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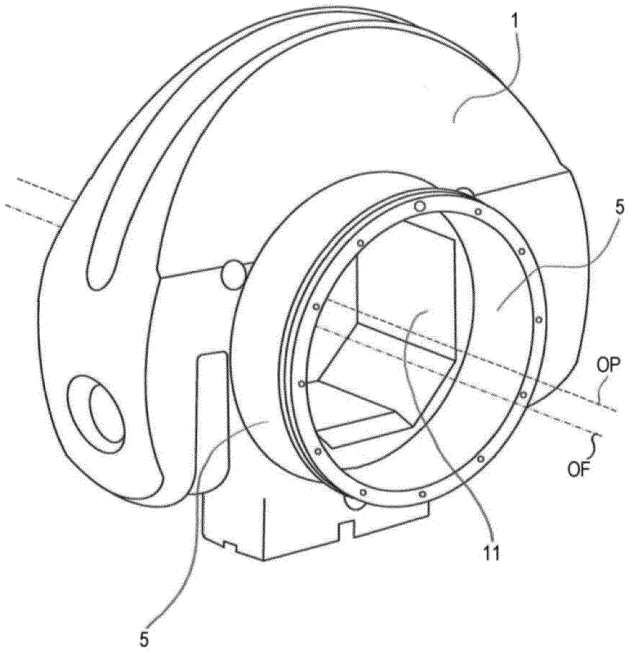
(54) **SHOE ROLL END MODULE AND METHOD TO ASSEMBLE A SHOE ROLL END MODULE**

(57) A shoe roll end module comprises a pedestal (1); a roll head (3) configured to support a belt (31) tensioned about the shoe roll; and an axially elongated annular structure (5) in connection with the pedestal (1). The axially elongated annular structure is configured to support the roll head (3).

FIG. 1



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Description

[0001] The invention pertains to a shoe roll end module and to a method to assemble such a shoe roll end module. Such shoe rolls are for instance used in a paper or board machine.

[0002] Document EP 1 619 299 B1 discloses an extended-nip press. The extended-nip press is provided between a shoe press roller and a counter roller, to press the moving web at a papermaking machine. The shoe press roller has a fixed carrier and a rotating flexible roller belt. The ends of the belt are supported on the carrier by end disks, with roller bearings running on bearing rings at roller journals. Between the shoe press and the belt a liquid is present.

[0003] In order to keep the belt in the shape of a cylindrical jacket, roll head elements are fitted with bearings to the axle. It is known to use an eccentricity of the belt for getting better inlet and outlet angles between the belt and the shoe. Thus, it is possible to use longer shoes inside a smaller diameter shoe press belt roll.

[0004] In prior art solutions, eccentricity is made with eccentric ferrules turned from a cast billet and fitted directly to an axle stub. Manufacturing such an eccentric ferrule is a challenging work. Moreover, it is a risk for working safety, because those big rotating eccentric masses can come loose from attachments during the turning work in manufacturing.

[0005] Moreover, in use it is difficult to affect the amount or direction of eccentricity for individual projects. Another issue is that an eccentric ferrule has a mass distribution that contributes for rotation in manufacturing.

[0006] Thus, there is need to provide a shoe roll head facilitating to set an amount or direction of eccentricity.

[0007] Surprisingly this invention solves the problems arising with an eccentric ferrule by combining pedestal, ferrule and roll head to a shoe roll end module. By arranging such an end module support, from one location a centric ferrule can be supported either to the pedestal or to the roll head.

[0008] According to the invention, a shoe roll end module comprises a pedestal; a roll head configured to support a belt tensioned about the shoe roll heads; and an axially elongated annular structure in connection with the pedestal. The axially elongated annular structure is configured to support the roll head.

[0009] Thus, in comparison to prior art structures, a shoe roll end module can be assembled or disassembled in a fast and clear manner. Since the individual parts are combined to one end module having only one fitting to the axle, the end module can be manufactured in a simple manner before assembly to the axle as well as the end module can be handled more easily.

[0010] 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.

[0011] Advantageously, generating straight lines of an outer surface of the axially elongated annular structure can be arranged in parallel to a center axis of an axle hole in the pedestal, and the outer surface of the axially elongated annular structure is eccentric to the center axis of the axle hole.

[0012] Due to this feature combination, it is possible to provide an eccentric member, which simply consists of an annular structure. Such an annular structure is comparably easy to manufacture, e.g. by turning. Moreover, by shifting the annular structure, with respect to the pedestal, a center axis position of the annular structure can be easily arranged with a required relation to the center axis position of the pedestal's axle hole. Accordingly, an arbitrary amount of eccentricity can be caused with the very same parts.

