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

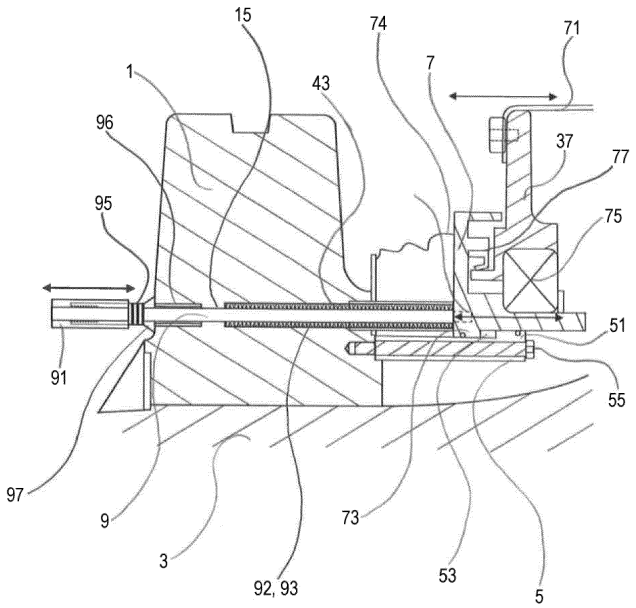
(72) Inventors:
- **KUPIAINEN, Seppo**
  40270 Palokka (FI)
- **LAMMINPARRAS, Sami**
  41900 Petäjävesi (FI)
- **YLÖNEN, Taneli**
  41160 Tikkakoski (FI)
- **ERONEN, Ville**
  40740 Jyväskylä (FI)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) **SHOE ROLL END MODULE**

(57) A shoe roll end module comprises a pedestal (1), having an axle hole (11) configured to accommodate an axle (3) of a shoe roll and a roll head (7) configured to hold a belt (71). A ferrule (5) is supported on the pedestal (1) and directed to an inner side of the pedestal (1). The roll head (7) is supported on the ferrule (5) in an axially movable manner. Moreover, at least two rod like indexing means (9) are guided through respective bores (15) in the pedestal and arranged with a predetermined distance around the axle hole (11) in an equal angular distance, and being configured to move the roll head (3) towards the pedestal (1).

FIG. 3



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Description

[0001] The invention pertains to a shoe roll end module and in particular, to a shoe roll end module having indexing means to facilitate adjustment of a roll head's position.

[0002] In prior art eccentric shoe press rolls, there is an eccentricity between the belt's rotating center and the center of the roll's axle. The eccentricity becomes the larger, the larger the diameter of the roll becomes. This eccentricity enables a longer water removal time than a geometry having concentric roll/belt structure (when the shoe length in machine running direction is longer than with concentric roll/belt).

[0003] Nowadays, the eccentricity and the need for rotating the roll head to adjust belt elongation or belt reduction while keeping the belt tension as required causes roll end pieces that are rather complex and expensive to manufacture. Moreover, the assembly of such a roll head structure is slow and requires lot of fitting work especially in the whole roll end assembly.

[0004] Examples of such separate roll head and pedestal structures can be found e.g. in document US 5 733 415 A and in document EP 01 619 299 B1.

[0005] Thus, there is a need to improve the pending structures and to provide a shoe roll end module with a roll head capable of improving adjustment of a belt's tension in a shoe press.

[0006] According to the invention, a shoe roll end module comprises a pedestal, having an axle hole configured to accommodate an axle of a shoe roll and a roll head configured to hold a belt. A ferrule is supported on the pedestal and directed to an inner side of the pedestal (towards the center of a paper or board machine comprising the shoe roll). The roll head is supported on the ferrule in an axially movable manner.

[0007] Preferably, an inner diameter of the ferrule can be configured to exceed an axle diameter of the axle so that the whole end module can be fitted to the axle by only one lifting.

[0008] Moreover, at least two rod like indexing means are guided through respective bores in the pedestal and arranged with a predetermined distance around the axle hole in an equal angular distance, and being configured to control the movement of the roll head in relation to the pedestal in the said end module.

[0009] Preferably, the indexing means can be arranged radially outside of the ferrule.

[0010] Provision of the rod like indexing means in the above-described manner enables a smooth and accurate control of the movement of the roll head towards the pedestal in a case where an adjustment of the belt's tension or a position change of the belt in order to reduce wear of the belt is required. Moreover, problems occurring due to jamming of the indexing means can be avoided, since there are at least two indexing means provided. In some cases a heavy outer indexing rod can control the movement of the head when placed close to ferrule's outer surface.

