(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 165 673 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.05.2017 Bulletin 2017/19

(51) Int Cl.:
D21F 5/18 *(2006.01)* ***D21F 9/00*** *(2006.01)*

(21) Application number: **15193630.9**

(22) Date of filing: **09.11.2015**

(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
Designated Validation States:
MA MD

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(54) PRODUCTION LINE FOR PRODUCING FIBER WEBS

(57) The invention relates to a production line for producing special fiber web grades, especially machine gazed fiber web grades, which production line comprises a forming section comprising a head box (100) and a forming unit (200), a press section (300), a drying section comprising a Yankee dryer (500), a calender (700) and a reel-up (800). The Yankee dryer (50) comprises a reversed Yankee cylinder (50) and that the top surface of the fiber web (W) is against the surface of the Yankee cylinder (50).

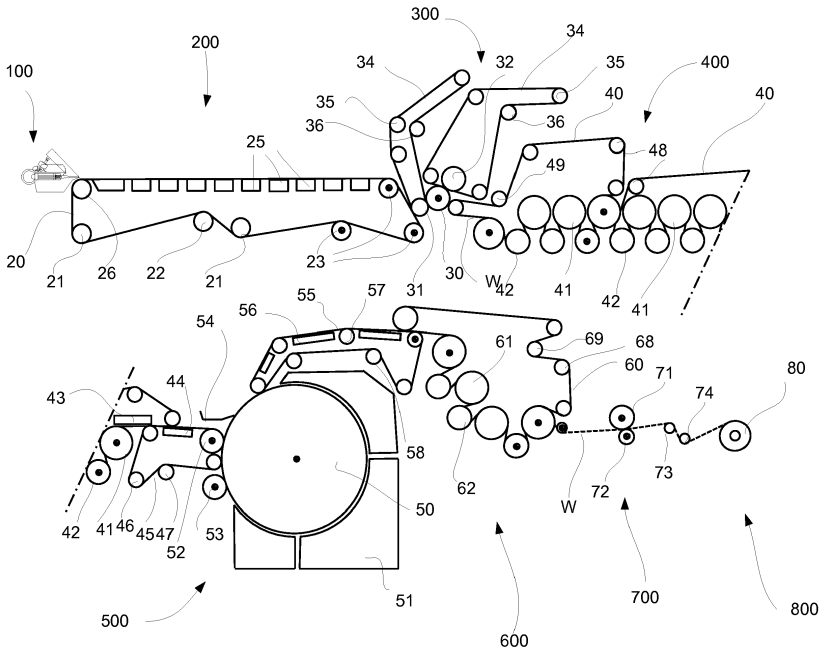

Fig. 1

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Description

[0001] The invention relates generally to producing fiber webs. Particularly the invention relates to a production line for producing special fiber web grades, especially machine glazed fiber web grades, according to the preamble of claim 1.

[0002] As known from the prior art in fiber web machines, especially in paper and board machines, the fiber web is produced and treated in an assembly formed by a number of apparatuses arranged consecutively in a process line. A typical production and treatment line comprises a forming section comprising a head box and a forming unit and a press section as well as a subsequent drying section and a reel-up. The production and treatment line can further comprise other devices and sections for finishing the fiber web, for example, a size press, a calender, a coating section. The production and treatment line also comprises typically at least one winder for forming customer rolls as well as a roll packaging apparatus. In this description and the following claims by fiber webs are meant for example paper and board webs.

