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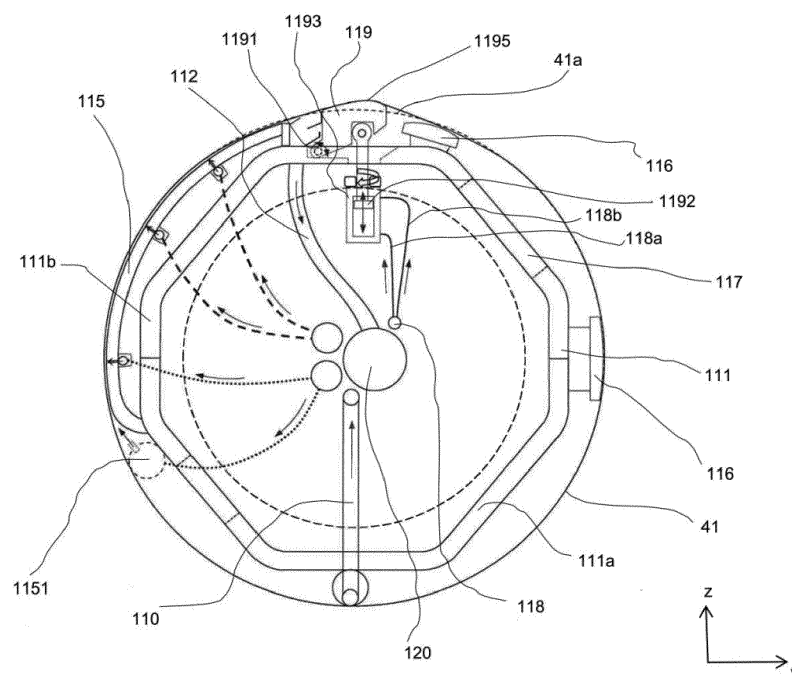
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(57) A Sleeve roll (1) comprises an axle beam (11) with an axle stub (13), said axle stub (13) being supported in a bearing structure (21); a roll head (31) configured to support a belt (41) tensioned about and being rotatable about the axle beam (11) in a belt loop; the belt (41) being

rotatable about and relative to the axle beam (11); and a movable forming element (119) configured to protrude from the axle beam (11), thereby abutting against the belt (41) to vary a cross sectional shape of the belt loop.

Fig. 5

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Description

[0001] The invention pertains to a sleeve roll. Such a kind of sleeve roll in general is provided in a forming section of a fiber web forming machine such as paper, board, tissue or pulp machine.

[0002] Prior art sleeve rolls are for instance known from document DE 31 42 045 A1. Here, a sleeve arrangement with stationary sector support shoe/beam is arranged in a forming section of a paper or board making machine. The forming section comprises two wires, each of them forming a closed loop. The two wires are guided such that they run along a portion of the sleeve arrangement with a stationary sector support shoe/beam circumference in an adjacent manner, thereby forming a fabric wrap where web is sandwiched between the wire. Thus, the sleeve arrangement with a stationary sector support shoe/beam causes a minimum distance between the two wires, thereby causing dewatering of a web located between the two wires.

[0003] Another forming section similar to the one of DE 31 42 045 A1, but comprising a sleeve roll with a cross section having a changing radius of curvature is known from document EP 2 350 385 B1. This shape enables an improved dewatering pressure caused by the change of the sleeve roll's radius of curvature.

[0004] In general, a sleeve roll comprises a static portion such as an axle beam for supporting a belt rotating about the axle beam. The belt is driven by the wire running about a portion of the sleeve roll sliding surface. Thus, there arise problems with friction forces, in particular during start up, where static friction forces occur, in a slow running mode where static friction forces as well as sliding friction forces occur, and in a normal running mode where mainly sliding friction forces occur.

[0005] There is need for a sleeve roll capable of coping with friction forces in different running modes.

[0006] According to the invention, a sleeve roll (1) comprises an axle beam (11) with an axle stub. The axle stub (13) is supported in a bearing structure (21). Moreover, the sleeve roll comprises a roll head (31) which is configured to support a belt (41) tensioned about and being rotatable about the axle beam (11) in a belt loop. The belt (41) is rotatable about and relative to the axle beam (11). A movable forming element (119) is configured to protrude from the axle beam (11), thereby abutting against the belt (41) to vary a cross sectional shape of the belt loop.

[0007] Thus, by means of the movable forming element the shape of the belt loop running about the axle beam and corresponding to the circumference of the roll head can be changed to have a protrusion where the movable forming element protrudes. This protrusion can be effected even during the paper or board making machine is running. Accordingly, a start moment can be reduced, when the movable forming element is retracted while starting, and effecting the protrusion only after the start has been performed. During start up of the fiber web form-

ing machine, the forming element is retracted inside the belt circle and support behind the element is against the belt inner surface. During start up all the lubrication inlets for sliding surface are in use and the wire tension can be reduced. Additionally, control of the water removal peak pressure and of the fabric tension is possible. The latter allows control of the water removal profile.

[0008] Moreover, such a movable forming element can be replaced easily when it is worn or when a radius of the surface abutting against the belt is to be changed.

[0009] Advantageously, a sliding surface (115) can be arranged adjacent to and, in a rotating direction of the belt (41), before the movable forming element (119).

[0010] Advantageously, the movable forming element (119) can be movable forwards and backwards in a protruding direction (z).

[0011] Thereby, the movable forming element can take at least two positions, that is, retracted or protruding. Furthermore, in addition to the above mentioned advantages,

[0012] Advantageously, the forwards and backwards movement of the movable forming element (119) in the protruding direction (z) can be effected by means of a piston (1192) accommodated in a cylinder (1193). The piston (1192) is capable of acting in both directions.

[0013] Such an arrangement effects that the movable forming element can be set at an arbitrary protruding position within the stroke of the piston. Thereby, when providing adjacent movable forming elements in the axial direction, any deflection can be compensated within a minimum range. With other words, the bending line in the cross machine direction (of a paper or board making machine) can be set to vary from an intended bending line less than 0.25 mm/m.

[0014] Advantageously, the movable forming element (119) can be supported at the axle beam (11), the support preferably being a hinge (1191) and the forming element moving cylinder structure is hinged.