[0011] In particular,

- the indexing means can comprise control means and movement means;
- the control means can comprise rod-, nut-, head-, and scale-means;
- the movement means comprise cylinder means and spring means (but also or alternatively screw means);
- an annular cylinder can initiate every movement by relieving the indexing nuts so that those are easy to be turned to a selected position (This advantage is also explained in the description of Fig. 1).

[0012] Advantageously, each of the indexing means can be formed as a single action annular cylinder configured to urge the roll head towards the pedestal.

[0013] Alternatively, each of the indexing means can be formed as a screw, the screw being in thread engagement with a thread bore provided in an indexing nut in connection to the pedestal and having an indexing head being in engagement with an outer side of the pedestal.

[0014] Advantageously, the bores through the pedestal can have an accommodation pocket on their side directed to the roll head, and at least one compression spring is accommodated in each accommodation pocket for indexing return movement means.

[0015] Moreover, a plurality of coaxially arranged springs having a different spring rate can be provided. Thereby, a spring constant of the biasing spring can be determined such, that, despite thread engagement of the screws with the thread bore in the roll head, relative positions of the indexing heads are maintained.

[0016] Biasing springs make the return movement when the indexing nuts are turned and the annular cylinder is depressurized (which is the end status of every movement so that hydraulic oil leakage is eliminated). No constant pressure is needed and indexing nuts and springs keep the roll head on its indexed position.

[0017] Advantageously, each of the indexing means can be formed a as a working cylinder, having one of its ends attached with the roll head and having the other of its ends attached at the pedestal.

[0018] Advantageously, each of the indexing means can be formed as a rod having one end attached to the roll head, and the other end accommodated in a hollow indexing nut, the indexing nut being in thread engagement with the rod.

[0019] Preferably, the rod can be guided through a slide bearing bush arranged at the outer side or inner side of the pedestal, and the screw is in thread engagement with an indexing nut being arranged outside of the pedestal.

[0020] Moreover, advantageously, a working cylinder can be provided at the inner side of the pedestal, the working cylinder being configured to change the roll head position.

[0021] The shoe roll head can comprise a controller

configured to engage the indexing means simultaneously.

[0022] It is to be noted, that simultaneous operation of the indexing means can be done manually as well as automatically.

[0023] In the shoe roll head, advantageously, the axle hole can have a polygonal section and one or two surfaces of the axle hole serve as a torque surface.

[0024] Here, a torque surface is defined as a surface of the axle hole, which is configured to absorb a torque of the axle occurring during operation of the shoe roll.

[0025] Moreover, the shoe roll end module with support from the pedestal moves the support of the roll head further away from the stressed part of the axle where its profile changes from an axle stub to a support beam for a press shoe.

[0026] Further advantages of the invention will be understood from the following description of presently preferred embodiments in context with the attached drawings in which:

Fig. 1 is a perspective view of a shoe roll head according to an embodiment of the invention.

Fig. 2 is a plan view of a shoe roll head pedestal from an inner side of a paper or board machine.

Fig. 3 is a section view of a shoe roll head structure according to an embodiment of the invention.

Fig. 4 is a section view of a shoe roll head structure according to the embodiment of the invention and shows elements pertaining to the indexing in greater detail.

[0027] Embodiments of the invention will be described by referring to Figs. 1 to 4. While the arrangement of Figs. 3 and 4 is slightly different with regard to the shape of a pedestal 1, an eccentric member and a roll head 7, regarding the indexing means, their function is the same. Also it is noted that, for the same and similar elements, the same reference signs will be assigned.

[0028] Fig. 1 is a perspective view of a shoe roll end module comprising a pedestal and a roll head in a same assembly. A pedestal 1 has an axle hole 11, which serves to accommodate an axle stub 3 of a shoe roll. In this regard, it is to be noted that the terms "axle" and related terms such as "axle hole" and "axle stub" are used throughout the application rather for sake of brevity. In fact a "pressure beam" and related terms such as an "accommodating hole for (such) a pressure beam" and a "stub of (such) a pressure beam", respectively, are meant instead.

[0029] The axle hole 11 in section has an octagonal shape. Thus, there are eight surfaces forming the axle hole 11. Among the eight surfaces, the highest surface 11b is finished with a degree of accuracy exceeding the finishing degree of the remaining seven surfaces. This highest surface 11b serves as a torque surface, and is manufactured with

- an increased roughness (Ra) level in comparison to a reference surface;
- an increased planar evenness of the surface in comparison to the reference surface;
- an increased degree of parallelism of the surface compared to the reference surface.

[0030] The shoe roll can be assembled above or below the counter roll, so the direction of the nip is in the 'flat' joint side of the pedestal and the torque surface is on the opposite side to that.