[0003] Fiber webs, especially paper and board are available in a wide variety of types and can be divided according to basis weight in two grades: papers with a single ply and a basis weight of 25-300 g/m^2 and boards manufactured in multiply technology and having a basis weight of 150-600 m/m^2. 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. The present invention relates especially to production of fiber webs for special paper grades, which are typically paper grades with a specific feature. It is also typically only a minor component in the final product. Typical special fiber web grades are: Electrical papers (cable paper, capacitor tissue, transformer board, conductive paper, creped papers), Absorbent lamination papers, furniture papers (absorbent kraft, décor paper, overlay, pre-impregnated foils, laminating kraft), Filter papers (engine protection, laboratory and diagnostics, food and beverage, coffee filters, tea bags, vacuum cleaner dust bag), Special strong papers (abrasive base, spinning kraft, hunting cartridge paper), Release papers (pressure-sensitive labels, posters, signs and manual labels, vinyl casting, cover strips, masking tape), Copy and imaging papers (photographic paper, blueprint diazo paper, carbonless copy, thermal printing paper), Packaging grades (sack kraft, flexible packaging, label papers), Specialty printing grades, Special fine papers (security papers, artists' papers, tracing paper, plotting paper, luxury stationery), Building papers (wallpaper, barrier papers), Cigarette papers and Functional papers. In particular the present invention relates to MG (machine glazed)-grades, in production of which Yankee dryer is used typically for improved top side smoothness. The Yankee dryer gives a smooth surface and also closes the surface structure of the fiber web very efficiently. The MG grades are used as specialty papers or boards, for example as wrapping papers and wraps for foodstuffs.

[0004] In publication FI20135150 is disclosed a fiber web machine for producing paper grades, which have one smooth surface comprising a head box, a forming unit of fourdrinier type, a press section comprising at least one press nip in a line press, a drying section comprising at least one normal Yankee dryer having at least one nip against the Yankee cylinder and a reel-up. The fiber web is guided directly from the press section to the Yankee cylinder. This fiber web machine is a so called MG machine.

[0005] The MG machines are typically used as multigrades machines i.e. different grades of fiber webs are produced in the machine. One object of the present invention is to create a production line for producing fiber webs of the MG machine type, in which capacity is not limiting the variety of grades to be produced.

[0006] An object of the invention is to create a production line for producing special fiber web grades, especially machine glazed fiber web grades in which the disadvantages and problems of prior art are eliminated or at least minimized.

[0007] In particular an object of the invention is to provide a new type of production line for producing machine glazed fiber web grades.

[0008] In order to achieve the above mentioned objects the production line according to the invention is mainly characterized by the features of the characterizing clause of claim 1. Advantageous embodiments and features are disclosed in the dependent claims.

[0009] In this description and in the claims by term top surface of the fiber web is meant the side of the fiber web that in the final product will be towards the contents of the wrap or the package. And thus the bottom surface of the fiber web is the other side of the web.

[0010] According to the invention the production line for producing special fiber web grades, especially machine glazed fiber web grades, comprises a forming section comprising a head box and a forming unit, a press section, a drying section comprising a Yankee dryer, a calender and a reel-up, wherein the Yankee dryer comprises a reversed Yankee cylinder and the top surface of the fiber web is against the surface of the Yankee cylinder.

[0011] According to an advantageous feature of the invention the drying section of the production line comprises a wire drying part comprising at least one single wire drying group and the wire drying part is in the production line before the Yankee dryer.

[0012] According to an advantageous feature of the invention the drying section of the production line comprises a wire drying part comprising at least one single wire drying group and the wire drying part is in the production line after the Yankee dryer.

[0013] According to an advantageous feature of the invention the wire drying part located after the Yankee

dryer is descending such that a center line of a drying cylinder in respect of a center line of its successive drying cylinder is at higher location.

[0014] According to an advantageous feature of the invention the forming section contains only one forming unit and one head box and the forming unit is a fourdrinier forming unit or a hybrid forming unit. Thus a single-ply forming is advantageously applied in the production line according to the invention.

[0015] According to an advantageous feature of the invention the Yankee dryer comprises at least one roll, which forms a nip against the Yankee cylinder. Advantageously the Yankee dryer comprises two one roll, each of which form a nip against the Yankee cylinder and one of the rolls is a smooth roll and one of the rolls is a grooved roll.

[0016] According to an advantageous feature of the invention the press section is a center roll press section and in the press section a smooth roll is against the bottom surface of the fiber web. According to an advantageous feature of the invention in the production line dry solids content of the fiber web is 45 - 55%, when the fiber web reaches the surface of the Yankee cylinder.