[0015] Thus, the forces of the rotation of the belt and tension from the wires wrapping partially the sleeve roll acting on the movable forming element are transferred to the axle beam having a rigid structure without affecting the accuracy in the web forming process. In a case where the movable forming element is supported by a hinge, instead of the above linear protrusion and retraction movement, the protrusion and retraction movement is performed along a curve. Thereby, in combination with a correspondingly changing radius of the top surface of the movable forming element getting into abutment with the belt, a smooth adjustment of the protrusion height while maintaining a low friction between the top surface of the movable forming element and the belt is achieved.

[0016] Protrusion of the forming element affects to the belt when exceeding the sleeve roll radius in operation position. Thus, good lubrication must be arranged before the forming element to ensure smooth belt gliding over said element which tensions the belt outwards. During the start up the forming element can be retracted inside

the roll head circle to reduce friction.

[0017] Protrusion/outstroke of the forming element out of the roll head/ belt circle can be 10-120 mm advantageously 20-70 mm. Also belt indent/inwards bulging before the forming element is possible while the sliding surface can be arranged some (tens) of millimeters below the head/belt but on the same radius. This helps to reduce the required protrusion/outstroke of the forming element, which is favorable to the life of the belt when reducing the belt tension, and thereby the belt wear.

[0018] Thus, remarkable changes of the fabric tension wrap parameters are possible. On the other side, too high forces acting onto the belt from the movable forming element, as well as bending forces acting on the support of the movable forming element due to friction between the belt and the top surface of the movable forming element can be prevented.

[0019] Advantageously, in cross section, a surface (1195) of the forming element (119) abutting against the belt (41) can have a curved, convex shape.

[0020] Thereby, a change of the curvature of the top surface of the forming element abutting against the belt can be applied. Thus, a compensation of the roll deflection can also be performed this way.

[0021] Advantageously, a radius of curvature of the curved, convex shape of the surface (1195) of the forming element (119) abutting against the belt (41) can get smaller in the rotating direction of the belt.

[0022] Thereby, the wire tension profile can be controlled in a smooth manner. Moreover, bending of the sleeve roll can be compensated.

[0023] Advantageously, a radius of curvature of the curved shape of the surface (1195) of the forming element (119) abutting against the belt (41) can change continuously or stepwise, wherein a number of steps can be 3 to 12.

[0024] Since the movable forming element can be easily replaced, it is possible to apply different movable forming elements with dedicated top surface shapes in dependency of the paper or board making process. A material of the forming element can be metal or polymer (reinforced composite) or a combination thereof. A manufacturing method can be extrusion, machining, additive manufacturing or casting. Also low friction coating or surface hardening can be used for the sliding surface and / or a forming element prone to wear.

[0025] Advantageously, the sliding surface (115) can cover a sector of 30° to 120° of the sleeve roll (1).

[0026] Since this range almost corresponds to the wire wrap, friction caused by the wire acting on the belt can be remarkably reduced. Moreover, it is possible to add another sliding surface in the belt running direction after the movable forming element to support the belt and reduce friction in a case where the movable forming element is retracted, for example during start up of the fiber web forming machine.

[0027] Advantageously, the sliding surface (115) in a cross section can have the same/constant radius of cur-

vature than the roll head (31).

[0028] Advantageously, a sliding surface of the sliding element (115) can be surface treated and/or can have depressions. Moreover, lubricating means (1151) can be arranged before the sliding surface (115) in a rotation direction of the belt (41), and/or through the sliding surface (115). These dimples/recesses/pockets are extended in the length direction of the axle beam as discrete row/s. There are narrow land areas between said pockets filled with lubricating oil. Recesses can have different lengths and different numbers of oil inlet openings per recess.

[0029] Thereby, the coefficient of friction is further reduced.

[0030] The invention also pertains to a paper or board making machine, which, in a dewatering section or forming section comprises two wires (1015, 1009) and the sleeve roll (1) as described above. The wire (1007) on the side of the sleeve roll (1) is in abutment with the sleeve roll (1) at the sliding surface (115), thereby transferring a rotation force to the belt (41) of the sleeve roll.

[0031] In the following, presently preferred embodiments of the invention will be described based on the figures, in which

Fig. 1 is a schematic view of forming section of a paper or board making machine employing a sleeve roll according to the invention;

Fig. 2 is a perspective view of a bearing structure supporting an axle stub of the sleeve roll according to the invention;

Fig. 3 is a perspective view of an axle beam of the sleeve roll according to the invention;

Fig. 4 is a section view along a length axis of the sleeve roll according to the invention; and

Fig. 5 is a cross section view perpendicular to the length axis of the sleeve roll according to the invention.

[0032] An example of a schematic structure of a forming section 1000 of a paper or board making machine applying a sleeve roll 1 according to the invention is shown in Fig. 1. A head box 1001 serves to supply a pulp suspension between the wires 1009, 1015 which are guided as closed loops. The wire loop 1015 is guided by guiding rolls 1013, a forming roll 1005 and the sleeve roll 1. A second wire 1009 is guided in another closed loop by guiding rolls 1007, the forming roll 1005 and the sleeve roll 1. Between the forming roll 1005 and a guiding roll 1007a of the guiding rolls 1007 dedicated to the second wire 1009, both wires 1015 and 1009 run in a parallel manner sandwiching the thereby formed web.

[0033] A forming gap with constant radius fabric tension wrap on forming roll and changing radius fabric ten-

sion wrap on sleeve roll is formed between the two wires 1015 and 1009 at circumferential portions of each of the forming roll 1005 and the sleeve roll 1 where both wires 1015 and 1009 run along the circumferential portions of the two rolls. Due to a slight elongation of the wires 1009 and 1015 in the portions not affected by a roll, in these fabric tension wraps a pressure acting through wire tension on the web is higher than in the portions where the wires are not supported.

[0034] The forming gap and fabric tension wrap formed at the forming roll 1005 serves to receive the pulp suspension from the headbox 1001. To provide this tension wrap at the forming roll 1005, the second wire is guided towards the forming roll by means of a breast roll 1007b, which is arranged close to the forming roll 1005 in a manner that a diffuser portion of the headbox 1 is arranged between the forming roll 1005 and the breast roll 1007b. Thus, a first dewatering of the web is performed at the forming roll 1005.