[0031] A corresponding surface of an axle stub 3 is manufactured with the same degree of accuracy. Thus, when bringing the torque surface 11b of the axle hole 11 and a corresponding surface of an axle stub in abutment, due to the high degree of accuracy of manufacturing of these surfaces it is possible to position the shoe roll with a degree of accuracy not possible with prior art solutions having a rocker bearing in the pedestal.

[0032] At an inner side of the pedestal 1, that is, a side, which is directed towards the center of the paper or board machine, a ferrule 5 as an axially elongated annular structure, is connected with the pedestal. According to the embodiment, the ferrule 5 is connected with the pedestal by means of bolts 55.

[0033] The ferrule 5 is an annular member. It is connected with the pedestal 1 in a manner that its center axis OF deviates from the center axis OP of the pedestal. Thus, due to shifting of the ferrule 5, it is possible to achieve a required degree of eccentricity.

[0034] In a shoe roll end module 2, the ferrule 5 is inserted into an inner bore of the roll head 7. The roll head 7 has an inner static structure and an outer dynamic (rotating) structure. A bearing 75 and a seal 77 connect these two structures of the roll head and prevent leakage of fluid, e.g. lubrication fluid. The roll head supports the belt 71. A bellows 74 connects the roll head 7 with the pedestal and prevents contamination of the inner portions of the roll head 7. So the roll end module 2 is compact and easy to assemble together without a need to fit each piece to the axle separately. There is only one fitting for the whole end module so that a prefabricated end module can be assembled to the axle with one lifting.

[0035] Moreover, the ferrule 5 has a flange 51 at its distal end, i.e. the flange 51 is provided at the side distanced from the pedestal 1. The flange 51 extends radially outwards and has two functions, which will be described later. Furthermore, there is a distance between an inner surface of the ferrule 5 and the axle 3 of the shoe roll.

[0036] In its bore, the roll head 7 has a radially inwards extending flange 73, which cooperates with a flange 51 at the distal end of the ferrule 5. The flange 51 extends radially outwards.

[0037] Thus, the flange 51 serves to secure the roll head 7 by getting into abutment with a flange 73 of the roll head. That is, the flange 73 is provided radially inwards and is arranged in an axial position between the

pedestal 1 and the flange 51 of the ferrule 5.

[0038] Secondly, since the flange 51 forms an annular gap 53 with the flange 73 provided at the roll head 7, by sealing the respective circumferential surfaces of the flanges 51 and 73, e.g. by means of O-rings, as shown in Fig. 3, the gap can be used as a hydraulic or pneumatic chamber. Then, by introducing a fluid into the annular gap, movement of the roll head towards the pedestal can be performed. This is done for instance to adjust the belt's 71 tension or position.

[0039] Accordingly, the roll head 7 can be moved towards the pedestal (in fig. 3 towards the left side, in Fig. 4 to the right side) by supplying a fluid under pressure into the annular gap 53. That is, the annular gap serves as a pressure fluid chamber.

[0040] The roll head 7 is connected with the pedestal 1 by means of indexing means having a rod shape. In the embodiment of Fig. 3, these indexing rods 9 are formed by a single action cylinder extending through a bore 15 provided in the pedestal 1 and being in thread engagement with a thread bore 72 in the roll head 7.

[0041] According to the embodiment, three such indexing rods 9 are provided. However, the number of indexing rods can be arbitrarily chosen, as long as there is more than one indexing rod. Moreover, it is important that the indexing rods are arranged in such a manner that axial forces are evenly distributed in order to prevent buckling and jamming of the indexing rods.

[0042] The indexing rod will be now described mainly by focusing on Fig. 4. It is to be noted that the same indexing means is applied with the embodiment of Fig. 3, but several components of the indexing means are shown in Fig. 4 only. On the other side, Fig. 3 shows some other elements required for the indexing such as the annular gap 53, which is used as a hydraulic chamber in the embodiment.

[0043] Each indexing rod 9 is provided with a fixed indexing head 91 on its outer end, that is, an end on the outer side of the pedestal 1. Moreover, an indexing nut 95 is arranged coaxially with the indexing rod 9 and the indexing head 91 such that it is arranged radially outside of the indexing rod 9, but radially inside of the indexing head 91. Moreover, the indexing nut 95 is in thread engagement with the indexing rod 9 by means of a thread 98. On its end directed to the pedestal 1, the indexing nut 95 has a stopper collar 97 having a tapered section and scale means 94.