[0013] Advantageously, the axially elongated annular structure can be a ferrule, being configured to, with a proximal end thereof, be attached to and dismounted from the pedestal or the roll head.

[0014] Moreover, advantageously, a center axis of the axially elongated annular structure can be arranged in parallel to a center axis of an axle hole in the pedestal and is distanced from the center axis of the pedestal.

[0015] Moreover, advantageously, the axially elongated annular structure can have a flange part on a distal end thereof, the flange part protruding radially outwards.

[0016] Such a flange part is advantageous for mounting a roll head, by inserting the annular structure into the roll head while the flange part gets into abutment with the roll head, the position of which is determined. Thus, the flange part works as a stopper preventing the roll head from falling off the ferrule.

[0017] In an advantageous manner, the roll head can have a base part, which is configured to be slid over the axially elongated annular structure. Moreover, it can have a rotating part, which is configured to hold the belt and to rotate with the belt a rotation axis of the shoe press roller, and a bearing, which is arranged between the base part and the rotating part.

[0018] Moreover advantageously, the roll head can have a flange part protruding radially inwards, such that, when the roll head is slid over the axially elongated annular structure the flange part of the roll head and the flange part of the axially elongated annular structure form an annular gap therebetween.

[0019] In a case where such an annular gap is formed, by correspondingly sealing the circumferential surfaces of the respective flange parts, the gap can serve as a pneumatic or hydraulic chamber for adjusting the roll head's position with regard to the annular structure and the pedestal.

[0020] Accordingly, in an advantageous manner, the annular gap can have a port for introducing a fluid in order to increase the annular gap's volume by moving the roll head towards the pedestal, in order to determine the roll head's position with regard to the pedestal.

[0021] Moreover advantageously, the axially elongat-

ed annular structure can be attachable in a manner such that its center axis changes its distance to the center axis of an axle hole in the pedestal.

[0022] Thereby, the amount of eccentricity can be adjusted according to actual needs.

[0023] Moreover advantageously, the axially elongated annular structure can be attached to the pedestal at merely one location by a fixing means serving as rotation axis such that the axially elongated annular structure can swing about the fixing means for adjusting the position of its center axis.

[0024] Moreover, according to the invention, a method to assemble a shoe roll end module comprises a step of sliding a roll head over an axially elongated annular structure; and a step of attaching the axially elongated annular structure supporting the roll head to a pedestal.

[0025] Thus, it is possible to assemble or disassemble the shoe roll end module in the course of setting up a shoe roll and/or to perform maintenance.

[0026] Advantageously, the attaching step can be performed in a manner that a center axis of the axially elongated annular structure is in parallel with the center axis of an axle hole of the pedestal.

[0027] Moreover advantageously, a step of adjusting a horizontal and/or vertical position of the roll head with regard to the pedestal by shifting the axially elongated annular structure can be performed.

[0028] Advantageously, furthermore a step of adjusting a distance of the roll head to the pedestal by sliding it on the axially elongated annular structure can be performed in the shoe roll end module.

[0029] Moreover advantageously, a distance-adjusting step can be performed, in which the distance of the roll head to the pedestal is adjusted by introducing a fluid into an annular gap. The annular gap is established between a radially inwardly protruding flange of the roll head and a radially outwardly protruding flange arranged an a distal end of the axially elongated annular structure when viewed from the pedestal. Additionally or alternatively, the distance-adjusting step can be performed by means of a working cylinder, having one of its ends attached with the roll head and having the other of its ends attached at the pedestal.

[0030] Other advantages and effects of the invention will become clear from the detailed description of a presently preferred embodiment in combination with the attached drawings. In the drawings:

Fig. 1 is a perspective view of a pedestal according to the embodiment, to which an axially elongated annular structure is attached;
Fig. 2 is a plan view of the pedestal of Fig. 1;
Fig. 3 is a section view of a shoe roll end module structure according to the embodiment.

[0031] A preferred embodiment of the invention will be described by referring to Figs. 1 to 3. Fig. 1 is a perspective view of a pedestal according to the embodiment, Fig. 2 is a plan view of the pedestal, and Fig. 3 is a section view of a shoe roll end module 2 structure according to the embodiment.

[0032] A pedestal 1 has an axle hole 11, which serves to accommodate an axle stub 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.

[0033] 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.

[0034] A corresponding surface of an axle stub 7 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.