[0017] Thus according to the invention in the production line for producing fiber webs a Yankee dryer comprising a Yankee cylinder and around its outer surface located Yankee hoods is used for closing the surface structure of the fiber web and to improve top side smoothness of the fiber web and advantageously before and after the Yankee dryer at least one drying cylinder group with advantageously single wire draw is located for providing further drying possibility of the fiber web. In the possible wire drying part before the Yankee dryer the bottom side of the fiber web is against the drying cylinders and in the possible wire drying part after the Yankee dryer the bottom side of the fiber web is against the drying cylinders, respectively. The Yankee dryer provides for the machine glazed surface of the fiber web and in the Yankee dryer the top surface of the fiber web is against the Yankee cylinder. In the Yankee dryer the Yankee cylinder is a reversed Yankee cylinder, in which the fiber web is first guided downwards along the cylinder surface and the rotating direction of the Yankee cylinder is counter-clockwise, when fiber web running direction is from left to right. By this the height of the production line is decreased, which f. ex. saves building costs of the machine hall for the production line. The fiber web is pressed against the cylinder surface of the Yankee cylinder by a drying fabric, advantageously by a drying felt.

[0018] Advantageously at least one nip is located at the Yankee cylinder formed by a roll pressing against the Yankee cylinder surface. Advantageously two pressing nips are formed against the Yankee cylinder by rolls, one of which is a smoot roll or a grooved roll or a perforated roll and the other is advantageously a grooved roll. In the first nip the fiber web is thus attached to the cylinder surface and in the other nip, which is advantageously the nip with the grooved roll, properties of the fiber web are improved, in case the grooved roll is used it is applied for marking the fiber web.

[0019] According to an advantageous feature of the invention the dry solids content of the fiber web is 45 - 55%, when the fiber web reached the surface of the Yankee cylinder. By this good attachment for the fiber web to the Yankee cylinder surface is achieved and good adherence during the run of the fiber web on the Yankee cylinder surface is achieved and the fiber web is unfastened only at the end run on the Yankee cylinder surface.

[0020] The fiber web is advantageously guided to and from the Yankee cylinder as a supported run, i.e. the fiber web is supported by a fabric during its run. The fiber web may have a free run from the press section to the wire drying part located before the Yankee dryer.

[0021] Advantageously from the Yankee cylinder of the Yankee dryer the fiber web is guided to the wire drying part with single wire draw, in which the wire drying part is descending i.e. center line of a first drying cylinder in respect the center line of its successive drying cylinder is at higher position. The advantageous, additional wire drying parts provide drying variation needed in multigrade production and also provide for flexibility for dry capacity content variation as the drying capacity of a single wire drying part is effectively variable by adjusting the drying capacity of the drying cylinders. Single wire drying groups provide good runnability of the fiber web.

[0022] The forming unit in the forming section is advantageously a fourdrinier forming unit or a hybrid forming unit, in which the fine substances in the fiber web concentrate on the side of the top surface of the fiber web and do not drain away with the white waters. Also the desired formation of the fiber web is achievable. Typically the forming section contains only one head box and one forming unit and the single-ply forming is applied.

[0023] The press section comprises advantageously a center roll with two press nip in which a smooth roll is against the bottom surface of the fiber web. Against the top surface of the fiber web advantageously a shoe press nip is located. In connection with each nip a felt is advantageously used as press fabric. In the press section good density of the fiber web is provided.

[0024] In the production line for producing fiber webs the production begins from a head box, type of which is advantageously a dilution head box but other types of head boxes can be used as well. Typically a one layer head box is used.

[0025] After drying in the production line for producing fiber webs the fiber web is calendered in a calender comprising at least one calender nip and at the end the full width fiber web is reeled to a parent roll in a reel-up. In the calender advantageously a thermo roll of the calendering nip will be against the top side of the fiber web. Depending on the final use of the fiber web further treatments can be provided and the full width web is typically before sending to customers formed to customer rolls in a slitter-winder and packed in roll packaging apparatus.