[0035] Another fabric forming wrap is formed at the sleeve roll 1. Since this description is mainly directed to the sleeve roll 1, in the following the fabric forming wrap formed at the sleeve roll 1 will be described as "the fabric forming wrap" while, if necessary, the fabric nip formed at the forming roll 1005 will be described as "the constant radius fabric tension wrap" or simply as "fabric tension wrap" (at the forming roll 1005).

[0036] Moreover, in the forming section other means for dewatering of the web such as dewatering elements 1003 or suction boxes 1011 are arranged. It will be understood that the above description of the forming section based on Fig. 1 is merely an example and does not at all limit the forming section to the wire arrangement and elements shown in Fig. 1 and described above. That is, next to the described elements or additional dewatering elements and suction boxes can be provided. On the other side, one or more of the shown dewatering elements and/or suction boxes can be omitted. Moreover different types of web forming concepts being suitable for all types of formers, head boxes, layouts and webs can be chosen. Likewise the function of the sleeve roll and its place within the former can vary according to specific needs of the particular web to be formed.

[0037] In order to form a web, pulp suspension is supplied from the headbox 1001 into the forming gap and the constant radius fabric tension wrap at the forming roll 1005 where a first dewatering takes place. From there, the web is guided between the two wires 1015 and 1009 towards the sleeve roll 1 and the fabric tension wrap. Thereby, the web passes dewatering means 1003, which improves the dryness content of the web. In the fabric tension wrap, a second dewatering takes place. As will be described below, by means of the sleeve roll 1 according to the invention, parameters of the fabric tension wrap such as its length, its exerted pressure, the running time of the web to pass the fabric tension wrap and others can be set. Thus, an effective dewatering takes place before the web is guided further via suction boxes 1011

to be taken over to be transferred to the next section such as a press section of the fiber web forming machine.

[0038] A sleeve roll 1 according to the invention comprises an axle beam 11 and an axle stub 13. As can be seen from Fig. 2, the axle stub 13 is supported in a pedestal (example for a bearing structure) 21. Moreover, as can be seen from Fig. 4, the sleeve roll 1 comprises a roll head 31 that supports a belt 41. The belt 41 is tensioned about and is rotatable about and relative to the axle beam 11. In particular, rotation of the belt 41 is caused by the wire 1015 directly contacting the belt 41 due to wire tension during the common path when passing the sleeve roll 1.

[0039] Back to Fig. 2, the pedestal 21 comprises an annular flange 25 mounted onto the axle stub 13 in such a manner that a torque can be transferred from the flange 25 to the axle stub 13.

[0040] In order to provide a torque, the flange 25 is connected with a rigging screw 23 by means of a joint 22. That is, one end of the rigging screw 23 is attached to the flange 25 by means of the joint 22. The other end of the rigging screw 23 opposite to the one end being attached to the joint is fixed to the pedestal 21. Thus, by turning the rigging screw 23, its length can be extended or shortened, thereby causing a rotation of the flange 25. The rotation of the flange 25 is transferred to the axle stub 13, thereby rotating the axle stub and the axle beam 11 of the sleeve roll 1. The flange 25 and the joint 22 form a moving means according to the invention, and the rigging screw 23 is one example of an actuating means according to the invention.

[0041] That is, instead of the rigging screw, the actuating means can comprise a screw, a gear, a worm gear, a hydraulic cylinder or other means suitable for providing a longitudinal movement which is then transferred to the rotational movement of the flange 25.

[0042] As can be seen from Fig. 3, the axle beam 11 is made of a hollow polygonal structure with (in the embodiment, eight) rounded corners. Moreover, a cross section of the axle beam body 111 is symmetric in different planes, and the width (in a y-direction in the figures) of the axle beam 11 is larger than its height (in a z-direction in the figures). The thickness of the plates forming the axle beam body 111 is between 30 and 60 mm. This geometry of the axle beam effects outstanding rigidity in its axial direction (rotation axis A direction), while forming of the desired cross sectional shape is still possible.

[0043] Rounded corners in the sense of the invention is to be understood that the corners have an arc like, convex, curved portion having a certain radius of curvature.

[0044] A head portion 113 of the axle beam 11 has a flange like shape and is provided with plural mounting bores 1131. The head portion 113 is surrounded by an axle beam body 111 which is comprised of two bended metal sheets 111a, 111b. The two metal sheets 111a, 111b are welded together at their edges to form a hollow body. The edges are arranged in a parallel manner to a

rotation axis A of the sleeve roll 1.

[0045] Moreover, in the axle beam 11 a maintenance opening 117 and other openings are provided to enable access to the inner space of the axle beam 11. Some or all of these openings can be closed with hatches.

[0046] As can be seen from Fig. 4, the axle stub 11 is mounted to the head portion 113. The roll head 31 is provided on the axle stub 11 in a sliding manner. Thus, the roll head 31 can move in an axial direction of the sleeve roll 1. In order to effect such a movement of the roll head 31, hydraulic cylinders (only one of them is shown in Fig. 4) 35 are fixed inside of the axle beam. A piston rod of each hydraulic cylinder 35 extend through the head portion 113 of the axle beam 11 and is fixed to the roll head. Thus, the roll head 31 can be moved in a sliding manner in the direction of the rotation axis A, that is, in Fig. 4 to the left and to the right. Thereby, on the one side an axial position of the roll head 31 can be determined, and on the other side, the tension of a belt 41 fixed to the roll head 31 and surrounding the axle beam 11 can be adjusted. The plural hydraulic cylinders 35 are arranged in such a manner, that the belt 41 is tensioned by a symmetric tensioning force.

[0047] For accurately determining the roll head's 31 position, and/or to prevent an excessive stretching of the belt 41, indexing means (not shown) are provided to inform a user of the roll head's amount of movement. In the embodiment, the indexing means show the distance from the inner side (right side in Fig. 4) of the pedestal 21 to the roll head 31.

[0048] Moreover in the roll head 31 an opening through the axle stub 13 is provided. The opening can be closed in an airtight manner and serves to arrange e.g. inlet and outlet pipes for fluids such as lubrication oil. Since the opening can be closed in an airtight manner, a pressure inside of the belt 41 can be maintained.

