



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.08.2013 Bulletin 2013/34

(51) Int Cl.:
D21G 1/00 (2006.01) D21G 1/02 (2006.01)

(21) Application number: **12155384.6**

(22) Date of filing: **14.02.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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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 comprising at least two stacks of calender rolls (10, 20), each stack comprising at least two calender rolls and at least one fly roll (15, 25) and at least one of the fly rolls (25) is movable between at least two locations. The in-

vention also relates to a 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 (10, 20), each stack comprising at least two calender rolls and at least one fly roll, and at least one fly roll (25) of the multiroll calender has at least two positions of use during calendering.

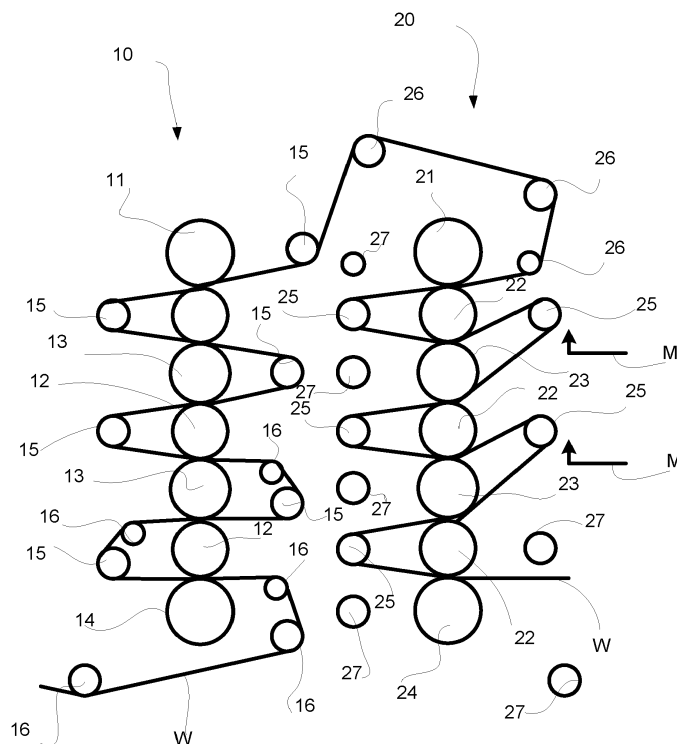


Fig. 2

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. 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.

[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. There are cases also in which a possibility for producing both one-sided and two-sided fiber webs in same calender is needed. In prior art this

is usually possible only by changing rolls of a calender for grade change. The procedure of changing calender rolls for grade change is often time-consuming and complicated.

[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. Also an object of the invention is to create a multiroll calender of which investment cost is low and a further object of the invention is to create a multiroll calender in which the changing of calender rolls is simple and easy.

[0021] In fiber web production one aim is to achieve high capacity of the production line thus it is very impor-

tant 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, especially during grade change.

[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 at least one fly roll of the multiroll calender has at least two positions of use during calendaring and the at least one of the fly rolls is movable between at least two locations. The number of movable fly rolls is chosen in dependency of calender type and/or the fiber web grades to be calendered.

[0027] According to the invention a method in a multiroll calender and a multiroll calender is provided in which at least one fly roll is located next to a thermo roll. By this great advantages are achieved since the thermo rolls need to be replaced more seldom than the soft rolls, for example polymer coated calender rolls. Advantageously substantially all fly rolls are located next to thermo rolls.

[0028] In order to minimize the investment cost the number of fly rolls and number of their drives is designed to be as low as possible.

[0029] According to the invention the location of fly rolls is designed such that the replacement of a fly roll is easy for changing a calender roll and / or for changing grade of the web.

[0030] According to an advantageous feature of the invention the number of fly rolls is minimized and thus down times are shorter and thus the capacity of the calender is improved.

[0031] Advantageously in the method a fiber web grade that has basis weight of 40 - 150 g/m², more advantageously 40 - 70 g/m², is calendered and advantageously in the method fiber web is calendered to surface roughness of 0,6 - 4,5 μm PPS s10, more advantageously 0,65 - 2,5 μm PPS s10.