[0026] As is clear from the above by the production line

according to the invention many advantages are achieved and for example in the forming section a fine substance rich top side of the fiber web is created and in the press section the top surface receives good density and in the Yankee cylinder the by the forming section created fine substance rich top side of the fiber web is against the cylinder and additionally the reversed Yankee cylinder also provides for cost savings due to the decreased height of the production line.

[0027] In the following the invention is explained in detail with reference to the accompanying drawing to which the invention is not to be narrowly limited.

[0028] In figure 1 is shown schematically an advantageous example of a production line for producing fiber webs according to the invention.

[0029] In figure 2 is shown schematically another advantageous example of a production line for producing fiber webs according to the invention.

[0030] During the course of the following description like numbers and signs will be used to identify like elements according to the different views which illustrate the invention and its advantageous examples. In the figures some repetitive reference signs have been omitted for clarity reasons. In the figures rolls and cylinders provided with a drive are denoted by a black center circle.

[0031] In the examples of figures 1 and 2 the production line for producing fiber webs comprises a forming section comprising a head box 100 and a forming unit 200 and a press section 300 as well as a subsequent drying section comprising a drying cylinder part 400, a Yankee dryer 500 and another wire drying part 600 followed by a calender 700 and a reel-up 800. The examples of figures 1 and 2 differ only in respect of the forming unit type and thus in figure 2 only the beginning of the production line is shown.

[0032] The head box 100 in the examples of the figures is a dilution head box but other types of head boxes are applicable in the production line. From the head box mass is fed on to a wire 20 of the forming unit 200.

[0033] The forming unit 200 in the example of figure 1 is a fourdrinier type former and in the example of figure 2 is a hybrid type former.

[0034] The forming unit 200 in the example of figure 1 comprises the wire 20, which runs as a continuous loop guided by guide rolls 21 located inside the wire loop, some rolls 23 are provided with a drive. Tension of the wire 20 is adjusted by outside the loop located tension roll 22. The wire 20 forms a continuous planar surface onto which the mass is fed form the head box 100 and below the planar run are located suction boxes 25 form removing water.

[0035] In the example of figure 2 the forming unit 200 is a hybrid type former and comprises the wire 20, which runs as a continuous loop guided by guide rolls 21 located inside the wire loop, some rolls 23 are provided with a drive. Tension of the wire 20 is adjusted by outside the loop located tension roll 22. The wire 20 forms a continuous planar surface onto which the mass is fed form the head box 100 and below the planar run are located suction boxes 25 for removing water. The hybrid forming unit 200 of the example of figure 2 also comprises above the planar section located suction box 28 with a wire loop 21 with inside the loop located guide rolls 23. In this example water can also be removed upwards and thus the fine contents on the top layer can be further adjusted by the suction box 28.

[0036] The forming unit 200 as the fourdrinier former (fig. 1) or the hybrid former (fig. 2) provides for the fine substances in the fiber web W concentrate on the side of the top surface of the fiber web W and the desired formation of the fiber web W is achieved. The forming unit 200 may also comprise a breast roll 26 shaker known as such from prior art. The forming unit 200 can also be provided with adjustable or loadable foils. From the forming unit 200 the fiber web W is guided to the press section 300.

[0037] The press section 300 is a center roll press section, in which press nips are formed by rolls 31, 32 located to create the press nip against the common center roll 30. For pick-up of the fiber web form the forming section the roll 31 is advantageously a suction roll. Each roll 31, 32 are provided with a press fabric 34 guided by guide rolls 35 located inside the loop formed by the press fabric. The tension of the fabrics 34 is adjusted by outside the loops located tension roll 36. The press section 300 thus comprises a center roll 30 with two press nips in which the center roll 30 has a smooth surface and it is against the bottom surface of the fiber web W. Against the top surface of the fiber web W advantageously at least one shoe press nip is formed by the press roll 32. In connection with each nip a felt is advantageously used as press fabric 34. In the press section 300 good surface smoothness on to the bottom side of the fiber web W and good density of the fiber web W is provided. From the press section 300 the fiber web W is guided to the a subsequent drying section comprising a wire drying part 400, a Yankee dryer 500 and another wire drying part 600. The fiber web W may have a free run from the press section 400 to the wire drying part 400 located before the Yankee dryer 500 or the fiber web W may be transferred from the press section to the wire drying part by closed transfer.