[0044] Thus, it can be said that the indexing nut 95 is movable together with the indexing head 91 when the indexing head is moved by means of the indexing rod 9 to an outer side of the pedestal, that is, towards the left side in Fig. 3 and to the right side in Fig. 4, respectively. Moreover, by engaging recesses 97a (see Fig. 1) provided in the stopper collar 97 by means of a tool and rotating the stopper collar 97, a distance between the indexing nut 95 and the indexing head 91 can be appropriately set as is required. In particular, for accurately setting the distance, a scale means is provided on the indexing nut 95. Since the roll head is moving together with the indexing rod 9, thereby the roll head's 7 distance towards the inner side of the pedestal 1 can be appropriately set as desired.

[0045] With regard to Fig. 3, a distance between the indexing head 91 and the stopper collar 97 is rather small. That is, the indexing head 91 is almost fully covering the indexing nut 95. In contrast, Fig. 4 depicts a situation where the indexing nut 95 has been rotated to such an extent that the distance between the indexing head 91 and the stopper collar 97 is almost extended to the greatest possible distance. Thus, the roll head 7 in Fig. 4 is moved much closer to the pedestal 1 than in Fig. 3.

[0046] Thus, by increasing a distance between the stopper collar 97 and the indexing head 91 by means of rotating the indexing nut 95 a distance between the roll head 7 and the pedestal 1 is reduced. On the other side, by decreasing the distance between the stopper collar 97 and the indexing head 91, the distance between the roll head 7 and the pedestal 1 can be increased.

[0047] According to the embodiment, such a movement of the roll head 7 in the direction away from the pedestal 1 is effected by means of compression springs 92 and 93. These springs 92 and 93 are arranged coaxially about the indexing rod 9, and are accommodated in a spring pocket 17 provided on the inner side of the pedestal 1 (the side directed to the machine center and the roll head 7, respectively).

[0048] In the above, merely a thread engagement between the indexing head 91 and the indexing nut 95 was mentioned, since such an actuation could be sufficient for indexing. However, according to the embodiment, an outwards movement of the indexing head 91 is effected hydraulically. That is, when supplying a corresponding fluid such as hydraulic oil into the annular gap 53 formed between the static part of the roll head 7 and the ferrule 5, a distance between the flange 51 of the ferrule 5 and the flange 73 of the roll head increases (see Fig. 3).

[0049] Thereby, movement of the whole roll head 7 towards the pedestal 1 is effected against the spring forces of the springs 92 and 93. Moreover, due to the movement of the roll head 7, the indexing head 91 being in thread engagement with the indexing nut 95 is moved into an axial direction of the indexing rod 9, i.e. towards an outer side of the pedestal. Thereby, an abutment between the stopper collar 97 and the pedestal 1 is released, and the distance between the stopper collar 97 and the pedestal is increased as long as the roll head 7 is moved towards the pedestal.

[0050] When the roll head 7 achieves a desired position, or preferably a position slightly beyond the desired position towards the pedestal 1, the indexing nut 95 is rotated such that the stopper collar 97 again approaches the pedestal 1. This rotation is performed until the scale on the indexing nut 95 shows the desired distance. In this state, if the position of the roll head 7 is slightly beyond the desired position (the distance between the inner side of the pedestal 1 and the roll head is too short), there is

still a small gap between the stopper collar 97 and the pedestal 1.

[0051] This small gap is removed by releasing the hydraulic pressure from the annular gap 53. That is, by releasing the hydraulic pressure, the spring forces of the extending springs 92 and 93 effect a movement of the roll head 7 towards the machine center. Accordingly, the distance between the roll head 7 and the pedestal 1 is again increased until the stopper collar (ring part) 97 of the indexing nut 95 gets into abutment with the pedestal 1. Then, the desired position of the roll head 7 is set. Axial movements of the indexing rod 9 into both directions are facilitated by means of a slide bushing 96 provided in the bore 15.

[0052] The invention has been described by means of a presently preferred embodiment, but its scope is merely defined by the attached claims. In particular, a combination of hydraulically actuated indexing rods and rods operating by thread engagement can be applied.

REFERENCE SIGNS LIST

[0053]

1	pedestal
11	axle hole (hole for accommodating a pressure beam stub)
15	bore
17	pocket
3	axle (pressure beam)
5	ferrule (axially elongated annular structure)
51	flange
53	annular gap (hydraulic chamber)
55	bolt
7	roll head
71	belt
72	thread bore
73	flange
74	bellows
75	bearing
77	seal
9	indexing rod
91	indexing head
92	compression spring
93	compression spring
95	indexing nut
96	slide bushing
97	stopper collar
98	thread

Claims

1. A shoe roll end module, comprising:

a pedestal (1), having an axle hole (11) configured to accommodate an axle (3) of a shoe roll;
a roll head (7) configured to hold a belt (71);

characterized by

a ferrule (5) supported on the pedestal (1) and directed to an inner side of the pedestal (1), wherein
the roll head is supported on the ferrule (5) in an axially movable manner.