[0032] Advantageously the multiroll calender and the method in the multi roll calender are utilized in connection with calendaring of fiber web grades: News, SC, LWC, MFC, MWC, WFU, WFC, Release, Glassine.

[0033] In connection with the invention advantageously at least one of the fly rolls is movable between at least two locations one of which optimizes the replacement time of a resilient-surfaced calender roll and one of which that optimizes the running properties of the fiber web in the calender. Advantageously the fly rolls are located next to the smooth-surfaced calender rolls. Advanta-

geously the number of fly rolls is minimized.

[0034] 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.

[0035] 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.

[0036] Further advantageous features of the invention will be disclosed in the dependent claims.

[0037] In the following the invention is discussed in more detail by reference to figures of accompanying drawings.

[0038] In figure 1 one example of a multiroll calender according to the invention is schematically shown.

[0039] In figures 2 - 3 another example of a multiroll calender according to the invention is schematically shown.

[0040] In figure 4 an advantageous feature relating to the invention is schematically shown.

[0041] In figures 5 - 6 another example of a multiroll calender is schematically shown.

[0042] 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.

[0043] Figures 1 - 6 schematically show examples of multiroll calenders with two stacks of calender rolls. Multiroll calender shown in figures comprises two stacks of calender rolls 10, 20, in which a fiber web W is calendered in the calendering nips between the calender rolls of the stacks of calender rolls. Reference numerals 11 - 17 refer to those parts and components of first stack 10 of calender rolls and reference numerals 21 - 29 to those of second stack 20 of calender rolls. By reference numerals 13, 23 a calender roll that is a resilient-surfaced calender

roll is indicated and by reference numeral 12, 22 a calender roll that is a smooth-surfaced calender roll is indicated. Resilient-surfaced calender rolls 13, 23 are soft-surfaced, for example polymer-surfaced deflection, rolls and smooth-surfaced rolls 12, 22 are metal rolls, or thermo rolls either heatable and/or coolable thermo rolls. Guide rolls guiding the web are indicated by reference numeral 26, fly rolls by reference numeral 25 and guide rolls not in use by reference numeral 27. In figures 1 - 3 a multiroll calender with two stacks of calender rolls 10, 20 is shown. The two stacks 10, 20 are located next to each other and a multiroll calender corresponding to the brand TwinLine is presented. The upper rolls 11, 21 and the lower rolls 14, 24 of each stack 10, 20 are deflection compensated rolls. Rolls 12, 22 are thermo rolls and rolls 13, 23 are resilient-surfaced polymer rolls. In figures 5 and 6 a multiroll calender with two stacks of calender rolls 10, 20 is shown. The two stacks 20, 30 are located on top of each other. The upper rolls 11 are deflection compensated rolls. Rolls 12, 22 are thermo rolls and rolls 13, 23 are resilient-surfaced polymer rolls. Lower rolls 14 are deflection compensated rolls. In calendering the web W is passed into a nip, i.e. calendering nip, formed between rolls 14, 12; 12, 13; 12, 11; 21, 22; 22, 23; 22, 24 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 calendering nips are formed between a smooth-surfaced press roll 12, 22 such as metal roll and a roll coated with resilient material such as a polymer roll 13, 23.

[0044] In the example of figure 1 one-sided fiber web grade is calendered, for example glassine type paper grade. In this example fly rolls 15, 25 of stacks of calender rolls 10, 20 are located such that replacement of resilient-surfaced polymer rolls 13, 23 is simple and easy. By locating the fly rolls 15, 25 next to the thermo rolls 12, 22 that need to be replaced more seldom than the polymer rolls 13, 23 timesaving is achieved in maintenance work.

