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

(11) **EP 3 848 503 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.07.2021 Bulletin 2021/28

(51) Int Cl.:
D21F 5/18 *(2006.01)* ***B65H 23/24*** *(2006.01)*
F26B 13/10 *(2006.01)*

(21) Application number: **20213721.2**

(22) Date of filing: **14.12.2020**

(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
KH MA MD TN

(30) Priority: **09.01.2020 FI 20205016**

(71) Applicant: **Valmet Technologies Oy**
02150 Espoo (FI)

(72) Inventors:
- **BEHM, Sari**
  04410 Järvenpää (FI)
- **IMMONEN, Sampo**
  40520 Jyväskylä (FI)
- **KARJALA, Eveliina**
  21420 Lieto (FI)
- **KIVIMAA, Juha**
  40950 Muurame (FI)
- **KOVANEN, Juha**
  70820 Kuopio (FI)
- **LARES, Matti**
  04300 Tuusula (FI)
- **LEWANDOWSKI, Petri**
  40630 Jyväskylä (FI)
- **LUOMI, Seppo**
  04410 Järvenpää (FI)
- **MAJAMÄKI, Mikko**
  21250 Masku (FI)
- **MÄNTYNEN, Antti**
  21120 Raisio (FI)
- **SOLIN, Richard**
  20100 Turku (FI)
- **SUNDQVIST, Hans**
  20720 Turku (FI)
- **TIKKA, Toni**
  40930 Kinkomaa (FI)
- **VILJANMAA, Mika**
  00760 Helsinki (FI)

(74) Representative: **Berggren Oy**
P.O. Box 16
Eteläinen Rautatiekatu 10A
00101 Helsinki (FI)

(54) DRYER FOR DRYING COATED FIBER WEBS

(57) The invention relates to a dryer for drying coated fiber webs, which comprises three air compartments (81, 82, 83) configured to provide drying air blows towards passing fiber web (W). Two of the air compartments (81, 82) are substantially rectangular chambers and located next to each other with two longitudinal back sides towards each other,
that third air compartment (83) is a turning air compartment located with a straight surface towards ends of the two rectangular air compartments (81, 82) and having a substantially curved outer, advantageously semi-circular, outer surface. The dryer (80) is configured to form a first longitudinal drying run for the fiber web (W) in a first vertical portion (87), a curved drying run for the fiber web (W) in a turning portion (89) and a second longitudinal drying run for the fiber web (W) in a second vertical portion (88). The dryer (80) further comprises along the vertical portions (87, 88) at a distance from the air compartments (81, 82) at least one blow device (85) configured to provide support air blows to support the run of the passing fiber web (W). The rectangular air compartments (81, 82) comprise an inlet channel (84) and two outlet channels (86) and that the inlet channel (84) is located in between the outlet channels (86) in length direction of the rectangular air compartment (81, 82).

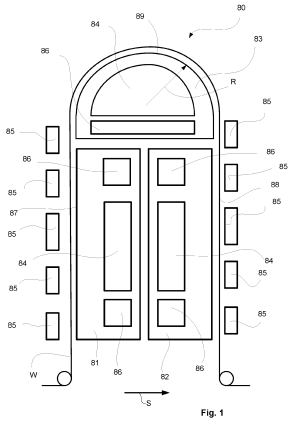

Fig. 1

EP 3 848 503 A1

Description

Technical field

[0001] In general, present invention relates to dryers for drying coated fiber webs in connection with producing coated fiber webs in a production line for coated fiber webs, in particular with producing coated board webs, more particularly with producing coated board webs of folding box board grades. More especially the present invention relates to a dryer according to preamble part of the independent dryer claim.

Background

[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 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 a 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. The length of the production line is thus typically very long in machine direction and thus requires a lot of space. 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 main carton board grades are folding boxboard (FBB), white-lined chipboard (WLC), solid bleached board (SBS) and liquid packaging board (LPB). In general, these grades are typically used for different kinds of packaging of consumer goods. Carton board grades vary from one- up to five-ply boards (150-400 g/m^2). The top side is usually coated with from one to three layers (20-40 g/m^2), the back side has less coating or no coating at all. There is a wide range of different quality data for the same board grade. FBB has the highest bulk thanks to the mechanical or chemi-mechanical pulp used in the middle layer of the base board.

[0004] Coated fiber web grades and coating are becoming more and more popular and thus the coating process and equipment have increasing demands imposed thereon. In coating, especially in pigment coating, the surface of a fiber web is formed with a layer of coating color (coating substance) at a coating station followed by drying. The process of coating can be divided in supplying the coating color onto the web surface, which is called the application of the coating color, as well as in the adjustment of final amount of coating color. The coating of paper and board web typically utilize a coating device - a coater. In connection with the coater different kinds of coating technology are employed in prior art arrangements, for example pond technology or film-transfer technology or spray technology or blade technology. One important recently developed application technique is curtain application, which is suitable to surface treatment of paper and board webs. By curtain application good coverage of treatment substance on the web surface is achieved.

[0005] As coated fiber web grades are becoming more and more popular and thus the process and equipment have increasing demands imposed thereon. In application the surface of a fiber web is formed with a layer of treatment substance at an application station followed by drying. In prior art fiber web production lines, the drying following the coating typically requires a lot of space, especially in machine direction and thus further increases length of the fiber web production line. The dryers known from prior art are provided with one inlet channel and one outlet channel next to each other in an air compartment of the dryer. This has caused uneven drying effects during the run of the passing fiber web to be dried and disturbances of the stability of the passing fiber web, which have been tried to prevent by locating the inlet and outlet channels in staggered configuration, which in turn has required increased space of the air compartments in the dryer, thus, increasing the size of the dryer significantly.

[0006] An object of the invention is to create a dryer for drying coated fiber webs, in which the disadvantages and problems of prior art are eliminated or at least minimized.

[0007] An object of the invention is to create an improved dryer for drying coated fiber webs, in which efficient contactless drying of coated fiber web is achieved.

[0008] A particular object of the invention is to create a dryer, in which the disadvantages and problems of prior art relating to space requirement in machine direction, especially due to drying after coating, are eliminated or at least minimized.

Summary

[0009] In order to achieve the above mentioned objects, the dryer according to the invention is mainly characterized by the features of the characterizing clause of the independent dryer claim. Advantageous embodiments and features are disclosed in the dependent claims.