[0038] In the first wire drying part 400 before the Yankee dryer 500 the fiber web W is dried in two drying groups of single wire draw. Each group comprises a drying wire 40, heated drying cylinders 41 in the top row and reversing cylinders 42 in the bottom row. The fiber web W that is being dried runs on support of the drying wire 40 such that the drying wire 40 presses the fiber web W on a drying cylinders 41 against heated cylinder surfaces, and the fiber web W remains at the side of the outside curve of reversing cylinders 42 located between drying cylinders 41. The drying wires 40 run as continuous loops guided by guide rolls 48 located inside the loop and tension of the wires 40 can be adjusted by outside the loop located tension roll 49. In the wire drying part 400 before the Yankee dryer 500 the bottom side of the fiber web W

is in contact with the surface of the drying cylinders 41. From the first wire drying section the fiber web W is guided as a supported run to the Yankee dryer. Advantageously the first wire drying part 400 contains only single wire draw drying group / groups and the wire drying part 400 is in the production line before the Yankee dryer 500. The fiber web W is supported by the support fabric 45 forming a continuous loop guided by guide rolls 46 located inside the loop and tensions of which can be adjusted by the outside the loop located tension roll 47. Also for smooth transfer of the fiber web W from the wire drying part to the Yankee dryer runnability devices 43, 44 are provided. In the wire drying part before the Yankee dryer the fiber web W is dried to the dry solids content of the fiber web is 45 - 55% and thus the fiber web reaches the surface of the Yankee cylinder in this dry solid content. By this good attachment for the fiber web W to the Yankee cylinder surface is achieved and good adherence during the run of the fiber web W on the Yankee cylinder surface is achieved.

[0039] The Yankee dryer 500 comprises a heated Yankee cylinder 50 and around its outer surface located Yankee hoods 51. The Yankee dryer 500 closes the surface structure of the fiber web W and improves top side smoothness of the fiber web W. The Yankee dryer 500 also provides for the machine glazed surface of the fiber web W. In the Yankee dryer the top surface of the fiber web W is dried against the Yankee cylinder 50. In the Yankee dryer 500 the Yankee cylinder is a reversed Yankee cylinder, in which the fiber web W is first guided downwards along the cylinder surface and the rotating direction of the Yankee cylinder is counter-clockwise, when the running direction of the fiber web W is from left to right. The fiber web W is pressed against the cylinder surface of the Yankee cylinder 50 by a drying fabric, advantageously by a drying felt. At least one nip is located at the Yankee cylinder formed by a roll 52, 53 pressing against the Yankee cylinder surface. Advantageously two pressing nips are formed against the Yankee cylinder by rolls 52, 53, first one 52 of which is a smooth roll or a grooved roll or a perforated roll and the other 53 is advantageously a grooved roll. In the first nip the fiber web W is attached to the cylinder surface and in the other nip, which is advantageously the nip with the grooved roll 53, properties of the fiber web W are improved, in case the grooved roll 53 is used it is applied for marking the fiber web. In connection with the Yankee cylinder 50 a web tray 54 is located for collecting the fiber web W in case of a web break. The Yankee hoods 51 blow hot air towards the fiber web W on the area of Yankee cylinder 50.