2. The shoe roll end module according to claim 1, wherein
an inner diameter of the ferrule is configured to exceed an axle diameter of the axle (3).

3. The shoe roll end module according to claim 1 or 2, wherein
at least two rod like indexing means are guided through respective bores (15) in the pedestal (1) and arranged with a predetermined distance around the axle hole (11) in an equal angular distance, and being configured to move the roll head (7) towards the pedestal (1).

4. The shoe roll end module according to any of claims 1 to 3, wherein
each of the indexing means is formed as a single action annular cylinder configured to urge the roll head (7) towards the pedestal (1).

5. The shoe roll end module according to any of claims 1 to 3, wherein each of the indexing means is formed as a screw, the screw being in thread engagement with a thread bore provided in the roll head (7) and having an indexing head being in engagement with an outer side of the pedestal (1).

6. The shoe roll end module according to claim 4 or 5, wherein
the bores (15) through the pedestal have an accommodation pocket (17) on their side directed to the roll head (7), and at least one biasing spring (92, 93) is accommodated in each accommodation pocket.

7. The shoe roll end module according to claim 6, wherein a plurality of coaxially arranged springs (92, 93) having a different spring rate are provided, wherein
a spring constant of the biasing spring (92) is determined such, that, despite threaded engaging the screws with the thread bore in the roll head (7), relative positions of the indexing heads are maintained.

8. The shoe roll end module according to claim 3, wherein
each of the indexing means is formed a as a working cylinder, having one of its ends attached with the roll head and having the other of its ends attached at the pedestal.

9. The shoe roll end module according to any of claims

3 to 4, wherein
each of the indexing means is formed as a rod (9) having one end attached to the roll head (7), and the other end accommodated in an indexing head (91), the indexing head (91) being in abutment with the pedestal (1), wherein a distance between the pedestal (1) and the indexing head (91) is adjustable.

10. The shoe roll end module according to any of claims 6 to 9, wherein
the indexing means is guided through a slide bearing bush (96) arranged at the outer side or inner side of the pedestal (1)

11. The shoe roll end module according to claim 5, wherein the screw is in thread engagement with a thread bush being arranged outside of the pedestal (1).

12. The shoe roll end module according to claim 6 or 7, wherein a working cylinder is provided at the inner side of the pedestal (1), the working cylinder being configured to change the roll head (3) position.

13. The shoe roll end module according to any of claims 1 to 12, comprising a controller configured to engage the indexing means simultaneously.

14. The shoe roll end module according to any of claims 1 to 13, wherein the axle hole (11) has a polygonal section and one or two surfaces of the axle hole (11) serve as a torque surface.