[0010] According to the invention the dryer for drying coated fiber webs, comprises three air compartments configured to provide drying air blows towards passing

fiber web; two of the air compartments are substantially rectangular chambers and located next to each other with two longitudinal sides towards each other; third air compartment is a turning air compartment located with a straight surface towards upper surfaces of the two rectangular air compartments having a substantially curved outer, advantageously semi-circular, outer surface; the dryer is configured to form a first longitudinal drying run for the fiber web in a first vertical portion, a curved drying run for the fiber web in a turning portion and a second longitudinal drying run for the fiber web in a second vertical portion; and the dryer further comprises along the vertical portions at a distance from the air compartments at least one blow device configured to provide support air blows to support the run of the passing fiber web; and the rectangular air compartments comprise an inlet channel and two outlet channels and the inlet channel is located in between the outlet channels in length direction of the rectangular air compartment.

[0011] According to an advantageous feature of the invention the dryer is a double-pass dryer configured to a U-shaped air dryer with an air turn.

[0012] According to an advantageous feature of the invention maximum blowing drying air temperature of the dryer is 500°C and minimum blowing drying air temperature is 50°C, advantageously 70°C.

[0013] According to an advantageous feature of the invention each air compartment is individually adjustable to provide three drying temperature zones for drying the fiber web.

[0014] According to an advantageous feature of the invention the air compartments and the blow devices comprise overpressure-nozzles, that on the substantially vertical portion of the rectangular air compartments the nozzles for air blows are at a spacing of 200 - 450 mm and that the nozzles of the blow devices are at a spacing of 300 - 1200 mm, advantageously at a spacing of 600 - 1200 mm, from each other.

[0015] According to an advantageous feature of the invention air equipment configuration of the dryer comprises separate air circulating equipment for the rectangular air compartments forming the vertical portions and the semi-circular, turning air compartment forming the curved, turning portion has its own air circulating equipment.

[0016] According to an advantageous feature of the invention the air circulating equipment for the vertical portions are in a cascade connection.

[0017] According to an advantageous feature of the invention air equipment configuration of the dryer comprises common air circulating equipment for the rectangular air compartments forming the vertical portions and the semi-circular, turning air compartment forming the curved, turning portion has its own air circulating equipment.

[0018] According to an advantageous feature of the invention air equipment configuration of the dryer comprises separate supply air system the blow devices providing support air flows to support the run of the passing fiber web.

[0019] By the invention many advantages are achieved: the improved dryer for drying coated fiber webs provides efficient contactless drying of coated fiber web and improved production line for coated fiber web shorter than known production lines for coated fiber webs and thus, considerable space savings in machine line direction of the production line are achieved. The advantageous configuration of the rectangular air compartments of the dryer provides that over all width in running direction of the fiber web is decreased by a third. Advantageously also three individually controllable drying zones can be used and thus, quality and energy consumption can be optimized. Additionally, improved usability of layout options, for example in view of tail threading, are provided.

Brief description of the drawings

[0020] 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.

In figure 1 is schematically shown an advantageous example of a dryer for coated fiber webs in accordance with the invention,

In figures 2A-2B is schematically shown an advantageous example of a rectangular air compartment of the dryer for coated fiber webs in accordance with the invention,

In figures 3A - 3C are schematically shown advantageous examples of air equipment configurations for a dryer for coated fiber webs in accordance with the invention,

In figure 4 is schematically shown an advantageous example of a production line for coated fiber webs.

[0021] 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.

Detailed description

[0022] In figure 1 is shown as a schematical cross-sectional view an example of a dryer 80 for drying coated fiber webs W. The dryer 80 extends substantially over the width of the fiber web i.e. in cross-direction in respect of the main running direction S of the fiber web W. In a fiber web production line for coated fiber web the dryer 80 is located after a coater. In the dryer 80 the fiber web W is dried by contactless drying. The dryer 80 comprises

three air compartments 81, 82, 83 forming chambers of the dryer 80. Each air compartment 81, 82, 83 is advantageously individually adjustable. Thus, three drying temperature zones for drying the fiber web can be provided. Two of the air compartments 81, 82 are substantially rectangular air chambers and located next to each other with two longitudinal "back" sides towards each other i.e. the sides without nozzles are located towards each other and the sides with nozzles towards the passing fiber web W, and the third air compartment 83, a turning air compartment, as a substantially curved outer, advantageously semi-circular outer surface and the third air compartment 83 is located with the straight surface towards the upper surfaces of other two air compartments 81, 82. Radius of the curved air compartment 83 is advantageously 800 - 1200 mm. Thus, the height of the rectangular air compartments 81, 82 in the main running direction S of the fiber web W is advantageously 800 - 1200 mm. Rectangular air compartments 81, 82 have advantageously width of 2,4 - 11 m in perpendicular direction in respect of the main running direction S of the fiber web W and length of 5 - 6 m i.e. in upwards direction of the plane of the main running direction S of the fiber web W. The configuration of the dryer 80 is thus such, that the fiber web W has first a longitudinal run in a vertical portion 87, in the figure upwards, thereafter a semi-circular run in a curved, turning portion 89 and next another longitudinal run in another vertical portion 88, in the figure downwards. The dryer 80 comprises thus the vertical portions 87, 88 and the curved, turning portion 89. Along the longitudinal runs of the fiber web W upwards from the plane of the main running direction S of the fiber web W in the vertical portion 87, 88 i.e. at longitudinal, outer sides of the two substantially rectangular air compartments 81, 82 at a distance from the rectangular air compartments 81, 82 on the other side of the fiber web W at least one, advantageously several blow devices 85 are located next to each other at a distance from each other and such that support air flows to support the run of the passing fiber web W are provided from the blow devices 85 as the fiber web W passes the rectangular air compartments 81, 82 of the dryer 80. Each air compartment 81, 82, 83 comprises one, pressurized air blow channel 84, inlet channel 84, for proving drying air for drying the passing fiber web W and the rectangular air compartments 81, 82 comprise two outlet channels 86 for removing the moist air from the drying area and the curved, turning air compartment 83 comprises one outlet channel 86. In the length direction of the dryer 80 and of the rectangular air compartments 81, 82 i.e. in the upwards direction of the plane of the main running direction S of the fiber web W the inlet channel 84 is located in between the two outlet channels 86. Each rectangular air compartment 81, 82 have in the middle of the vertical portion the inlet, i.e. air blow channel 84 and at the area of each end an outlet channel 86. The blow devices 85 provide support air blows to support the run of the passing fiber web W i.e. the air blows keep the fiber web at a suitable distance from the air compartments 81, 82 corresponding nozzle sides.