[0040] After the Yankee dryer 500 the fiber web W is guided by a support fabric 55, guided by guide rolls 57 and tension roll 58 and aided by runnability devices 56 to a wire drying section 600 of single wire draw having one drying cylinder group with drying cylinders 62, reversing cylinders 62 and a drying wire 60 and its guide rolls 68 and tension roll 69 for providing further drying possibility of the fiber web W and in which the bottom side of the fiber web W is in contact with the surface of the drying cylinders 41. This wire drying part 600 is descending i.e. center line of a first drying cylinder 61 in respect of center line of its successive the drying cylinder is at higher position. After the wire drying part 600 the fiber web W is guided in a free run to the calender 700. Advantageously the wire drying part 600 contains only single wire draw drying group / groups and the wire drying part 600 is in the production line after the Yankee dryer 500. By this arrangement fiber web W is supported at least from the beginning of first wire drying part 400 until the end of wire drying part 600. In the calender 700 the fiber web W is calendered in a calender nip formed between two calender rolls 71, 72 on which one is a thermo roll 71 that is against the top side of the fiber web W. From the calender 700 the fiber web W is guided to the reel-up 800.

[0041] In the reel-up 800 the full width fiber web W is reeled to a parent roll 80.

[0042] Above only some advantageous examples of the inventions has been described to which examples the invention is not to be narrowly limited and many modifications and alterations are possible within the invention.

Claims

1. Production line for producing special fiber web grades, especially machine gazed fiber web grades, which production line comprises a forming section comprising a head box (100) and a forming unit (200), a press section (300), a drying section comprising a Yankee dryer (500), a calender (700) and a reel-up (800), **characterized in that** the Yankee dryer (50) comprises a reversed Yankee cylinder (50) and that the top surface of the fiber web (W) is against the surface of the Yankee cylinder (50).

2. Production line according to claim 1, **characterized in that** the drying section of the production line comprises a wire drying part (400) comprising at least one single wire drying group and that the wire drying part (400) is in the production line before the Yankee dryer (500).

3. Production line according to claim 1 or 2, **characterized in that** the drying section of the production line comprises a wire drying part (600) comprising at least one single wire drying group and that the wire drying part (600) is in the production line after the Yankee dryer (500).

4. Production line according to claim 3, **characterized in that** the wire drying part (600) located after the Yankee dryer (500) is descending such that a center line of a drying cylinder (61) in respect of a center line of its successive drying cylinder (61) is at higher

position.

5. Production line according to any of claims 1 - 4, **characterized in that** the forming section contains only one forming unit (200) and one head box (100) and that the forming unit (200) is a fourdrinier forming unit or a hybrid forming unit.

6. Production line according to any of claims 1 - 5, **characterized in that** the Yankee dryer (500) comprises at least one roll (52, 53), which forms a nip against the Yankee cylinder (50).

7. Production line according to claim 6, **characterized in that**, the Yankee dryer (500) comprises two one roll (52, 53), each of which form a nip against the Yankee cylinder (50) and that one of the rolls (52,53) is a smooth roll and one of the rolls (52,53) is a grooved roll.

8. Production line according to any of claims 1 - 7, **characterized in that**, the press section (300) is a center roll press section and that in the press section a smooth roll (30) is against the bottom surface of the fiber web (W).

9. Production line according to any of claims 1 - 8, **characterized in that**, in the production line dry solids content of the fiber web (W) is 45 - 55%, when the fiber web (W) reaches the surface of the Yankee cylinder (50).