[0035] 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.

[0036] 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.

[0037] With regard to the center axis OP of the axle hole 11 corresponding to the center axis of the axle (pressure beam), certain eccentricity is required in order to meet the loads occurring on the shoe roll. That is, since the belt 31 of the shoe roll in section has a shape of a cardioid, the rotation axis position of the belt does not correspond to the center axis of the axle. Accordingly, a certain eccentricity is required for the roll head 3 holding the belt 31.

[0038] According to the embodiment of the shoe roll end module, it is possible to connect the ferrule 5 with the pedestal in an arbitrary manner as indicated by the arrows in Fig. 2. Thus, any required degree of eccentricity

can be obtained when assembling the shoe roll head structure.

[0039] 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.

[0040] Before being connected with the pedestal 1, the ferrule 5 is inserted into an inner bore of the roll head 3when assembling the shoe roll end module 2. The roll head 3 has an inner static structure 35 and an outer dynamic (rotating) structure 37. A bearing 39 and a labyrinth seal connect these two structures 35 and 37 of the roll head 3 and prevent leakage of fluid, e.g. lubrication fluid. The roll head 3 supports the belt 31. A bellows 34 connects the roll head with the pedestal and prevents contamination of the inner portions of the roll head 3.

[0041] Moreover, in the shoe roll end module the roll head 3 is connected with the pedestal 1 by means of indexing rods 4. These indexing rods 4 comprise a screw extending through a bore provided in the pedestal 1 and being in thread engagement with a thread bore 32 in the roll head 3. An indexing head 41 is arranged on the outer side of the pedestal 1.

[0042] Pressurization of the annular gap 53 reveals in that indexing head 41 just moves along in a longitudinal manner because its far end is fixed to the rod 4. An indexing nut 45 having a scale shows the movement when being screwed back against the pedestal 1. This allows keeping the gap 53 without pressure when not moving the head. Springs 43 and the indexing nut 45 keep the head in the indexed position. Thus, movement of the roll head 3 towards the pedestal 1 is effected, i.e. in the Figure towards the left direction as indicated by the double arrows in Fig. 3.

[0043] Loosening of the indexing nut 45 effects a movement of the roll head 3 from the pedestal 1 towards the machine center, i.e. into the right direction in the figures as also indicated by the double arrows in Fig. 3. This rightward movement is mainly effected by means of the compression springs 43. The compression springs are provided about the portion of the screw between the roll head 3 and the pedestal 1. Thus, a movement of the roll head 3 towards the pedestal 1 effects compression of the springs 43. The compression is then relieved upon loosening of the indexing nut 45, which effects then the roll head's 3 movement towards the machine center.

[0044] In its bore, the roll head 3 has a radially inwards extending flange 33, which cooperates with the flange 51 of the ferrule 5 in two manners as indicated above.

[0045] Firstly, the flange 51 serves to secure the roll head 3 by getting into abutment with a flange 33 of the roll head. That is, the flange 33 is provided radially inwards and is arranged in an axial position between the pedestal 1 and the flange 51 of the ferrule 5.

[0046] Secondly, since the flange 51 forms an annular gap 53 with the flange 33 provided at the roll head 3, by sealing the respective circumferential surfaces of the flanges 51 and 33, 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 31 tension and indexing the belt to a different axial position in order to reduce belt wear in the edge areas.

[0047] The main advantages of the shoe roll end module invention described by means of the preferred embodiment are:

- there is an increased possibility to adjust the individual components. That is, by connecting the ferrule with the pedestal at an arbitrary location it is possible to adjust eccentricity according to the project. Modifications to a cast model are not necessary;
- the roll head can be arranged at an arbitrary required position with respect to the axle and the shoe by sliding it over the ferrule;
- turning work of the centric ferrule is well known and easily to be achieved;
- 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;
- for manufacturing the ferrule, less material is required, i.e. material of the billet can be saved;
- final assembly is getting significantly faster with pre assembling of the shoe press and modules;
- pre assembling is possible with said new shoe roll end module;
- less fitting and sealing surfaces are to be machined, only one fitting form locking location compared to the earlier two separate parts with own fitting surfaces in different locations;
- the number of needed small parts, like protective lids for sealings, etc. decreases;
- it is possible to adjust eccentricity specially without extra parts, thereby geometry of the shoe inlet can be optimized.

[0048] While the invention has been described by means of a presently preferred embodiment, it is to be understood that the scope of the invention is merely defined by the attached claims.