[0023] The dryer 80 is a double-pass dryer 81, 82; 87,88 configured to a U-shaped air dryer with an air turn 83; 89. The drying air of the dryer 80 can also be gas or steam. The maximum blowing air temperature is advantageously about 500°C and the minimum blowing air temperature is 50°C, advantageously 70°C. Various types of nozzles can be used in connection with the air compartments 81, 82, 83 and the blow devices 85, advantageously the nozzles are overpressure-nozzles. On the substantially vertical portion 87, 88 the nozzles for air blows are at a spacing for example 200 - 450 mm from each other. The nozzles of the blow devices 85 have advantageously a longer spacing from each other than the nozzles of the vertical portions 87, 88, advantageously the spacing is 300 - 1200 mm, more advantageously 600 - 1200.

[0024] In figures 2A-2B is schematically shown an example of a rectangular air compartment 81; 82 of the dryer 80. The air compartments 81, 82 are substantially rectangular air chambers having back side 93, nozzle side 92 and side ends 94 and front and back ends 95 of which front and back ends 95 only one is marked in the cut-view of the figure 2. The longitudinal "back" side 93, the upper side 93 in the figure 2, or the rectangular air compartment 81; 82 is towards the other rectangular air compartment 82; 81 i.e. the sides without nozzles of the two rectangular air compartments 81; 82 of the dryer 80 are located towards each other. The side 92 with nozzles 91 of the rectangular air compartment 81; 82 is towards the passing fiber web W. The height H of the rectangular air compartments 81, 82 in the main running direction S of the fiber web W is advantageously 800 - 1200 mm. Rectangular air compartments 81, 82 have advantageously width of 2,4 - 11 m in perpendicular direction in respect of the main running direction S of the fiber web W and length of 5 - 6 m i.e. in upwards direction of the plane of the main running direction S of the fiber web W. The air compartment 81; 82 comprises one, pressurized air blow channel 84, the inlet channel 84, for proving drying air via the nozzles 91 for drying the passing fiber web W and two outlet channels 86 for removing the moist air from the drying area. In the length direction of the rectangular air compartment 81; 82 the inlet channel 84 is located in between the two outlet channels 86. The rectangular air compartment 81; 82 has in the middle of the vertical portion the inlet, i.e. air blow channel 84 and at the area of each end an outlet channel 86. Various types of nozzles 91 can be used in connection with the air compartments 81, 82, advantageously the nozzles are overpressure-nozzles. The nozzles 91 for air blows towards the fiber web are at a spacing for example 200 - 450 mm from each other.

[0025] In figures 3A - 3C is shown examples of air equipment configurations for the dryer 80. In the examples of figures 3A-3C air equipment configurations for the air compartments 81, 82, 83 comprise air circulating equipment 98 with air inlets 84 to each air compartment

81, 82 83 and two air outlets 86 from each rectangular air compartment 81, 82 and one air outlet 86 from the semi-circular, turning air compartment 83. The air equipment configurations also comprise a heating unit 97 and they may also comprise a heat recovery unit 99. In the example of figure 3A the air equipment configuration comprises separate air circulating equipment 98 for the rectangular air compartments 81, 82 forming the vertical portions 87, 88. In the example of figure 3B the air equipment configuration comprises common air circulating equipment 98 for the rectangular air compartments 81, 82 forming the vertical portions 87, 88. In the example of figure 3C the air equipment configuration comprises separate air circulating equipment 98 for the rectangular air compartments 81, 82 forming the vertical portions 87, 88 and the semi-circular, turning air compartment 83 forming the curved, turning portion 89 has its own air circulating equipment 98. The air circulating equipment 98 for the vertical portions 87, 88 of the example of figure 3C are in a cascade connection such that exhaust air of first, in running direction of the fiber web, rectangular air compartment 81 is guided to second, in running direction of the fiber web, rectangular air compartment 82 as replacement air to optimize energy efficiency.

[0026] In the example of figure 3A the air equipment configuration comprises separate air circulating equipment for the rectangular air compartments 81, 82 forming the vertical portions 87, 88 and the semi-circular, turning air compartment 83 forming the curved, turning portion 89 has its own air circulating equipment. The blow devices 85 on the vertical portions 87, 88 providing support air flows to support the run of the passing fiber web W comprise their own, separate supply air system 96 and advantageously hot air from heat recovery system 99 is mixed to the blowing air. This configuration is very advantageous in case different fiber web grades are produced and thus different temperature for the air blow from the rectangular air compartments 81, 82 of the dryer 80 can be used.

[0027] In the example of figure 3B the air equipment configuration comprises common air circulating equipment for the rectangular air compartments 81, 82 forming the vertical portions 87, 88 and the semi-circular, turning air compartment 83 forming the curved, turning portion 89 has its own air circulating equipment. The blow devices 85 on the vertical portions 87, 88 providing support air flows to support the run of the passing fiber web W comprise their own, separate supply air system 96 and advantageously hot air from heat recovery system 97 is mixed to the blowing air. This configuration is very cost effective as savings in equipment needed are achieved.

[0028] In the example of figure 3C the air equipment configuration comprises separate air circulating equipment for the rectangular air compartments 81, 82 forming the vertical portions 87, 88 and the semi-circular, turning air compartment 83 forming the curved, turning portion 89 has its own air circulating equipment. The air circulating equipment for the vertical portions 87, 88 of the example of figure 3C are in a cascade connection such that exhaust air of first, in running direction of the fiber web, rectangular air compartment 81 is guided to second, in running direction of the fiber web, rectangular air compartment 82 as replacement air to optimize energy efficiency. The blow devices 85 on the vertical portions 87, 88 providing support air flows to support the run of the passing fiber web W comprise their own, separate supply air system 96 and advantageously hot air from heat recovery system 97 is mixed to the blowing air.

[0029] In figure 4 is schematically shown an example of a fiber web production line which comprises a forming section comprising a head box/head boxes 10 and a forming unit 20. The production line further comprises a press section 25, a drying section 30, a sizing section 35, a calender 40, coating sections 45, 50, a final calender 75, a reel-up 55 and a slitter-winder 60. In this example a three-ply fiber web is produced, in which the fiber web comprises a top layer, a middle layer and a bottom layer. The middle layer is the bulkiest layer. The head box 10 is a three-layer head box, shown in the figure 4, or the production line may comprise three separate head-boxes - one for each layer of the fiber web. The three-layer headbox 10 comprises headers 101, 102, 103 from which the pulp suspensions for each layer of a multiply fiber web are fed to manifold tubes, to an equalization chamber and further via a turbulence generator to slice channels ending to a slice opening of the headbox 10. The forming unit 20 comprises advantageously at least one sleeve roll 201. A sleeve roll is a roll that comprises a stationary support shaft, an belt loop, which is led to circle around the stationary support shaft, that the sleeve roll further comprises at least one curvilinear dewatering zone consisting of two partial curves such that the radius of curvature of a first partial curve is greater than the radius of curvature of a second partial curve following the first partial curve in the travel direction of belt loop. A sleeve roll configuration is disclosed for example in EP patent application 17164069 of the applicant. The press section 25 comprises at least one press nip N25, in the example of the figure 4 there are four press nips N25and it can be configured in various, as such known for one skilled in the art known ways. The drying section 30 comprises for example drying cylinder groups R30 with drying cylinders 301 and drying wires 302 and it can be configured in various, as such known for one skilled in the art known ways. The sizing section 35 comprises a hard nip sizer 351 and drying equipment 352. The calender 40 is advantageously a metal belt calender comprising a metal belt 401 and a calender roll 402, between of which the fiber web is calendered. The coating sections 45, 47, 50 comprise coaters 451, 471, 501 for applying coating onto the multi-ply fiber web and dryers 80 following the coaters 451, 471, 501. After the first coater 451 one dryer 80 located above the machine level is provided. After the second coater 471 one dryer 80 located below the machine level and a drying cylinder group 472 located above the machine level is provided. After the third coater 501