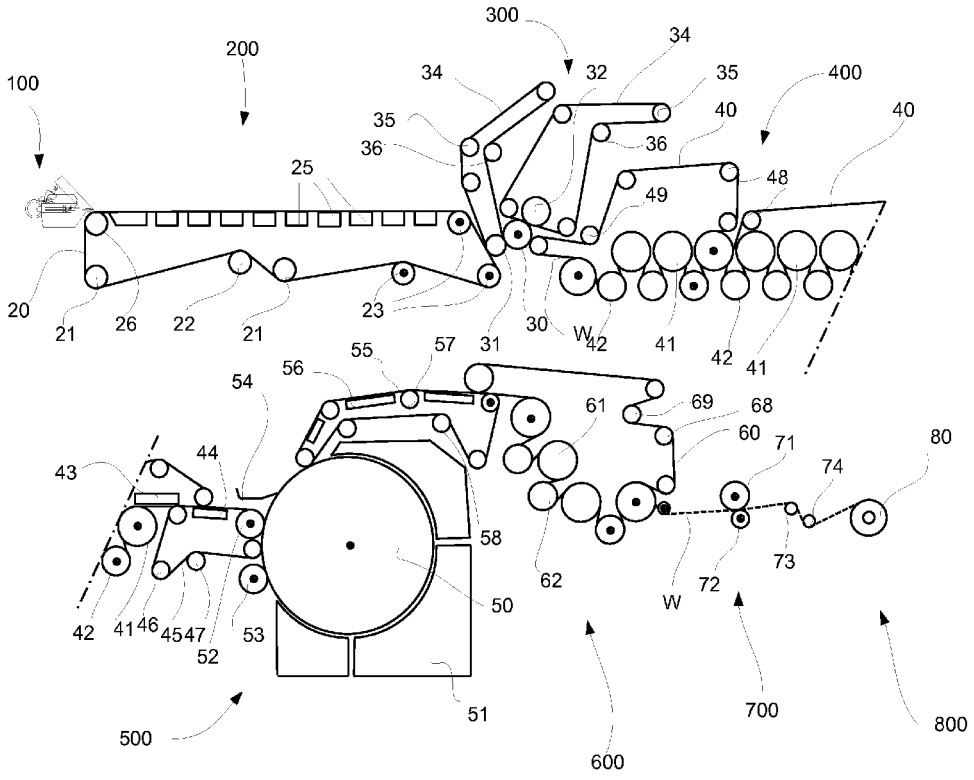
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Fig. 1

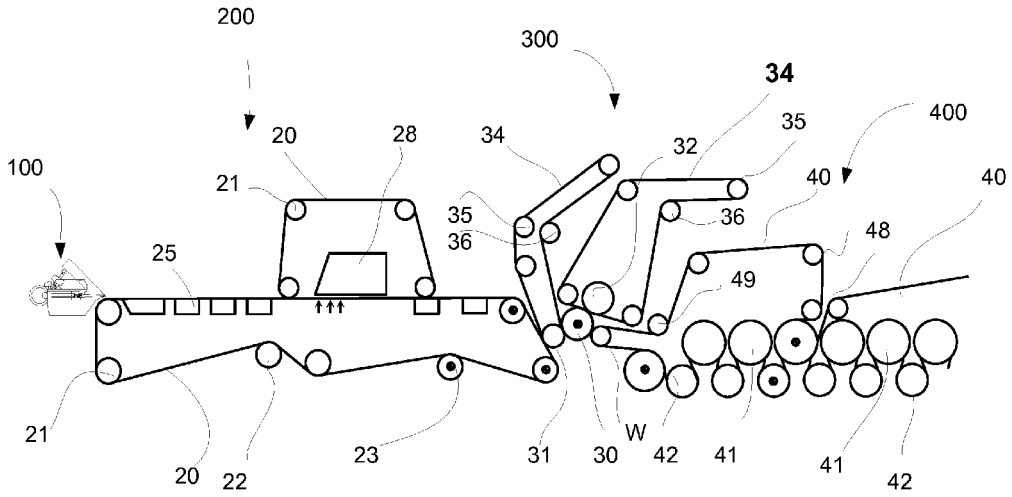
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Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 3630

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	WO 99/23298 A1 (KIMBERLY CLARK CO [US]) 14 May 1999 (1999-05-14) * page 29, line 21 - page 30, line 22 * * page 28, lines 19-23 * * page 31, line 22 - page 32, line 8 * * figures 2,4 *	1,5,6,9	
Y	DE 10 2014 205381 A1 (VOITH PATENT GMBH [DE]) 24 September 2015 (2015-09-24) * paragraphs [0023] - [0026]; figures *	2	
Y	WO 81/02704 A1 (VALMET OY [FI]; WEISSHUHN F [CH]) 1 October 1981 (1981-10-01) * page 6, lines 8-22; figure 1 *	8	

TECHNICAL FIELDS SEARCHED (IPC)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 April 2016	Pregetter, Mario

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 19 3630

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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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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