender rolls (20) the upper side of the web (W) to be calendered is in contact with a thermo roll/thermo rolls (22B, 24B) in the first stack of calender rolls (20) and the upper side of the web (W) is in contact with a thermo roll/thermo rolls (22B, 24B) in the second stack of calender rolls (30) so that by using the first running direction two-sided fiber web grade can be produced and by using the second running direction one-sided fiber web grade can be produced. 25 30 35 40

4. Method according to claim 1, **characterized in that** in first running direction of the at least one stack of calender rolls (20) the lower side of the web (W) to be calendered is in contact with a thermo roll/thermo rolls (22B, 24B) in the first stack of calender rolls (20) and the upper side of the web is in contact with a thermo roll/thermo rolls (22b, 24B) in the second stack of calender rolls (30) and in second running direction of the at least one stack of calender rolls (20) the lower side of the web to be calendered is in contact with a thermo roll/thermo rolls (22B, 24B) in the first stack of calender rolls (20) and the lower side of the web (W) is in contact with a thermo roll/thermo rolls (22B, 24B) in the second stack of calender rolls (30) so that by using the first running direction two-sided fiber web grade can be produced 45 50 55

and by using the second running direction one-sided fiber web grade can be produced.

5. Method according to any of claims 1 - 4, **characterized in that** in the method a fiber web grade that has basis weight of 40 -150 g/m² is calendered. 5

6. Method according to any of claims 1 - 4, **characterized in that** in the method fiber web is calendered to surface roughness of 0,6 - 4,5 μm PPs. 10

7. Multiroll calender for calendering a fiber web, particularly a paper or board web (W), which multiroll calender comprises at least two stacks of calender rolls (20, 30), each stack comprising at least three calender rolls, **characterized in that** in the multiroll calender running direction of the fiber web (W) to be calendered is changeable in at least one calender roll stack (20, 30) for calendering a different grade of fiber web. 15

8. Multiroll calender according to claim 7, **characterized in that** in the multiroll calender (10) comprises at least two stacks of at least four calender rolls (20, 30). 25

9. Multiroll calender according to claim 7 or 8, **characterized in that** stacks of calender rolls (20, 30) are vertical or inclined or horizontal. 30