[0049] As shown in Fig. 5, the axle beam has a sliding surface 115. The sliding surface extends in a length direction and curves in a cross direction of the axle beam 11. In the embodiment, the sliding surface is an individual component mounted to the axle beam 11, but instead it can be integrally formed with the axle beam 11.

[0050] Moreover, a movable forming element 119 is arranged adjacent to the sliding surface 115 in the axle beam body 111. That is, the forming element is provided such that the belt 41 passing the sliding surface 115 thereafter goes over the forming element 119. In cross section, a surface 1195 of the forming element 119, which is in abutment against the belt 41 has a curved, convex shape. A radius of curvature of the curved, convex shape of the surface 1195 gets smaller in the rotating direction of the belt 41. Said curvature of the forming element gets smaller in radius than the radius of the sleeve roll. The forming element is movable to that regard that its protruding height from the axle beam body 111 can be altered. In the axle beam body 111, a piping system is provided to supply lubrication fluid to the sliding surface 115.

[0051] Since the movable forming element 119 is configured to protrude from the axle beam 11, it abuts against the belt 41 which is rotating about the axle beam 11. By altering the forming element's 119 protrusion height, a cross sectional shape of the loop formed by the belt 41 is altered.

[0052] In order to protrude or to retract, the movable forming element 119 is made to move forwards and backwards in its protruding direction z. This is effected by means of a piston 1192 accommodated in a cylinder 1193. The piston 1192 is capable of acting in both directions. Thus, the movable forming element can be made to protrude a desired height. Protrusion of the forming element affects to the belt when exceeding the sleeve roll radius in the operation position. Thus, a good lubrication must be arranged before the forming element to ensure smooth belt gliding over said element tensioning the belt outwards. In the start up the forming element can be retracted inside of the roll head circle in order to reduce friction.

[0053] Protrusion/outstroke of the forming element out of the roll head/ belt circle (the imaginary shape of the section of the belt which is a circle, unless it is guided in a different manner) can be 10-120 mm, advantageously 20-70 mm. In Fig. 5 the belt circle is indicated with 41a and drawn with a dashed line. Also belt indent/inwards bulging before the forming element is possible while the sliding surface is arranged some (tens) of millimeters below the head/belt but at the same radius. This helps to reduce the required outstroke which favorable to the life of the belt.

[0054] The movable forming element 119 is supported at the axle beam 11 by means of a hinge 1191. Thus, the position of the movable forming element 119 cannot only be changed in a linear manner, but it can also be tilted. The moving means of the hinged forming element are favorably also tiltable/hinged.

[0055] In the running direction of the belt 41, arranged before the movable forming element 119 is the sliding surface 115. The sliding surface 115 in a cross section has the same radius of curvature than the sleeve roll/roll head 31. Moreover, the sliding surface is surface treated and preferably can be provided with depressions such as dimples. In addition, lubricating means 1151 are arranged before the sliding surface 115 in a rotation direction of the belt 41. Thus, a coefficient of friction of the sliding surface 115 can be remarkably reduced, resulting in a smooth run of the belt 41 over the sliding surface 115 before it gets to the movable forming element 119.

[0056] As will be understood, due to the movable forming element 119, the cross section shape of the sleeve roll 1 can be altered depending on the requirements of the web being formed. Moreover, these alterations can be performed while the paper or board making machine is running. In addition, not only the cross section of the sleeve roll 1 can be altered, but by rotating the axle stub 13 via the rigging screw 23 and the flange 25, the rotational position of the movable forming element can be

changed. Thereby, it is possible to effect changes of the fabric tension wrap parameters in a high variety which leads to an improved dewatering and forming of the web. Reference signs 116 indicate additional sliding elements, one of them being provided close behind the movable forming element 119.

[0057] In addition, Figs. 4 and 5 show pipes 110, 112, 114 used for supply and discharge of lubricant (see the arrows in the pipes in Fig. 4). Supply and discharge is performed via bores in the axle stub 13. Moreover, these pipes are supported in the inner of the axle beam 11. A main discharge pipe 120 serves for return lubricant which needs to be cooled and filtered before being newly fed to the sleeve roll. In addition to the lubricant feed pipes smaller hydraulic pipes such as the ones referred to by 118, 118a, 118b are also shown. These latter hydraulic pipes 118, 118a, 118b serve for actuating the piston 1192. Connections to the hydraulic actuators, lubricant collector devices and lubricant feeding/spraying pipes are performed by means of steel enforced hoses for allowing thermal movements and bending.

[0058] While the invention has been described based on a presently preferred embodiment thereof, the scope of the invention is not limited by the above description and the figures, but is defined by the claims.

[0059] Accordingly, alterations to the embodiment are possible. For instance, the described cross sectional shape is not necessarily provided for the whole axle beam body, but merely a portion of the axle beam body can have a polygonal cross section. The other portion(s) can have a different cross section.

[0060] The polygonal cross section can have six to twelve corners or corresponding angles. While it is preferred that the corners are rounded, such rounding is not unambiguously necessary, for instance in a case where the metal sheets are not bended but plural metal stripes are welded together to form the axle beam body.

[0061] Also, at least one portion of the axle beam body can have a round cross section.

[0062] Instead of changing continuously, the radius of curvature of the curved shape of the surface of the forming element abutting against the belt can change stepwise. A number of steps can be 3 to 12.

[0063] While a certain range of the wrap is not mentioned above, the sliding surface can cover a sector of 30° to 120° of the sleeve roll, so that the wires having common wrap on the sleeve roll can drive the belt with help of the supporting sliding surface.

[0064] While in the embodiment lubricating means are arranged before the sliding surface in a rotation direction of the belt, lubricating means can alternatively or additionally be provided through the sliding surface. The arrangement of the lubrication means depends on the assembly before forming of the sliding surface.

[0065] While in cross section of the axle beam a polygonal structure has been described, other more complex shapes to dimension such as a T-beam, Y-beam or X-beam cross section can be used for forming the axle

beam in certain cases.