one dryer 80 located above the machine level and one dryer 80 located below the machine level is provided. The dryer 80 requires only a short space in the machine direction in relation to the drying effect, thus even 50% space savings are achieved in the machine direction. The drying after the coaters with the corresponding dryer 80 begins very rapidly after the coating. The coating sections 45, 50 advantageously comprise at least curtain coating device 471, advantageously for applying a barrier coating onto the multi-ply fiber web. Each coater 451, 471, 501 in the coating sections 45, 47, 50 is advantageously a curtain coater or a blade coater. The reel-up 55 is advantageously a linear reel-up i.e. configured such that the parent roll 551 forming the reeling nip with the reeling cylinder 552 during reeling is supported on horizontal guides 553 and at substantially same vertical height throughout the reeling. The slitter-winder 60 comprises an unwinding station 601, a slitting section 602 and a winding section 603. The winding section 603 is advantageously a two-drum winder 604, 605, in which a belt arrangement i.e. a so-called set of belt rolls with belt loop or belt loops 608 located around two guide rolls 606, 607 is used as one of the two winding drums 605. The production line may also comprise one or more combined pulpers 70 i.e. one pulper 70 is used for more than one sections of the production line. In the example of the figure 4 one combined pulper 70 is used for the drying section 30 and the sizing section 40 and another combined pulper 70 is used for the final calender 75 and the reel-up 50.

[0030] In the description in the foregoing, although some functions have been described with reference to certain features and examples, those functions may be performable by other features and examples whether described or not. Although features have been described with reference to the certain examples, those features may also be present in other examples whether described or not.

[0031] Above only some advantageous examples of the inventions have 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. Dryer for drying coated fiber webs, **characterized in that** the dryer (80) comprises three air compartments (81, 82, 83) configured to provide drying air blows towards passing fiber web (W), that two of the air compartments (81, 82) are substantially rectangular chambers and located next to each other with two longitudinal back sides (93) towards each other,
that third air compartment (83) is a turning air compartment located with a straight surface towards ends (94) of the two rectangular air compartments (81, 82) and having a substantially curved outer, advantageously semi-circular, outer surface,
that the dryer (80) is configured to form a first longitudinal drying run for the fiber web (W) in a first vertical portion (87), a curved drying run for the fiber web (W) in a turning portion (89) and a second longitudinal drying run for the fiber web (W) in a second vertical portion (88),
that the dryer (80) further comprises along the vertical portions (87, 88) at a distance from the air compartments (81, 82) at least one blow device (85) configured to provide support air blows to support the run of the passing fiber web (W),
that the rectangular air compartments (81, 82) comprise an inlet channel (84) and two outlet channels (86) and that the inlet channel (84) is located in between the outlet channels (86) in length direction of the rectangular air compartment (81, 82).

2. Dryer according to claim 1, **characterized in that** the dryer (80) is a double-pass dryer (81, 82; 87,88) configured to a U-shaped air dryer with an air turn (83; 89).

3. Dryer according to claim 1 or 2, **characterized in that** maximum blowing drying air temperature of the dryer (80) is 500°C and minimum blowing drying air temperature is 50°C, advantageously 70°C.

4. Dryer according to any of claims 1 - 3, **characterized in that** each air compartment (81, 82, 83) is individually adjustable to provide three drying temperature zones for drying the fiber web.

5. Dryer according to any of claims 1 - 4, **characterized in that** the air compartments (81, 82, 83) and the blow devices (85) comprise overpressure-nozzles, that on the substantially vertical portion (87, 88) of the rectangular air compartments the nozzles (91) for air blows are at a spacing of 200 - 450 mm and that the nozzles of the blow devices (85) are at a spacing of 300 - 1200 mm, advantageously at a spacing of 600 - 1200 mm, from each other.

6. Dryer according to any of claims 1 - 5, **characterized in that** air equipment configuration of the dryer (80) comprises separate air circulating equipment for the rectangular air compartments (81, 82) forming the vertical portions (87, 88) and the semi-circular, turning air compartment (83) forming the curved, turning portion (89) has its own air circulating equipment.

7. Dryer according to claim 6, **characterized in that** the air circulating equipment for the vertical portions (87, 88) are in a cascade connection.

8. Dryer according to any of claims 1 - 5, **characterized in that** air equipment configuration of the dryer (80) comprises common air circulating equipment for the

rectangular air compartments (81, 82) forming the vertical portions (87, 88) and the semi-circular, turning air compartment (83) forming the curved, turning portion (89) has its own air circulating equipment.

9. Dryer according to any of claims 1 - 8, **characterized in that** air equipment configuration of the dryer (80) comprises separate supply air system the blow devices (85) providing support air flows to support the run of the passing fiber web (W).