FIG. 1

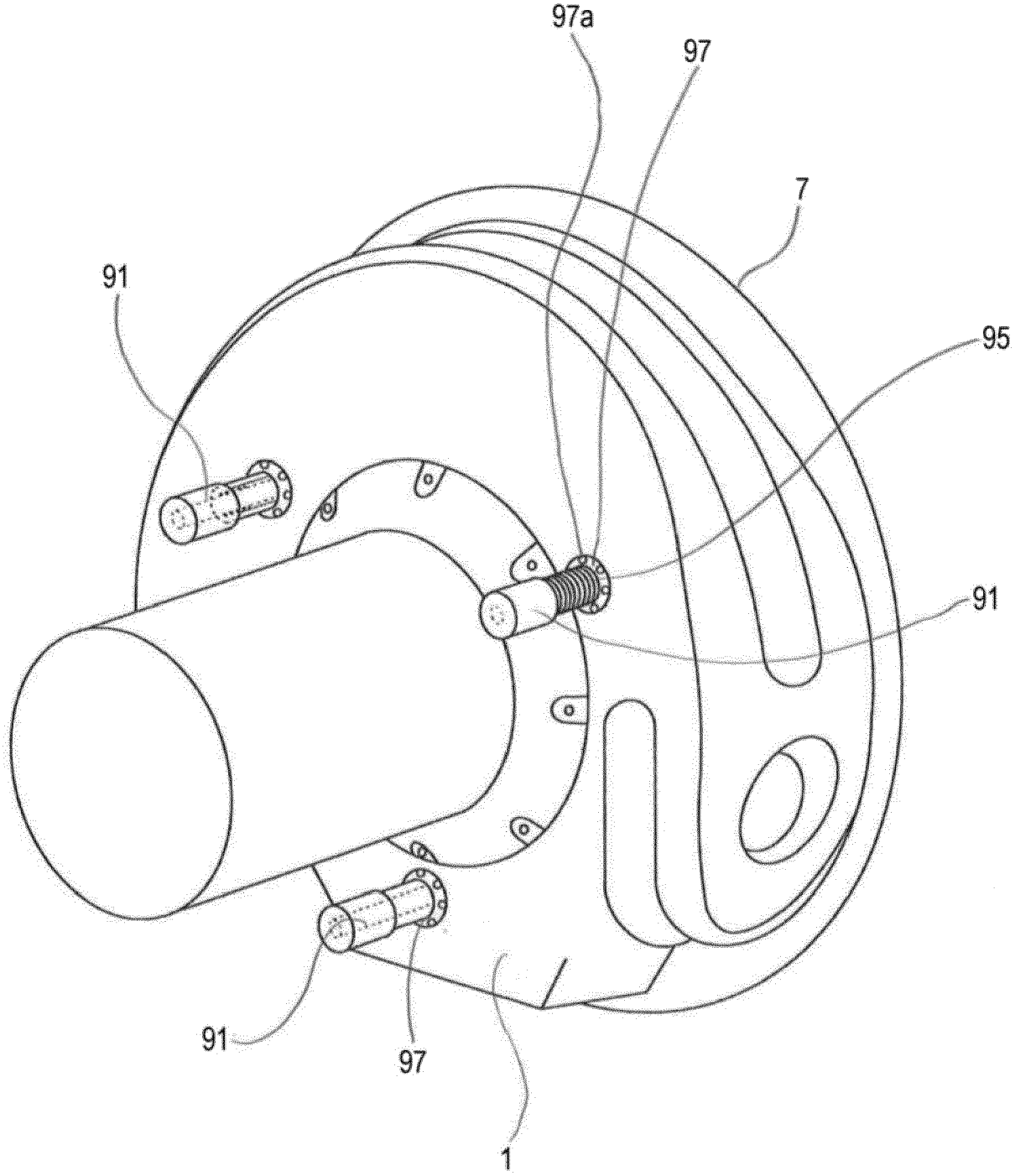


FIG. 2

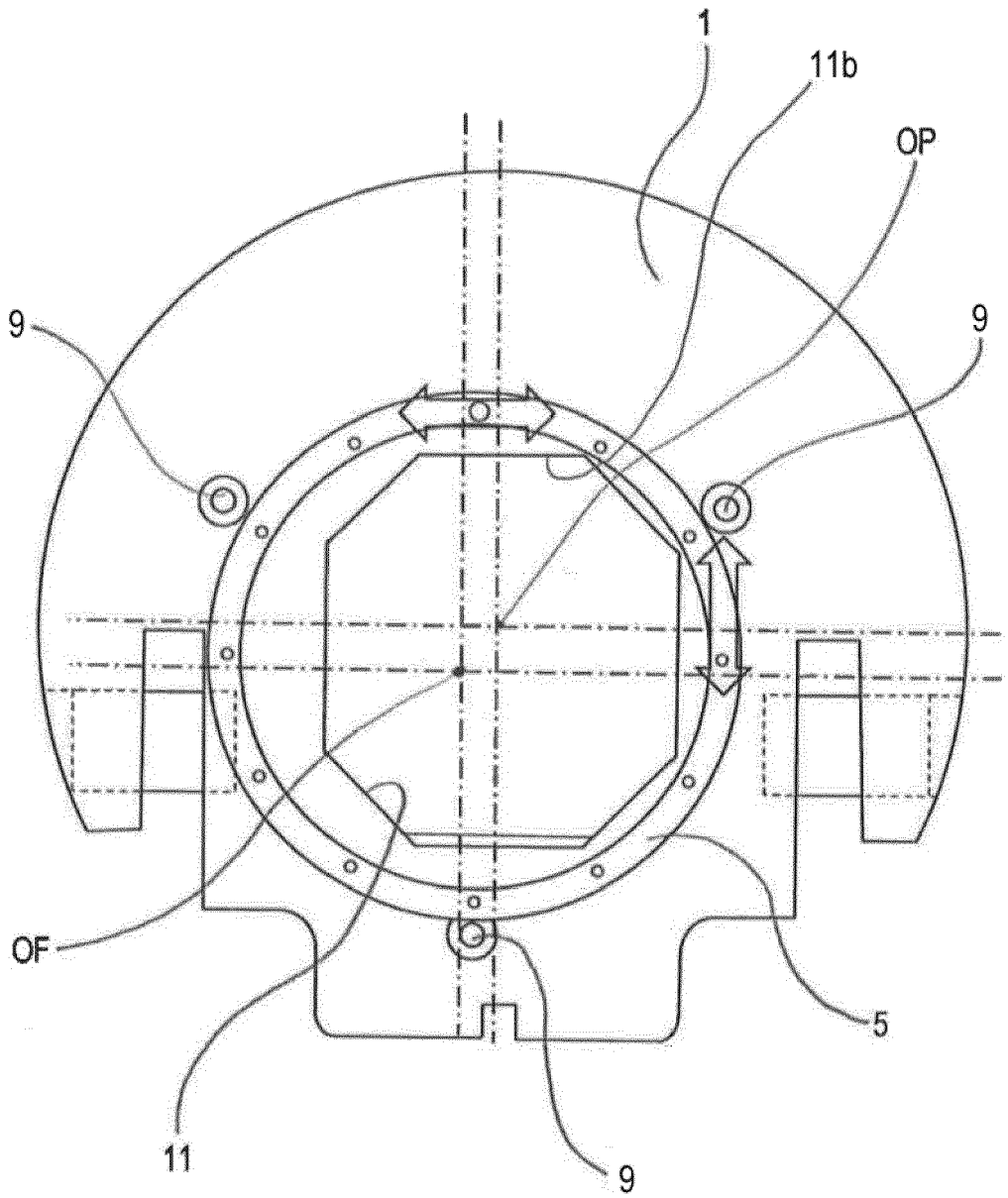


FIG. 3

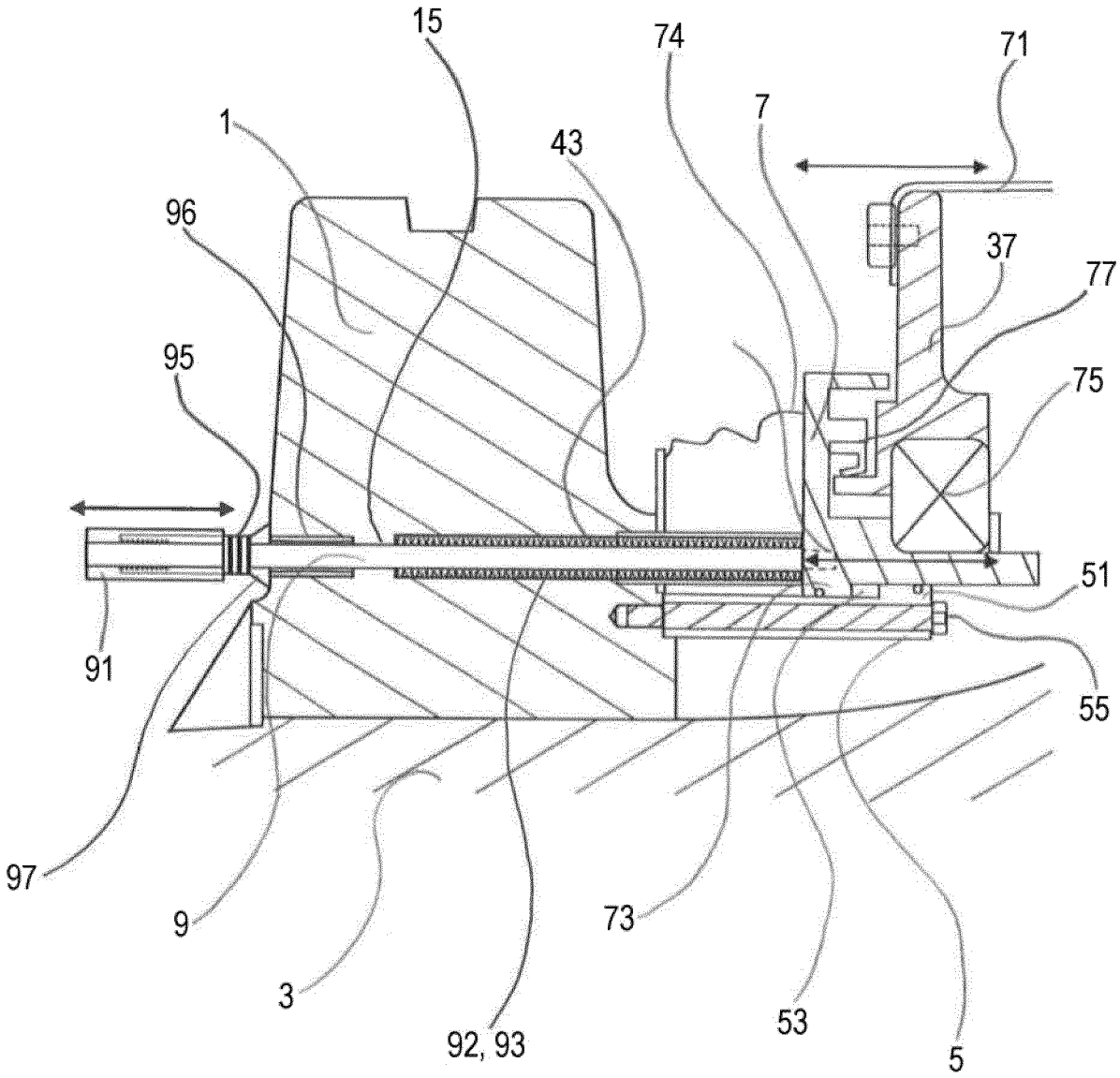