Claims

1. Sleeve roll (1) comprising an axle beam (11) with an axle stub (13), said axle stub (13) being supported in a bearing structure (21); a roll head (31) configured to support a belt (41) tensioned about and being rotatable about the axle beam (11) in a belt loop; the belt (41) being rotatable about and relative to the axle beam (11); and a movable forming element (119) configured to protrude from the axle beam (11), thereby abutting against the belt (41) to vary a cross sectional shape of the belt loop.
2. Sleeve roll (1) according to claim 1, wherein a sliding surface (115) is arranged adjacent to and, in a rotating direction of the belt (41), before the movable forming element (119).
3. Sleeve roll (1) according to claim 1 or 2, wherein the movable forming element (119) is movable forwards and backwards in a protruding direction (z).
4. Sleeve roll (1) according to claim 3, wherein the forwards and backwards movement of the movable forming element (119) in the protruding direction (z) is effected by means of a piston (1192) accommodated in a cylinder (1193), the piston (1192) capable of acting in both directions.
5. Sleeve roll (1) according to any of the preceding claims, wherein the movable forming element (119) is supported at the axle beam (11), the support preferably being a hinge (1191).
6. Sleeve roll (1) according to any of the preceding claims, wherein a stroke of the forming element (119) to protrude from the perimeter circle of the roll head or of a circle (41a) when viewing the section of the belt (41) is in a range of 10 - 120 mm, preferably 20 - 70 mm.
7. Sleeve roll (1) according to any of the preceding claims, wherein in cross section, a surface (1195) of the forming element (119) abutting against the belt (41) has a curved, convex shape.
8. Sleeve roll (1) according to claim 7, wherein a radius of curvature of the curved, convex shape of the surface (1195) of the forming element (119) abutting against the belt (41) gets smaller in the rotating direction of the belt.

9. Sleeve roll (1) according to any of claims 7 and 8, wherein a radius of curvature of the curved shape of the surface (1195) of the forming element (119) abutting against the belt (41) changes continuously or stepwise, wherein a number of steps can be 3 to 12. 5
10. Sleeve roll (1) according to any of claims 2 to 9, wherein the sliding surface (115) covers a sector of 30° to 120° of the sleeve roll (1). 10
11. Sleeve roll (1) according to any of claims 2 to 10, wherein the sliding surface (115) in a cross section has the same radius of curvature than the roll head (31). 15
12. Sleeve roll (1) according to any of claims 2 to 11, wherein a sliding surface of the sliding element (115) is surface treated and/or has depressions. 20
13. Sleeve roll (1) according to any of claims 2 to 12, wherein lubricating means (1151) are arranged before the sliding surface (115) in a rotation direction of the belt (41), and/or through the sliding surface (115). 25
14. Paper or board making machine, comprising, in a dewatering section two wires (1015, 1009), and 30
the sleeve roll (1) according to any of claims 2 to 13, wherein the wire (1015) on the side of the sleeve roll (1) is in abutment with the sleeve roll (1) at the sliding surface (115), thereby transferring a rotation force to the belt (41) of the sleeve roll. 35

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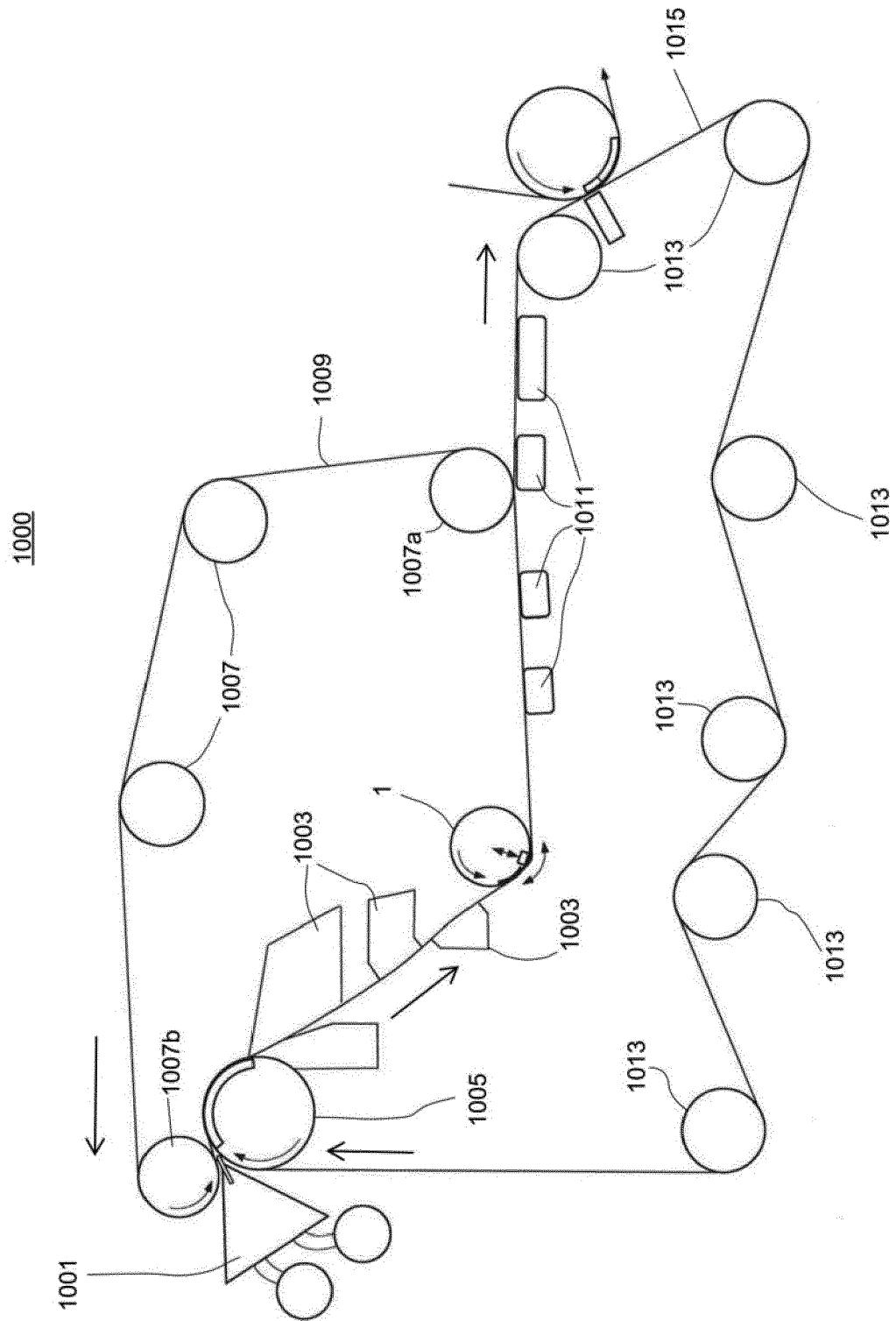