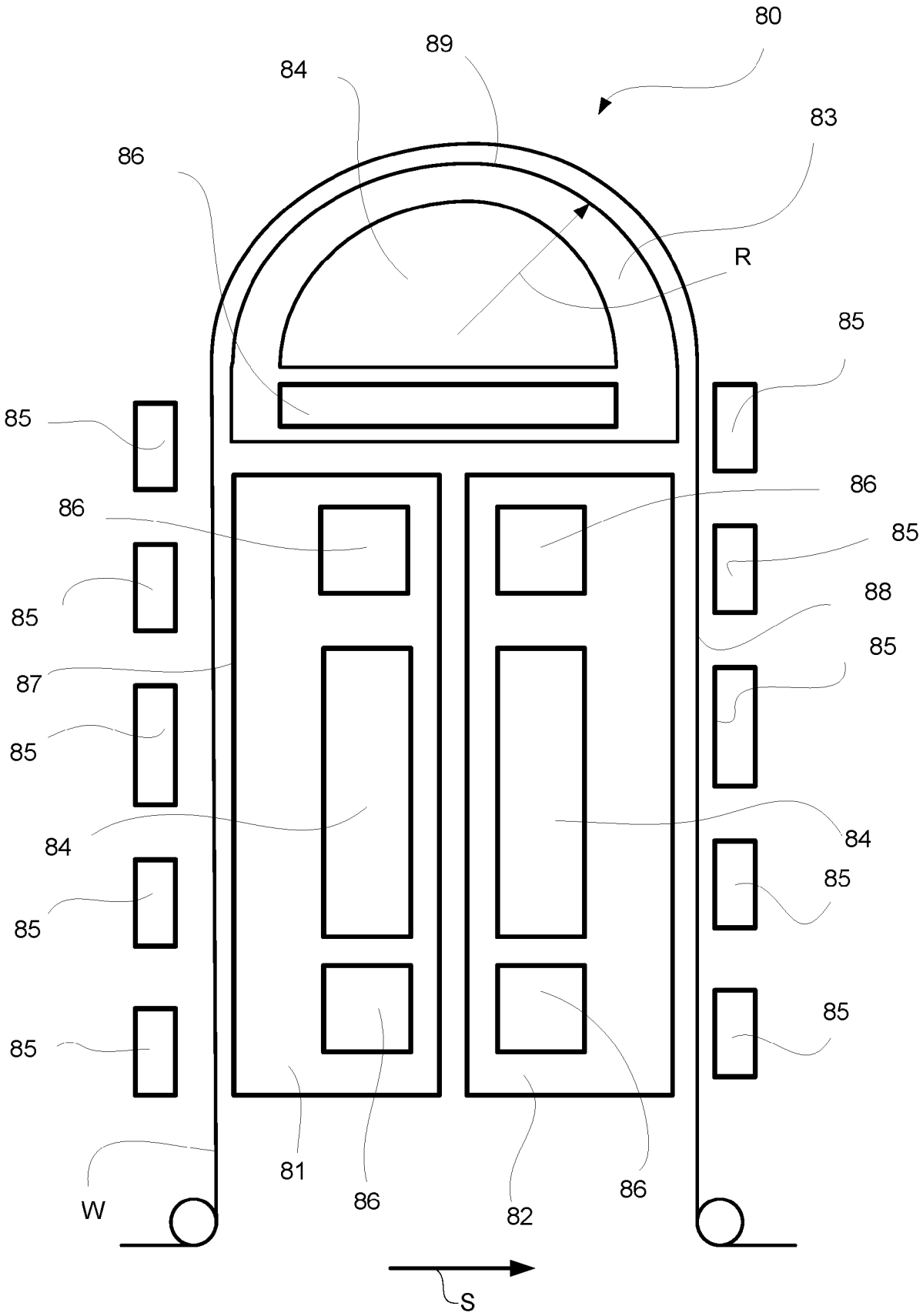
80
89
84
83
86
R
85
85
86
86
85
85
88
87
85
85
84
84
85
85
85
85
W
81
86
82
86
S