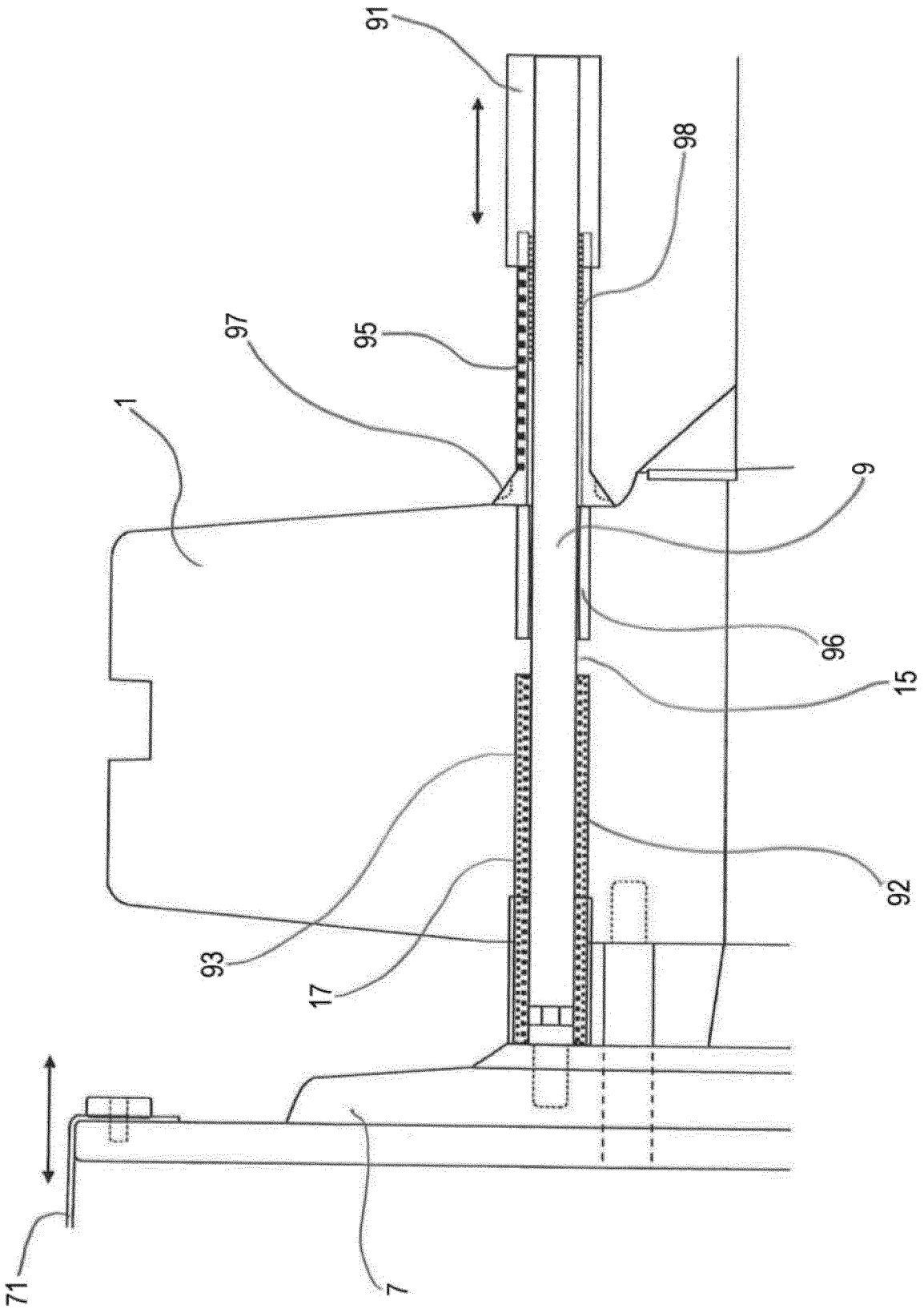


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 1556

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D21F
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 October 2019	Maisonnier, Claire

CATEGORY OF CITED DOCUMENTS

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