Fig. 1

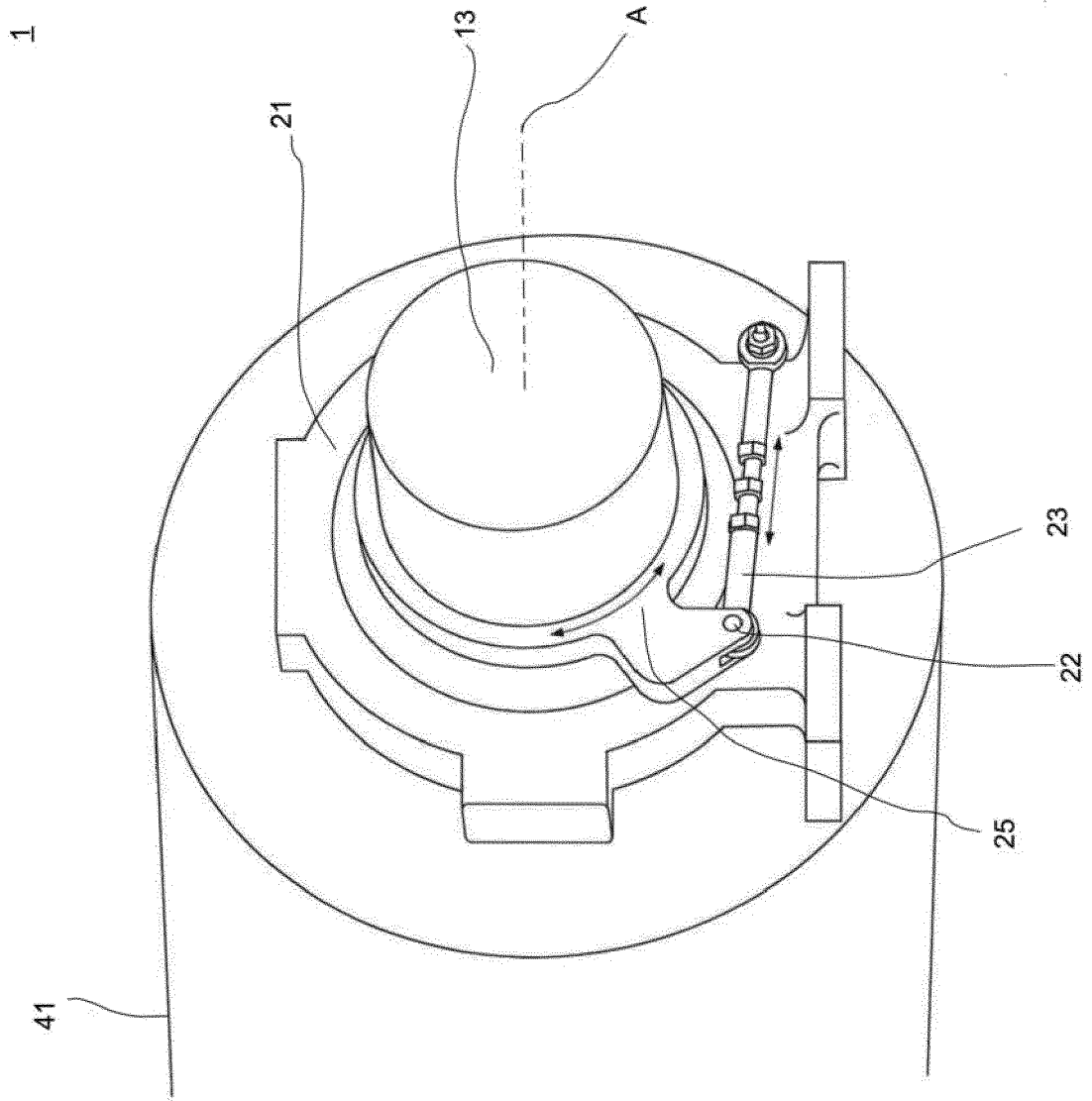


Fig. 2