Fig. 1

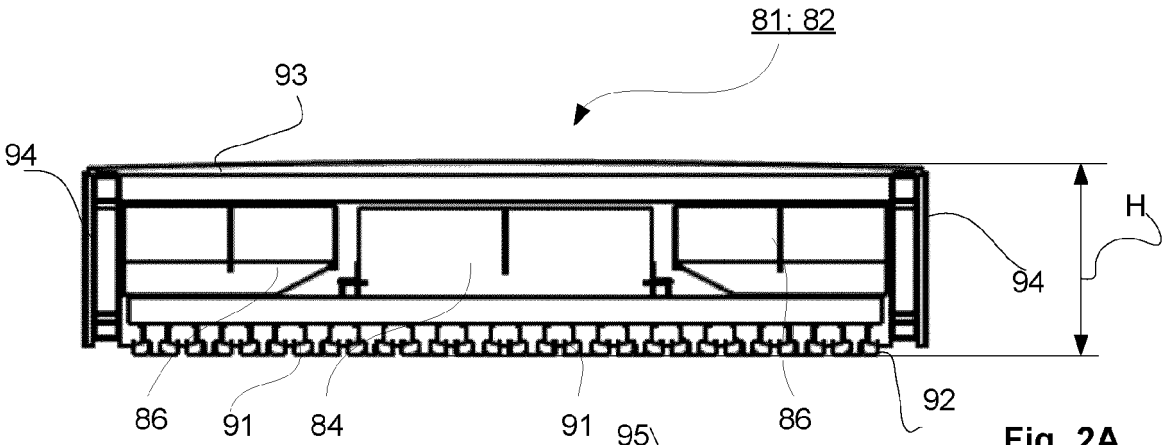

Fig. 2A

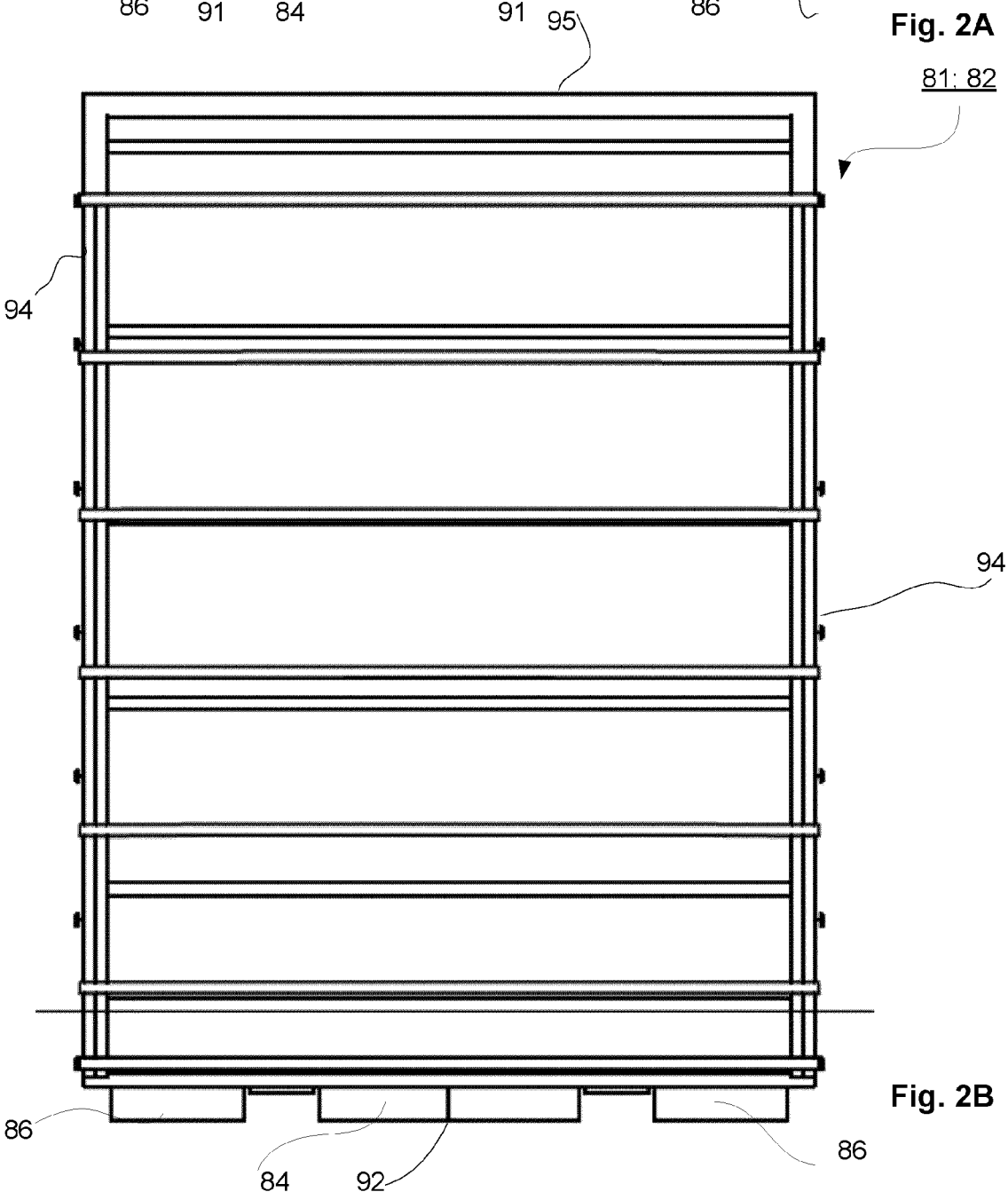

Fig. 2B

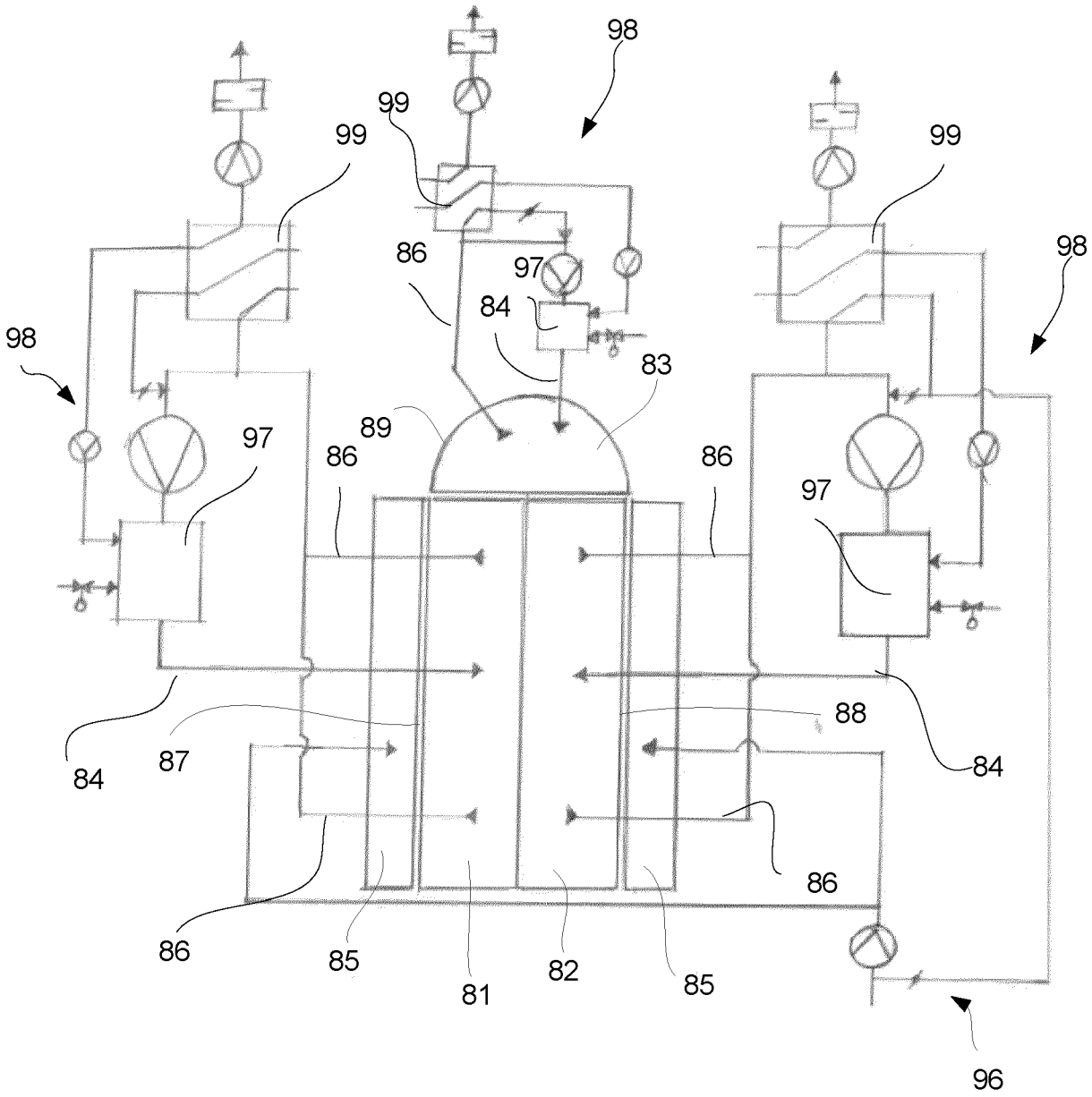
98
99
99
86
97
84
83
98
99
98
89
97
86
86
97
88
84
87
84
86
86
85
81
82
85
96