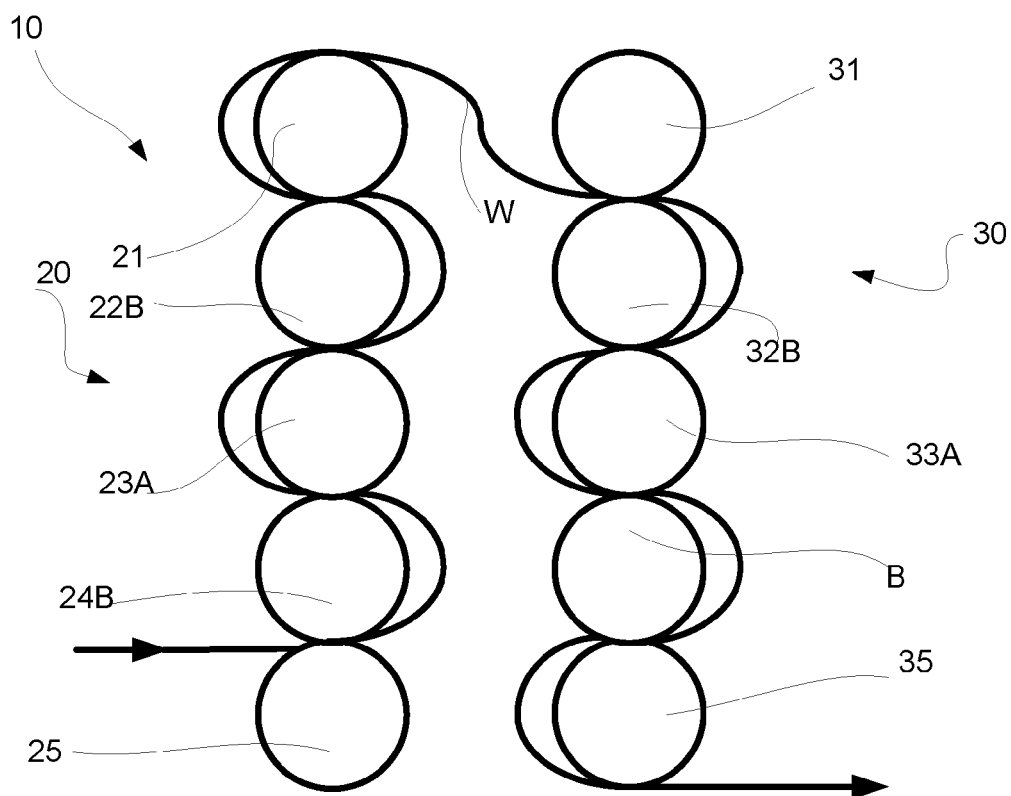


Fig. 1

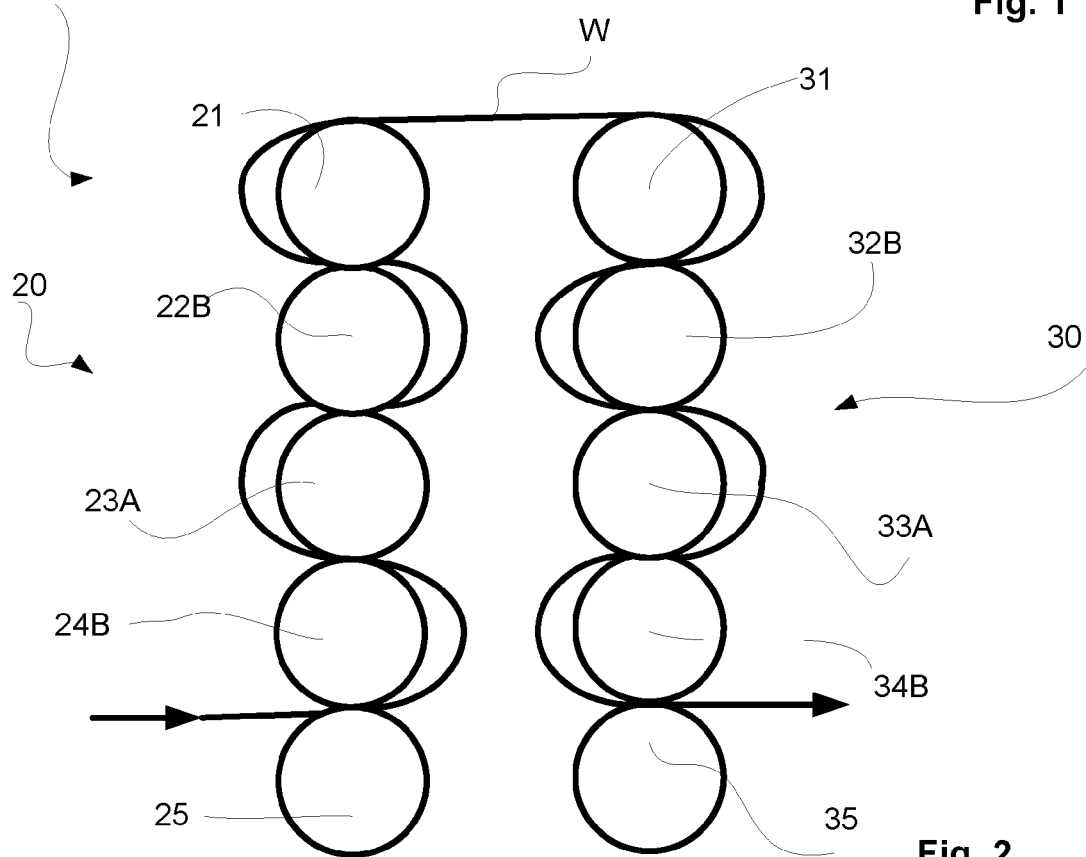


Fig. 2

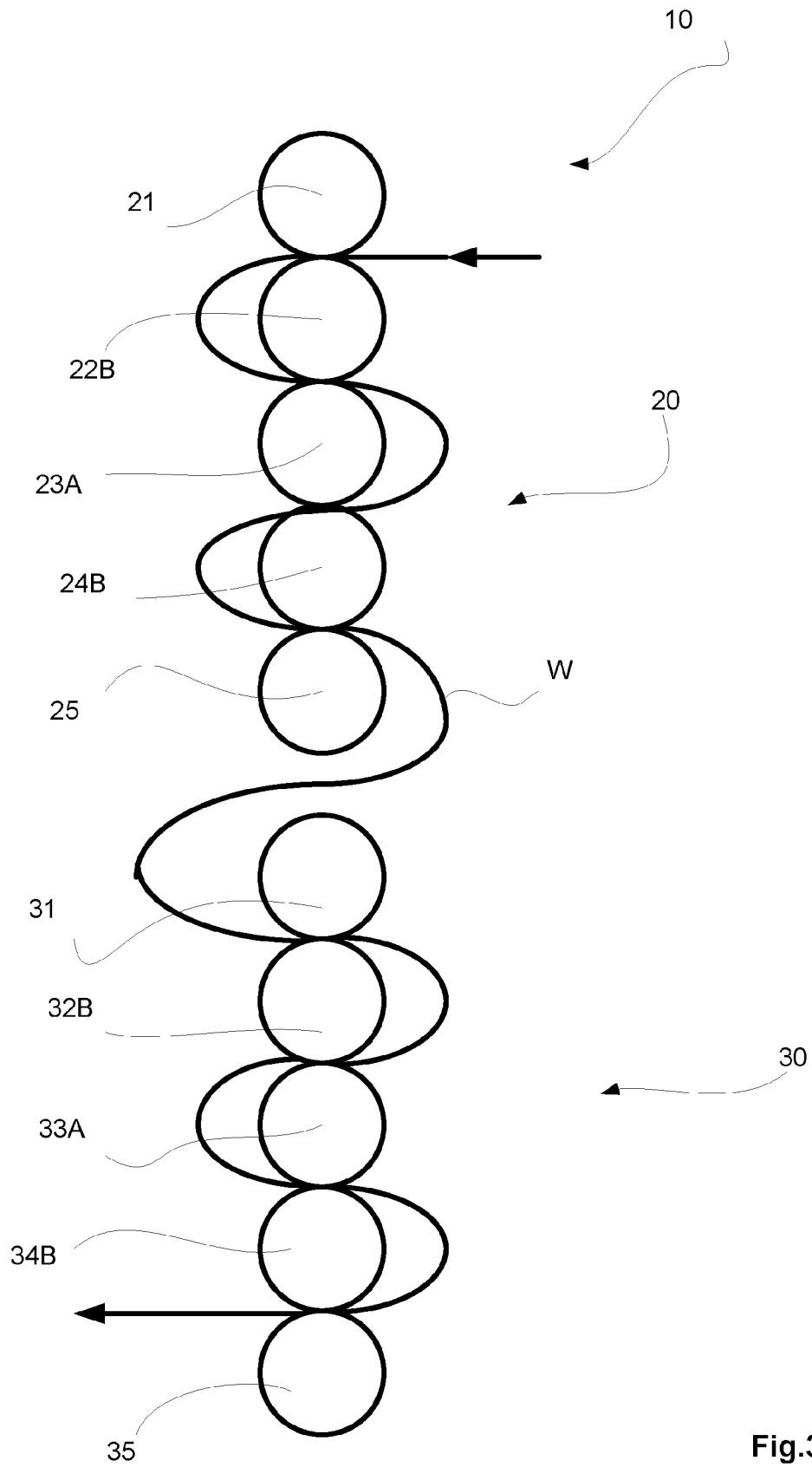


Fig.3

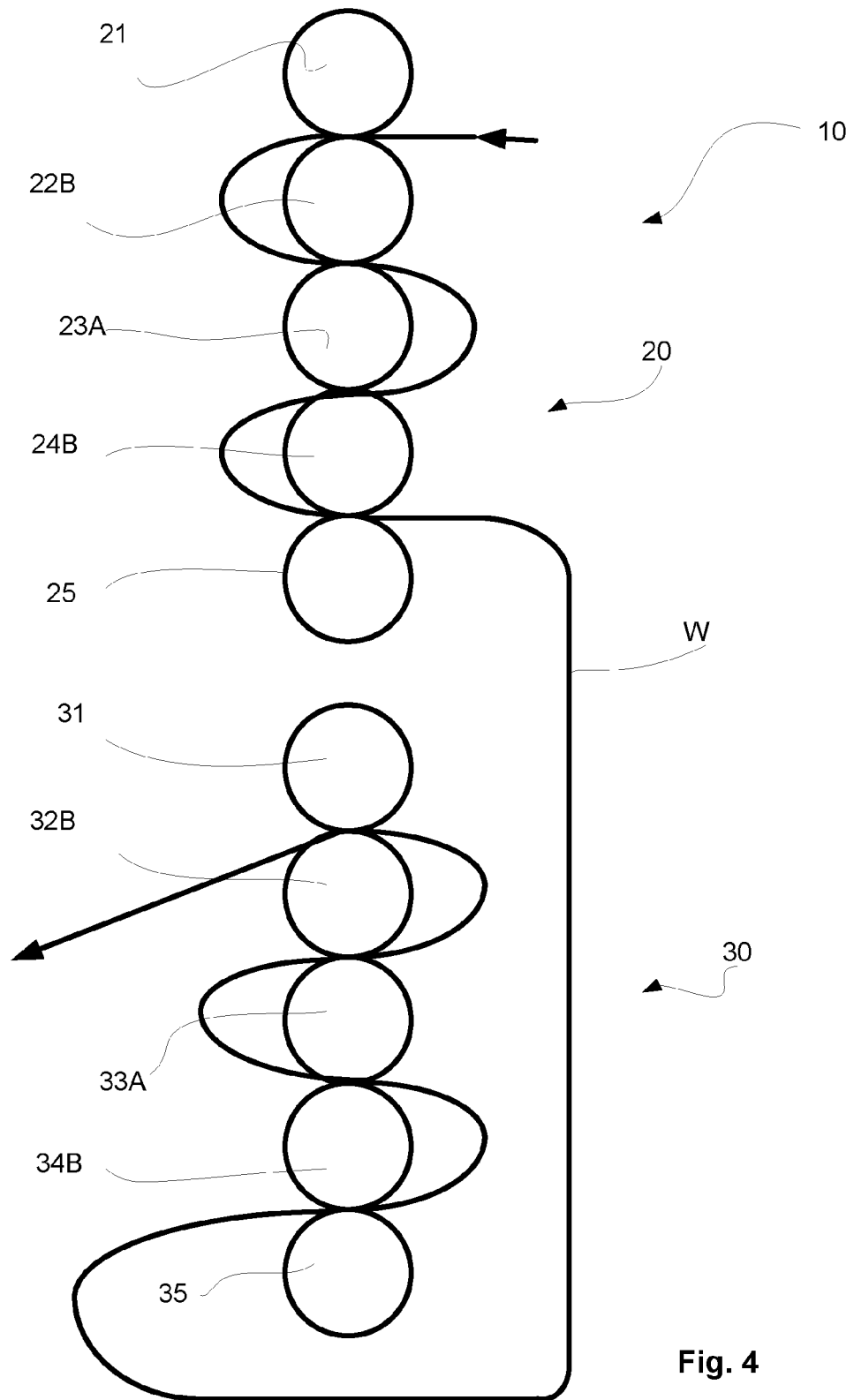


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 1578

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/082986 A1 (METSO PAPER INC [FI]; VILJANMAA MIKA [FI]) 26 July 2007 (2007-07-26)	1,4,5,7,9	INV. D21G1/00
Y	* page 1, line 5 - page 2, line 21 * * page 5, line 1 - page 8, line 21; figures 1, 2 *	6	
Y	----- WO 2004/061222 A1 (METSO PAPER INC [FI]; KYYTSONEN MARKKU [FI]; VAINIO RISTO [FI]; TIRRO) 22 July 2004 (2004-07-22)	6	
A	* page 1, line 6 - page 2, line 28 * * page 3, line 22 - page 4, line 18 * * page 7, line 4 - page 8, paragraph 16; figures 1, 2 *	1-4,7-9	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D21G
Place of search		Date of completion of the search	Examiner
Munich		8 May 2012	Sabatucci, Arianna
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 12 15 1578

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08-05-2012

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