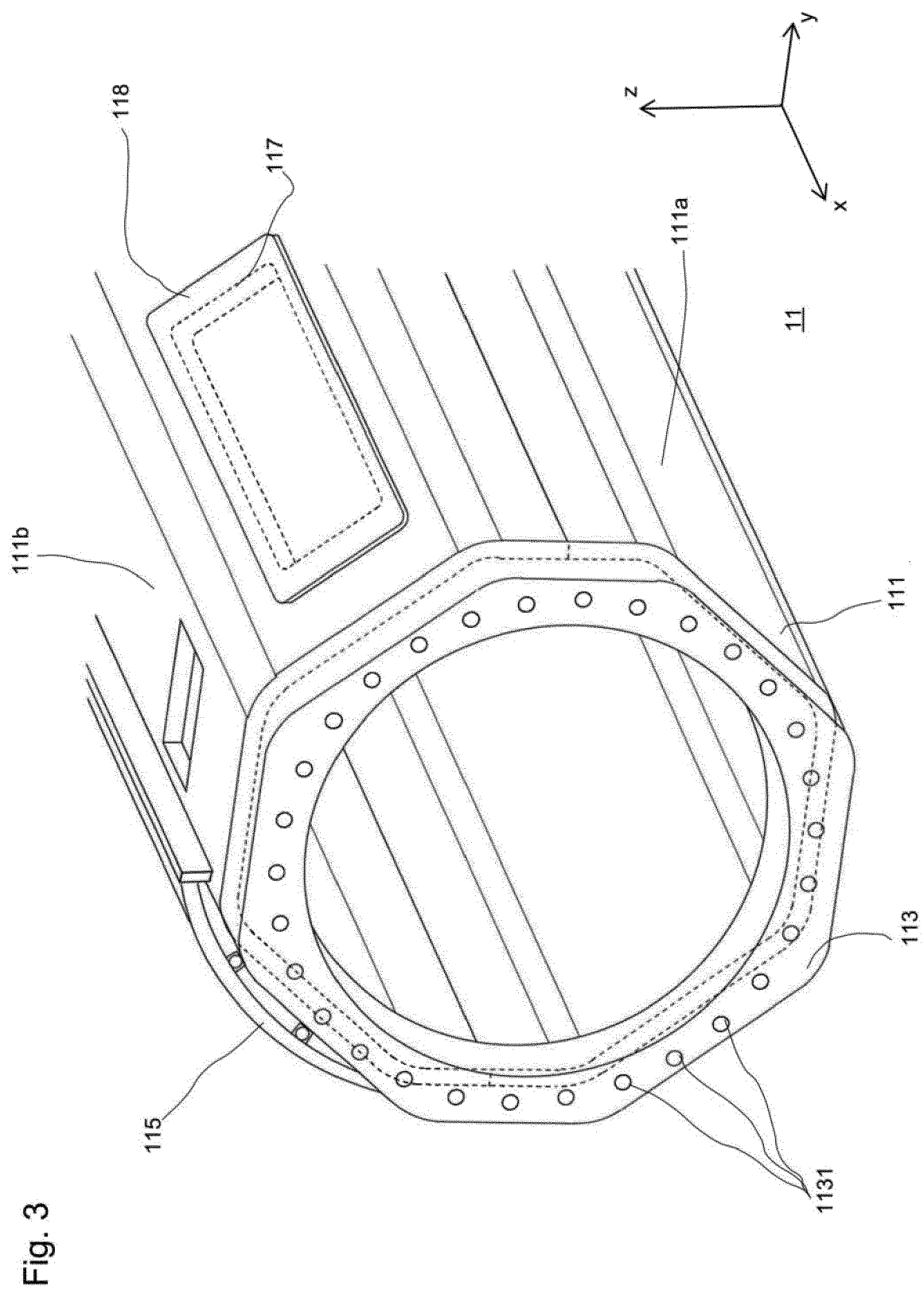
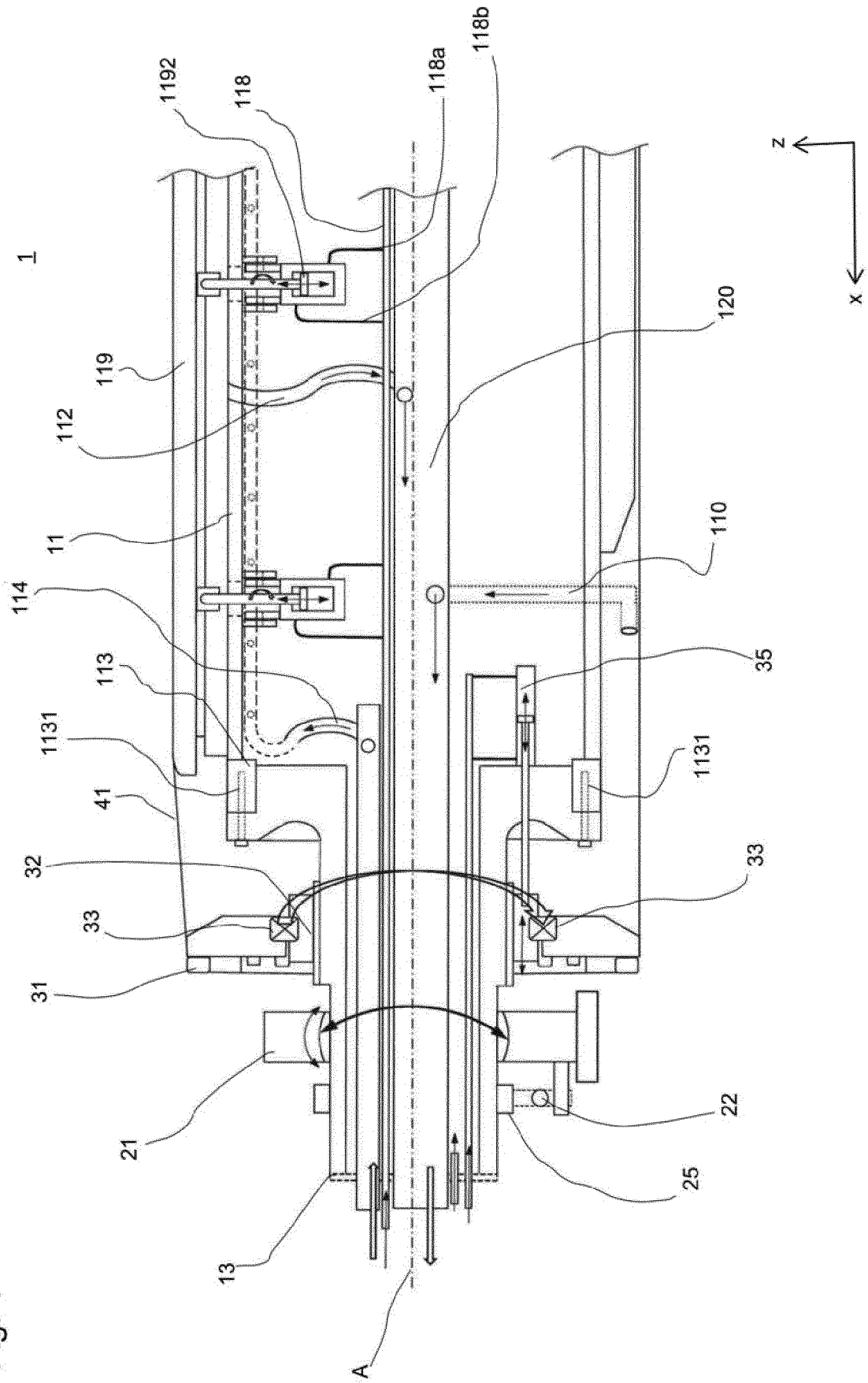