Fig. 3A

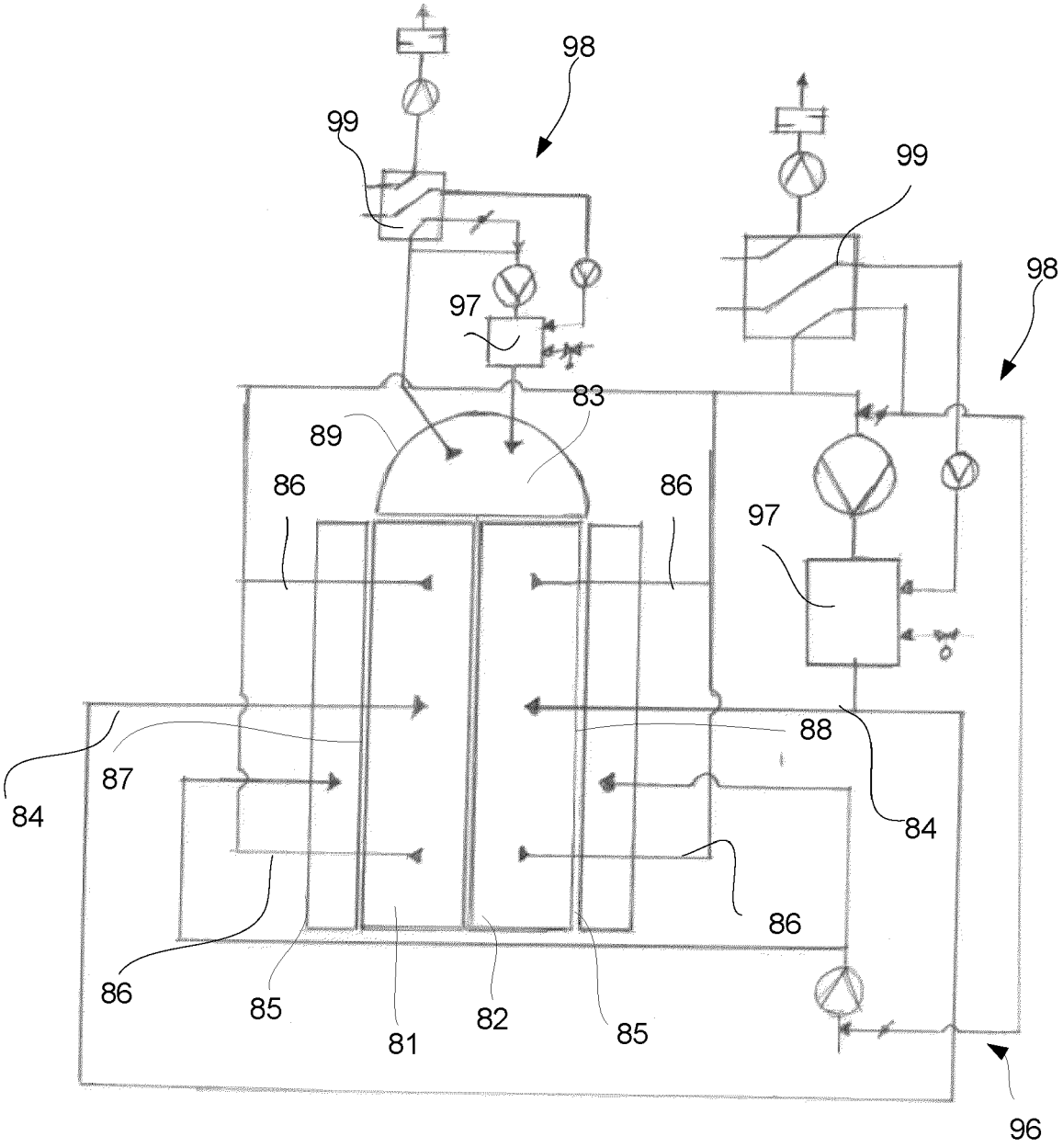

Fig. 3B

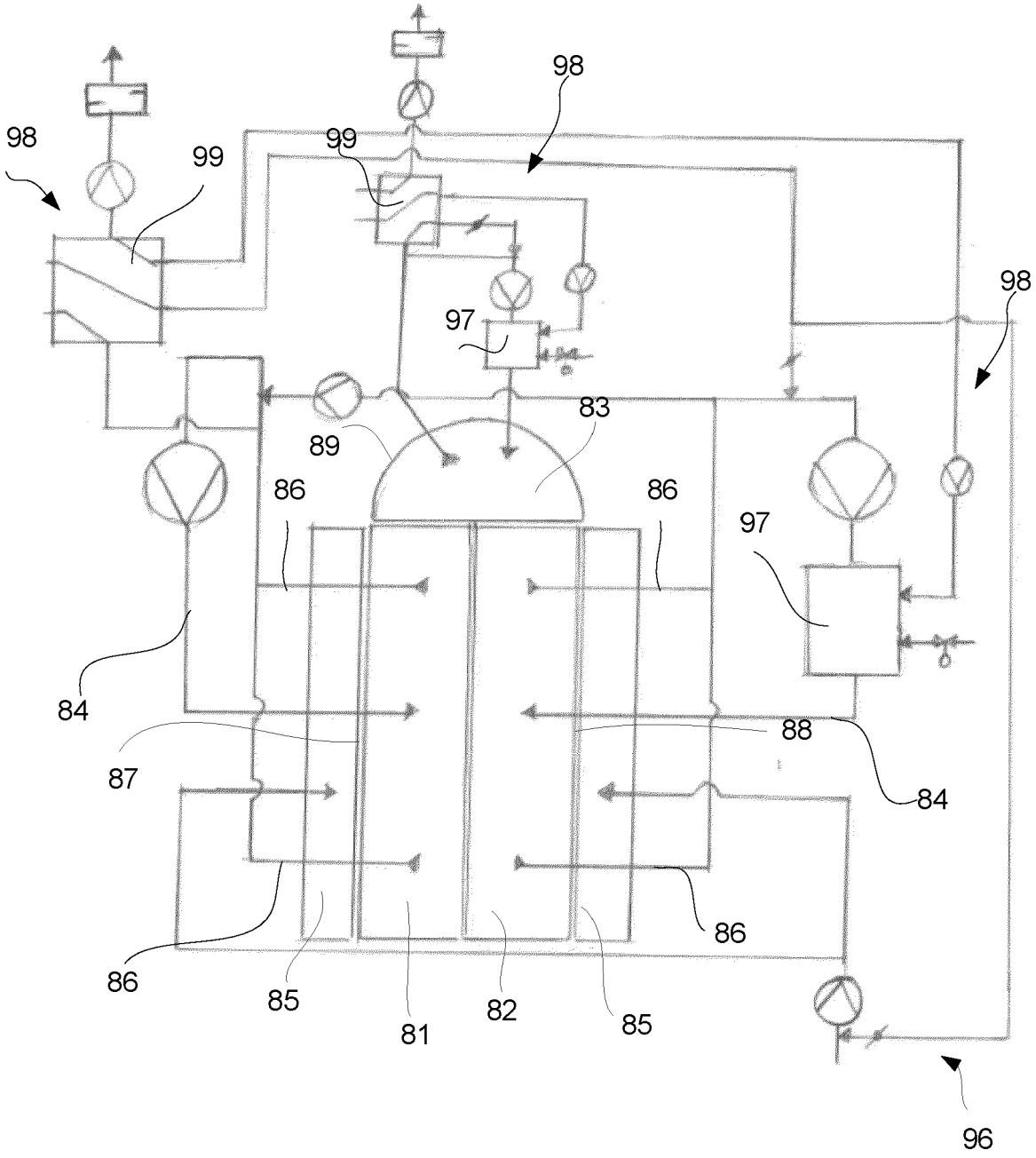

Fig. 3C

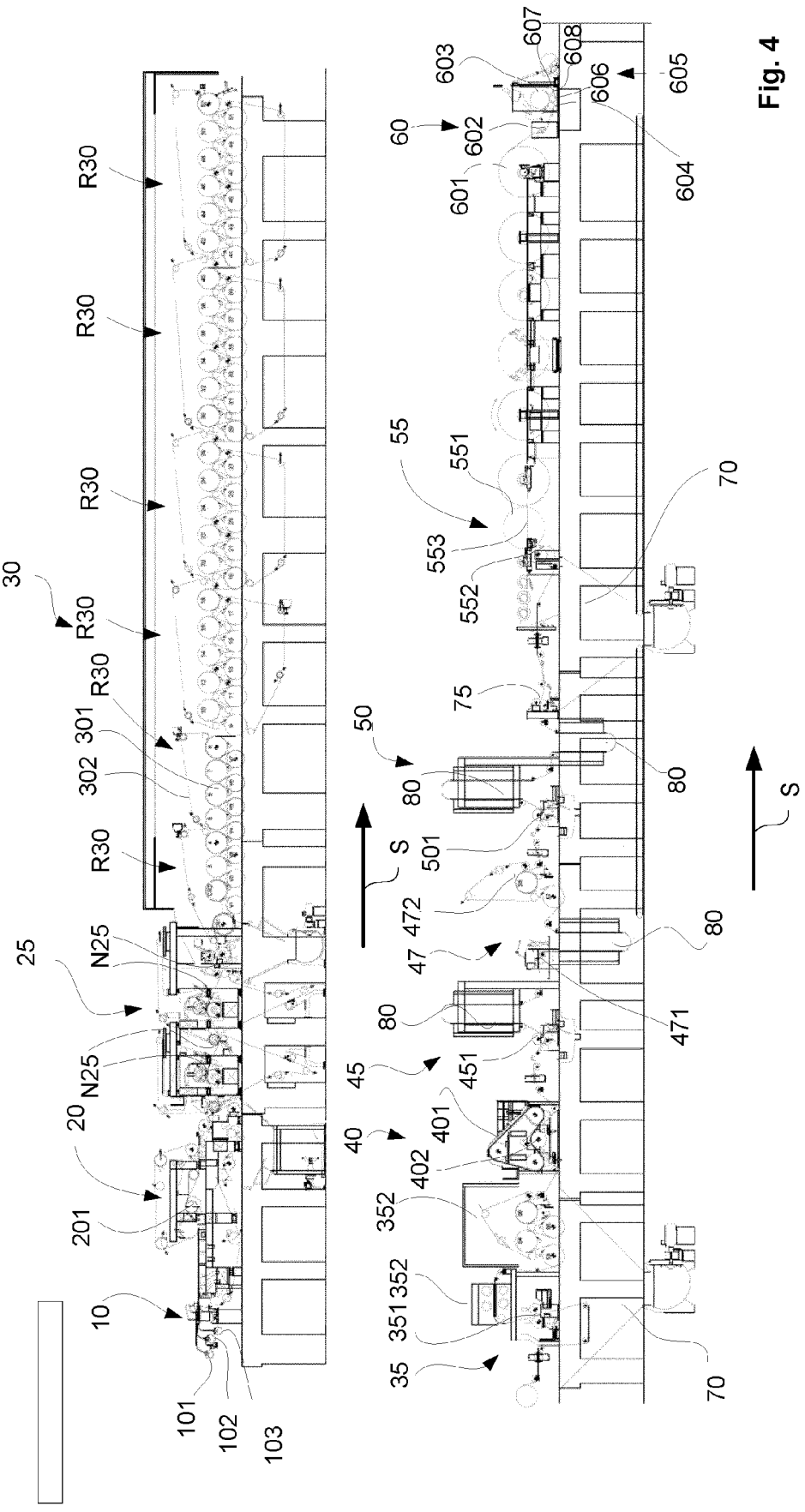
30
R30
R30
R30
R30
R30
R30
301
302
25
N25
N25
20
201
10
101
102
103
50
S
80
501
472
47
80
471
451
45
40
401
402
352
352
351
35
75
551
553
552
55
60
602
601
603
607
608
606
605
604
70
80
80
70
S

Fig. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 21 3721

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 3 231 937 A1 (VALMET TECHNOLOGIES OY [FI]) 18 October 2017 (2017-10-18) * paragraphs [0054] - [0055]; figures *	1-9	INV. D21F5/18 B65H23/24 F26B13/10
A	WO 00/01881 A1 (VALMET CORP [FI]; HEIKKILAE PERTTI [FI] ET AL.) 13 January 2000 (2000-01-13) * page 9, line 31 - page 10, line 2; figure 7 *	1-9	
A	DE 20 2018 101573 U1 (VALMET TECHNOLOGIES INC [FI]) 28 March 2018 (2018-03-28) * paragraphs [0027] - [0031]; figures *	1-9	
A	DE 10 2010 003322 A1 (VOITH PATENT GMBH [DE]) 29 September 2011 (2011-09-29) * paragraphs [0024] - [0026]; figures *	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

D21F
F26B
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 May 2021	Pregetter, Mario

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 21 3721

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-05-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3231937 A1	18-10-2017	CN 107287965 A	24-10-2017
		EP 3231937 A1	18-10-2017
		US 2017292221 A1	12-10-2017
WO 0001881 A1	13-01-2000	AT 259909 T	15-03-2004
		AU 4786699 A	24-01-2000
		CA 2337023 A1	13-01-2000
		DE 69914920 T2	05-01-2005
		EP 1102889 A1	30-05-2001
		ES 2216532 T3	16-10-2004
		FI 981548 A	07-01-2000
		US 6311410 B1	06-11-2001
		WO 0001881 A1	13-01-2000
DE 202018101573 U1	28-03-2018	AT 16567 U1	15-01-2020
		CN 209816552 U	20-12-2019
		DE 202018101573 U1	28-03-2018
DE 102010003322 A1	29-09-2011	CN 203346726 U	18-12-2013
		DE 102010003322 A1	29-09-2011
		EP 2553171 A2	06-02-2013
		WO 2011117133 A2	29-09-2011

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 17164069 A **[0029]**