[0045] In the example of figure 2 two-sided fiber web grade is calendered, for example... In this example fly rolls 15, 25 are located next to thermo rolls 15, 25. The fly rolls 15, 25 can be movable to locations shown in the example of figure 3 for achieving good running properties for the fiber web. In the example of figure 3 also two-sided fiber web grade is calendered. In this example the fly rolls 25 located next to two the upmost thermo rolls 22 in the second stack are movable between at least two locations as shown by arrows M in each figure 2 and 3; on location in which the replacement of resilient-surfaced polymer rolls is simple and easy (fig. 2) and one location in which running properties of the fiber web in the calender are taken in account (fig. 3). The number of movable fly rolls is chosen in dependency of calender type and/or the fiber web grades to be calendered.

[0046] In figure 4 an advantageous feature relating to the multiroll calender is schematically shown. In this example the rollers 28, 29 are attached to a bearing housing of a nip roll and they keep the threading rope at right

route in locations where the fly rolls are omitted.

[0047] In figures 5 and 6 another example of a multiroll calender is schematically shown in which figure 5 shows an example of calendering one-sided fiber web grades with the multiroll calender and figure 6 shows an example of calendering two-sided fiber web grades with the multiroll calender. In this example for the grade change the locations of thermo rolls 22 and polymer rolls 23 in the lower stack has been changed.

[0048] 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.

ized in that at least one fly roll (15, 25) is located next to a thermo roll (12, 22).

9. Multiroll calender according to claim 5, **characterized in that** number of fly rolls is minimized.

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 comprising at least two stacks of calender rolls (10, 20), each stack comprising at least two calender rolls and at least one fly roll (15, 25), **characterized in that** at least one of the fly rolls (25) is movable between at least two locations.
2. Method according to claim 1, **characterized in that** in the method the fiber web (W) is calendered in a multiroll calender comprising at least two stacks of at least four calender rolls (10, 20).
3. Method according to any of claims 1 or 2, **characterized in that** in the method a fiber web grade that has basis weight of 40 - 150 g/m², advantageously 40 - 70 g/m², is calendered.
4. Method according to any of claims 1 - 3, **characterized in that** in the method fiber web is calendered to surface roughness of 0,6 - 4,5 µm PPs10, advantageously 0,65 - 2,5 µm PPS s10.
5. 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 (10, 20), each stack comprising at least two calender rolls and at least one fly roll, **characterized in that** at least one fly roll (25) of the multiroll calender has at least two positions of use during calendering.
6. Multiroll calender according to claim 5, **characterized in that** in the multiroll calender comprises at least two stacks of at least four calender rolls (10, 20).
7. Multiroll calender according to claim 5, **characterized in that** stacks of calender rolls (10, 20) are vertical or inclined or horizontal.
8. Multiroll calender according to claim 5, **character-**