Fig. 4



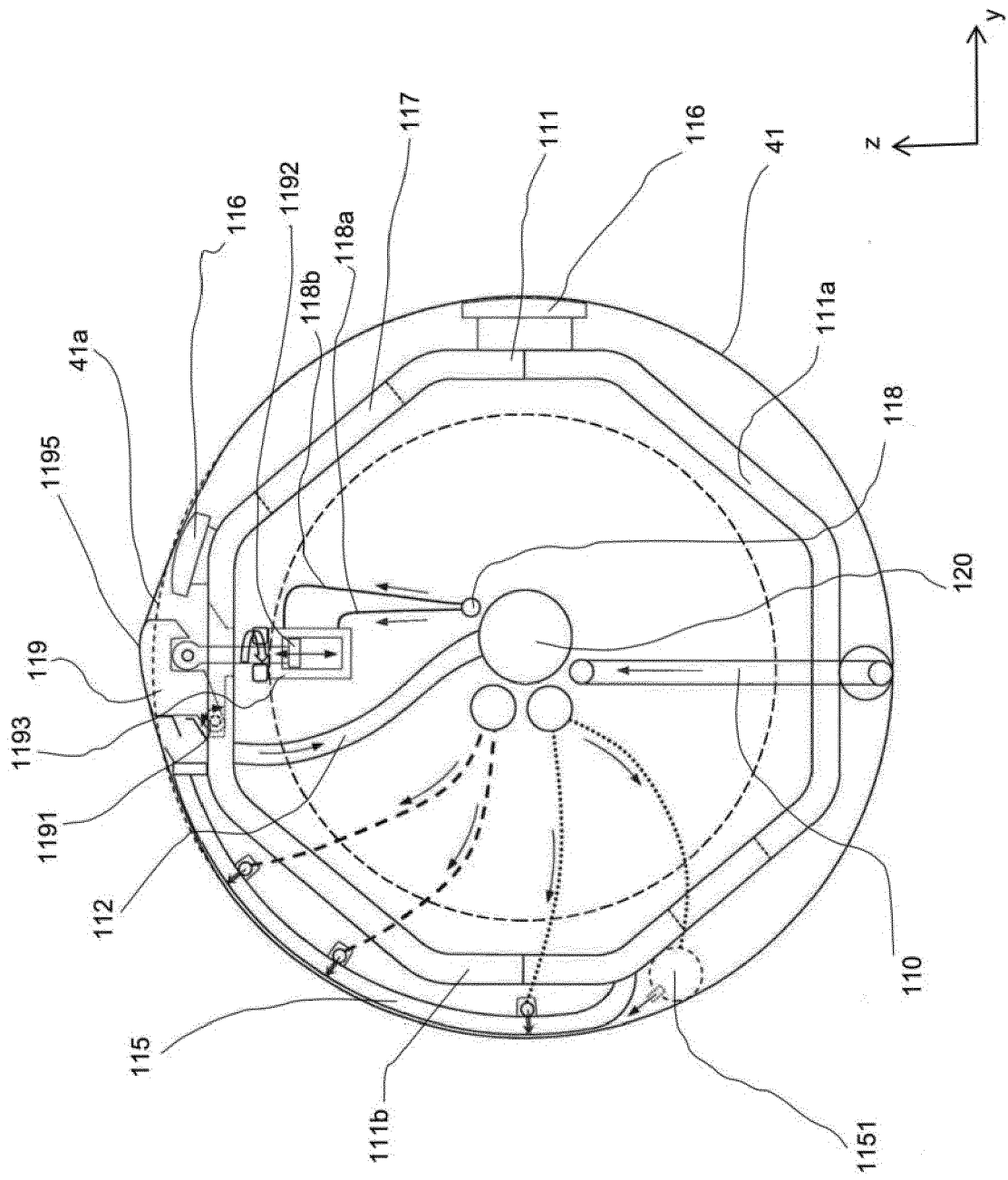


Fig. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 17 5728

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2020/076204 A1 (VALMET OY [SE]) 16 April 2020 (2020-04-16)	1-3,5, 7-11,13, 14	INV. D21F1/40 D21F7/00 D21F9/00
Y	* page 7, line 5 - page 23, line 6; figures *	4,12	
X	WO 2018/097777 A1 (VALMET OY [SE]) 31 May 2018 (2018-05-31)	1,3,5-9, 14	
Y	* page 6, line 15 - page 17, line 12; figures *	4,12	
Y	WO 02/40771 A1 (METSO PAPER KARLSTAD AB [SE]) 23 May 2002 (2002-05-23) * page 6, line 8 - page 7, line 11; figures *	4	
Y	EP 0 345 501 A1 (VALMET PAPER MACHINERY INC [FI]) 13 December 1989 (1989-12-13) * column 2, lines 35-48; figures *	12	
			TECHNICAL FIELDS SEARCHED (IPC)
			D21F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 June 2020	Examiner Maisonnier, Claire
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	

 1
 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 17 5728

5 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.

24-06-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2020076204 A1	16-04-2020	SE 1851245 A1	10-03-2020
		WO 2020076204 A1	16-04-2020
-----		-----	
WO 2018097777 A1	31-05-2018	BR 112019010828 A2	01-10-2019
		CN 110199061 A	03-09-2019
		EP 3545129 A1	02-10-2019
		JP 2019535924 A	12-12-2019
		SE 1651555 A1	13-02-2018
		US 2019338465 A1	07-11-2019
		WO 2018097777 A1	31-05-2018
-----		-----	
WO 0240771 A1	23-05-2002	CA 2429187 A1	23-05-2002
		EP 1360373 A1	12-11-2003
		JP 2004514070 A	13-05-2004
		US 2002059872 A1	23-05-2002
		WO 0240771 A1	23-05-2002
-----		-----	
EP 0345501 A1	13-12-1989	AT 82604 T	15-12-1992
		CA 1322122 C	14-09-1993
		CN 1038052 A	20-12-1989
		DE 68903534 T2	06-05-1993
		EP 0345501 A1	13-12-1989
		FI 892518 A	26-11-1989
		JP 2693573 B2	24-12-1997
		JP H0219588 A	23-01-1990
		SE 461171 B	15-01-1990
		US 4917768 A	17-04-1990
-----		-----	

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

- DE 3142045 A1 [0002] [0003]
- EP 2350385 B1 [0003]