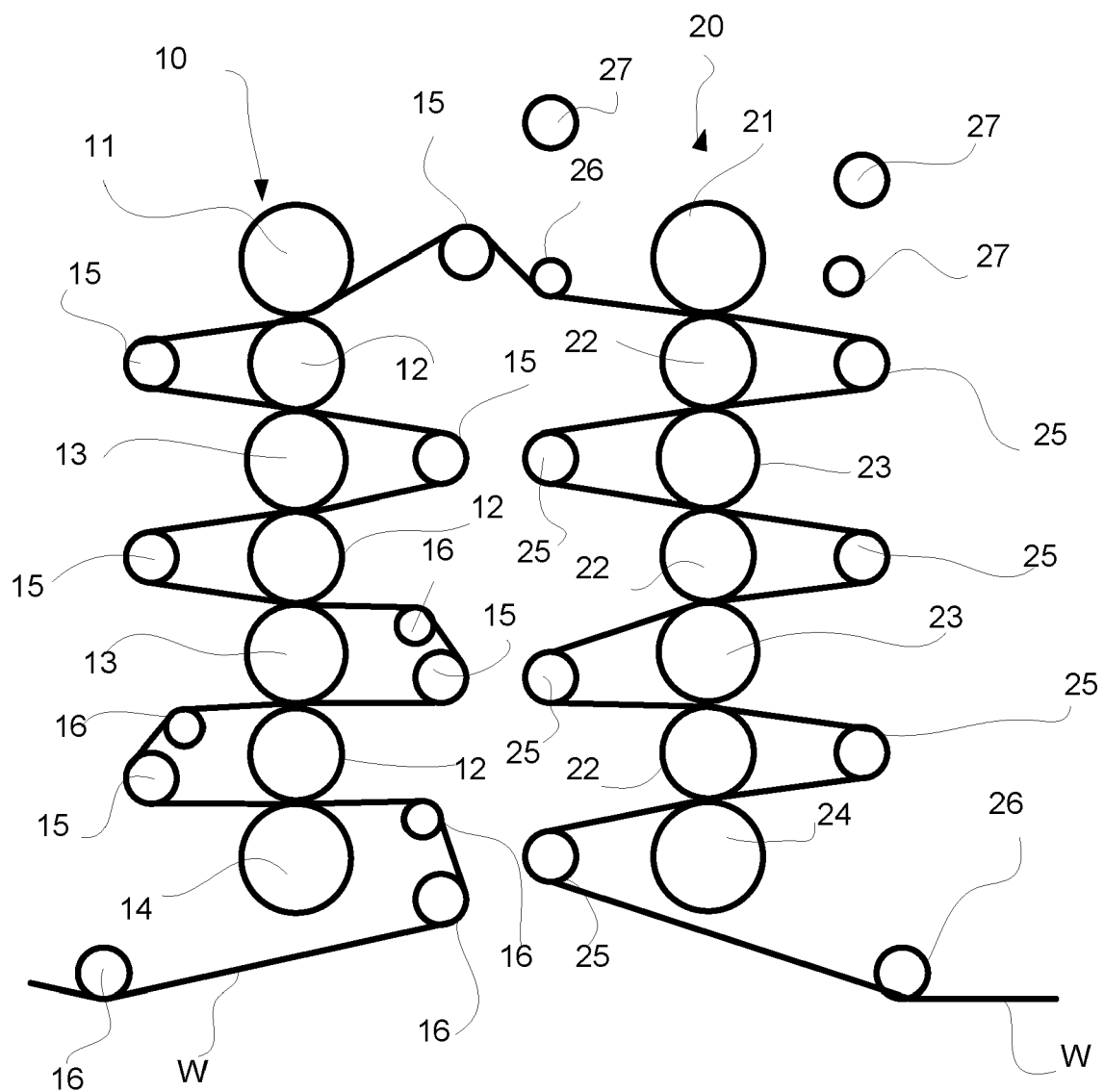


Fig. 1

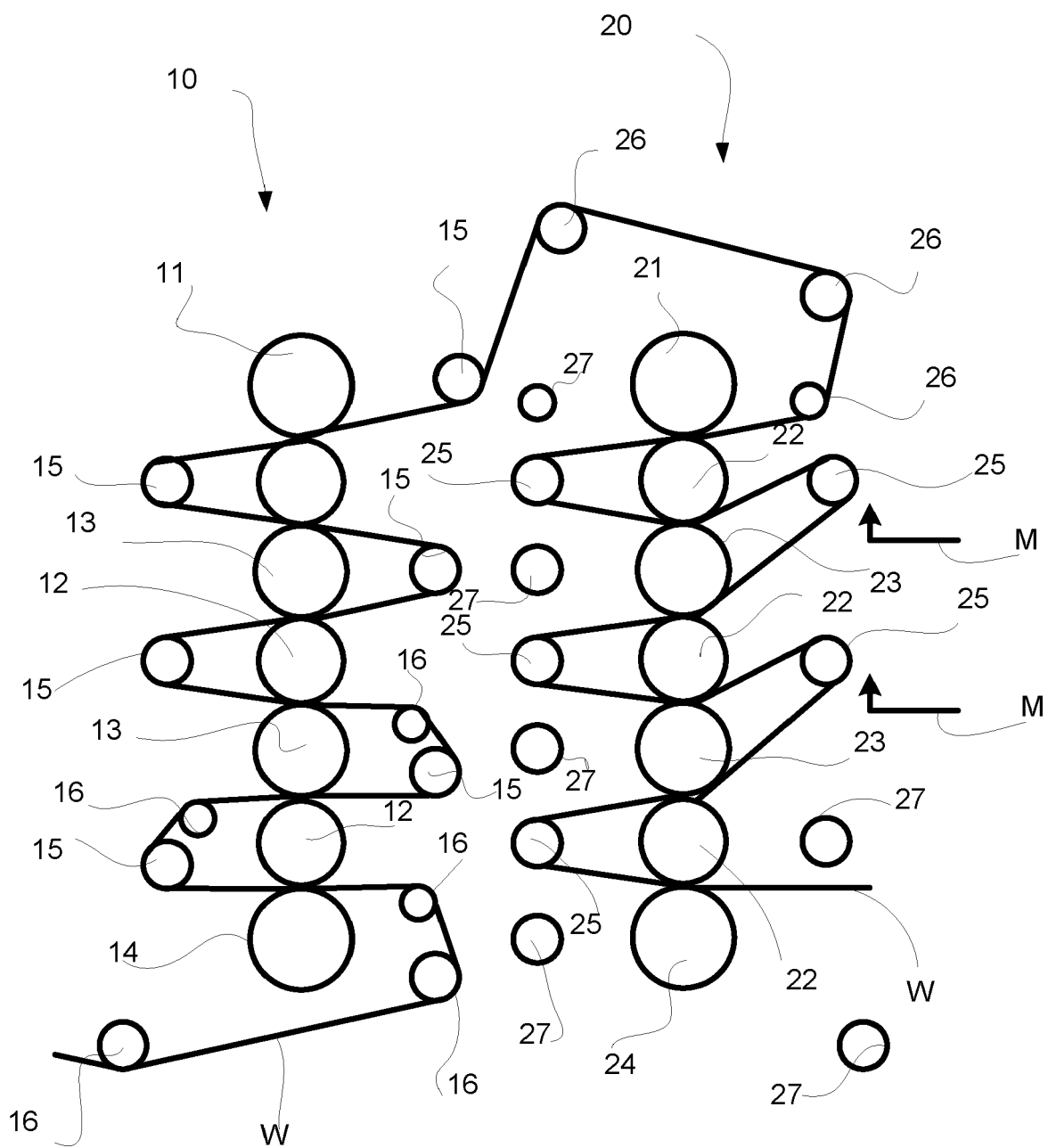


Fig. 2

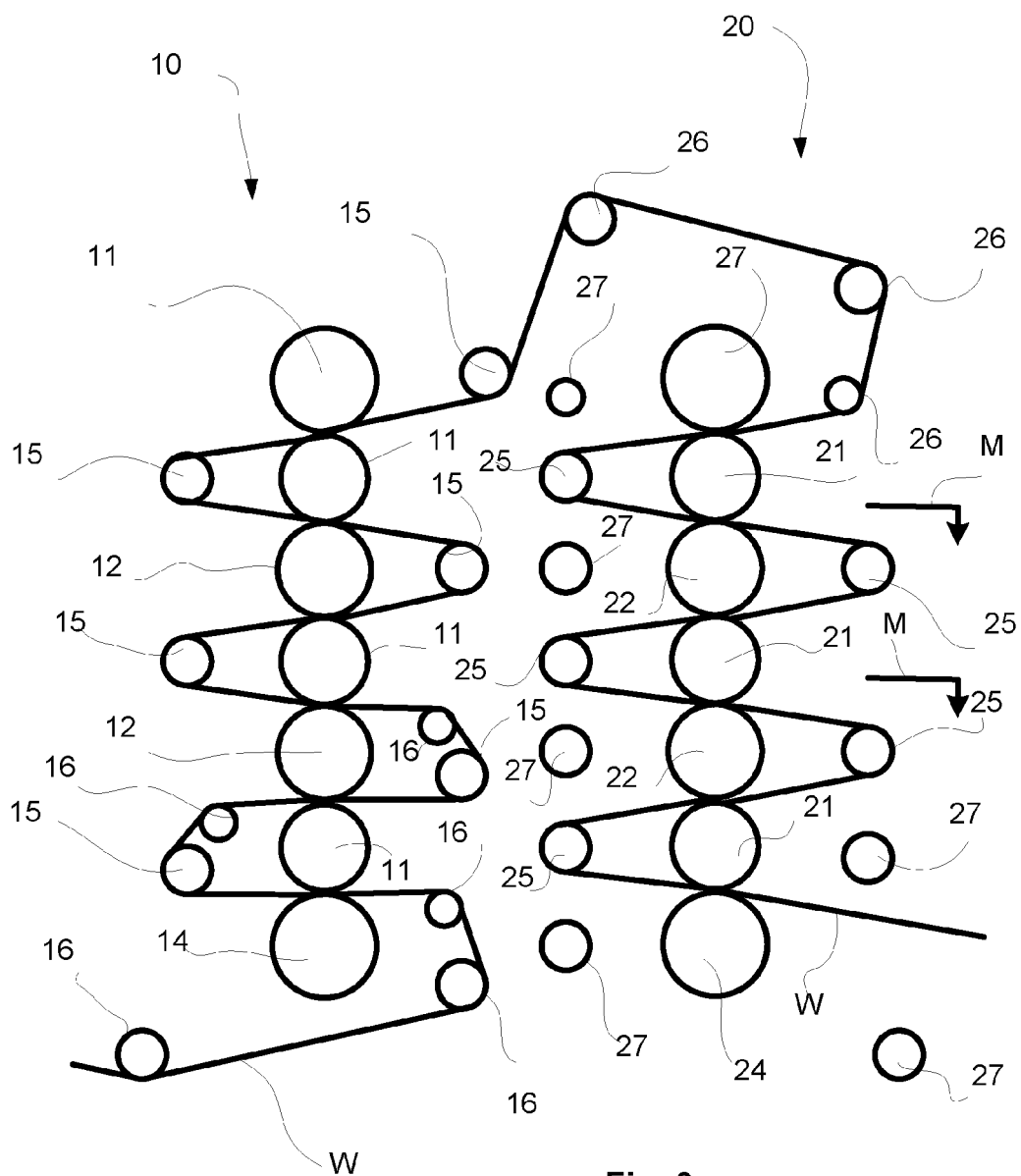


Fig. 3

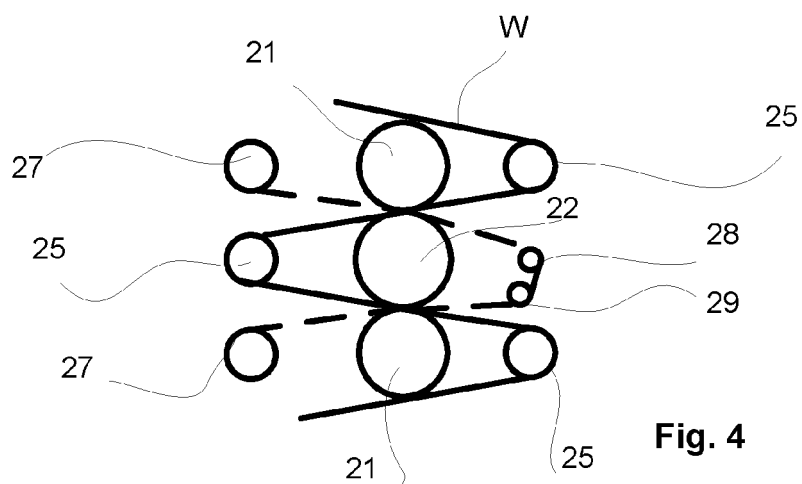
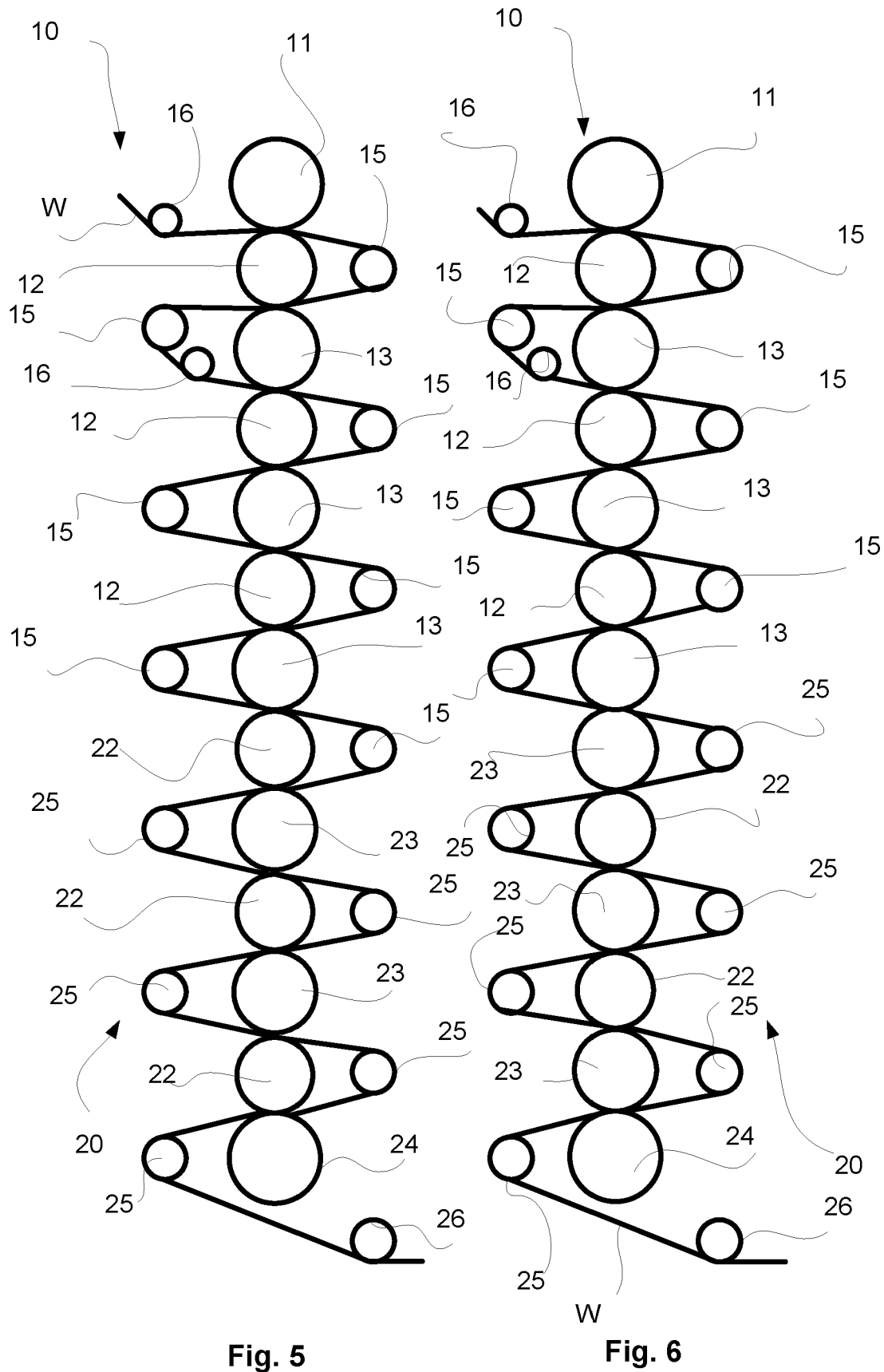


Fig. 4





EUROPEAN SEARCH REPORT

Application Number
EP 12 15 5384

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,D	WO 2006/051169 A2 (METSO PAPER INC [FI]; KANTANEN KAISA [FI]; MALINEN MARKKU S [FI]; KUOS) 18 May 2006 (2006-05-18) * the whole document *	1-9	INV. D21G1/00 D21G1/02
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			TECHNICAL FIELDS SEARCHED (IPC)
			D21G
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 June 2012	Examiner Beckman, Anja
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
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 15 5384

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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18-06-2012

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