REFERNCE SIGNS LIST

[0049]

1	pedestal
11	axle hole (hole for accommodating a pressure beam stub)
11b	torque surface
3	roll head
31	belt
32	thread bore

33 flange
34 bellows
35 static part
37 rotating (dynamic) part
39 bearing
4 indexing rod
41 screw head
43 spring
5 ferrule (axially elongated annular structure)
51 flange
53 annular gap
55 bolt

Claims

1. A shoe roll end module comprising:

a pedestal (1);
a roll head (3) configured to support a belt (31) tensioned about the shoe roll;
characterized by
an axially elongated annular structure (5) in connection with the pedestal (1), and being configured to support the roll head (3).

2. The shoe roll end module according to claim 1, wherein
generating straight lines of an outer surface of the axially elongated annular structure (5) are arranged in parallel to a center axis (OP) of an axle hole (11) in the pedestal (1), and the outer surface of the axially elongated annular structure (5) is eccentric to the center axis (OP) of the axle hole (11).

3. The shoe roll end module according to claim 1 or 2, wherein
the axially elongated annular structure (5) is a ferrule, being configured to, with a proximal end thereof, be attached to and dismounted from the pedestal (1).

4. The shoe roll end module according to any of the preceding claims, wherein
a center axis (OF) of the axially elongated annular structure (5) is arranged in parallel to a center axis (OP) of an axle hole (11) in the pedestal (1) and is distanced from the center axis (OP) of the pedestal (1).

5. The shoe roll end module according to any of the preceding claims, wherein
the axially elongated annular structure (5) has a flange part (51) on a distal end thereof, the flange part (51) protruding radially outwards.

6. The shoe roll end module according to any of the preceding claims, wherein the roll head (3) has
a base part (35) configured to be slid over the axially elongated annular structure (5),
a rotating part (37) configured to hold the belt (31) and to rotate with the belt (31) a rotation axis of the shoe press roll, and
a bearing (39) arranged between the base part and the rotating part.

7. The shoe roll end module according to claim 5 or 6, wherein
the roll head (3) has a flange part (33) protruding radially inwards, such that, when the roll head (3) is slid over the axially elongated annular structure (5) the flange part (33) of the roll head (3) and the flange part (51) of the axially elongated annular structure (5) form an annular gap (53) therebetween.

8. The shoe roll end module according to claim 5, wherein
the annular gap (53) has a port for introducing a fluid in order to increase the annular gap's (53) volume by moving the roll head (3) towards the pedestal (1), in order to determine the roll head's (3) position with regard to the pedestal (1).

9. The shoe roll end module according to any of the preceding claims, wherein
the axially elongated annular structure (5) is attachable in a manner such that its center axis (OF) changes its distance to the center axis (OP) of an axle hole (11) in the pedestal (1).

10. The shoe roll end module according to any of the preceding claims, wherein
the axially elongated annular structure (5) is attached to the pedestal (1) at merely one location by a fixing means (55) serving as rotation axis such that the axially elongated annular structure (5) can swing about the fixing means (55) for adjusting the position of its center axis (OF).

11. Method to assemble a shoe roll end module, comprising
a step of sliding a roll head (3) over an axially elongated annular structure (5);
a step of attaching the axially elongated annular structure (5) supporting the roll head (3) to a pedestal (1).

12. The method to assemble a shoe roll end module according to claim 10, wherein the attaching step is performed in a manner that a center axis (OF) of the axially elongated annular structure (5) is in parallel with the center axis of an axle hole (11) of the pedestal (1).

13. The method to assemble a shoe roll end module according to claim 11 or 12, furthermore comprising

a step of adjusting a horizontal and/or vertical position of the roll head (3) with regard to the pedestal by shifting the axially elongated annular structure (3).

14. The method to assemble a shoe roll end module according to any of claims 11 to 13, furthermore comprising
a step of adjusting a distance of the roll head (3) to the pedestal (1) by sliding it on the axially elongated annular structure (5).

15. The method to assemble a shoe roll end module according to any of claims 11 to 14, wherein
a distance adjusting step is performed, in which the distance of the roll head (3) to the pedestal (1) is adjusted by introducing a fluid into an annular gap (53) established between a radially inwardly protruding flange (33) of the roll head (3) and a radially outwardly protruding flange (51) arranged an a distal end of the axially elongated annular structure (5) when viewed from the pedestal (1), and/or
the distance adjusting step is performed by means of a working cylinder, having one of its ends attached with the roll head (3) and having the other of its ends attached at the pedestal (1).

FIG. 1

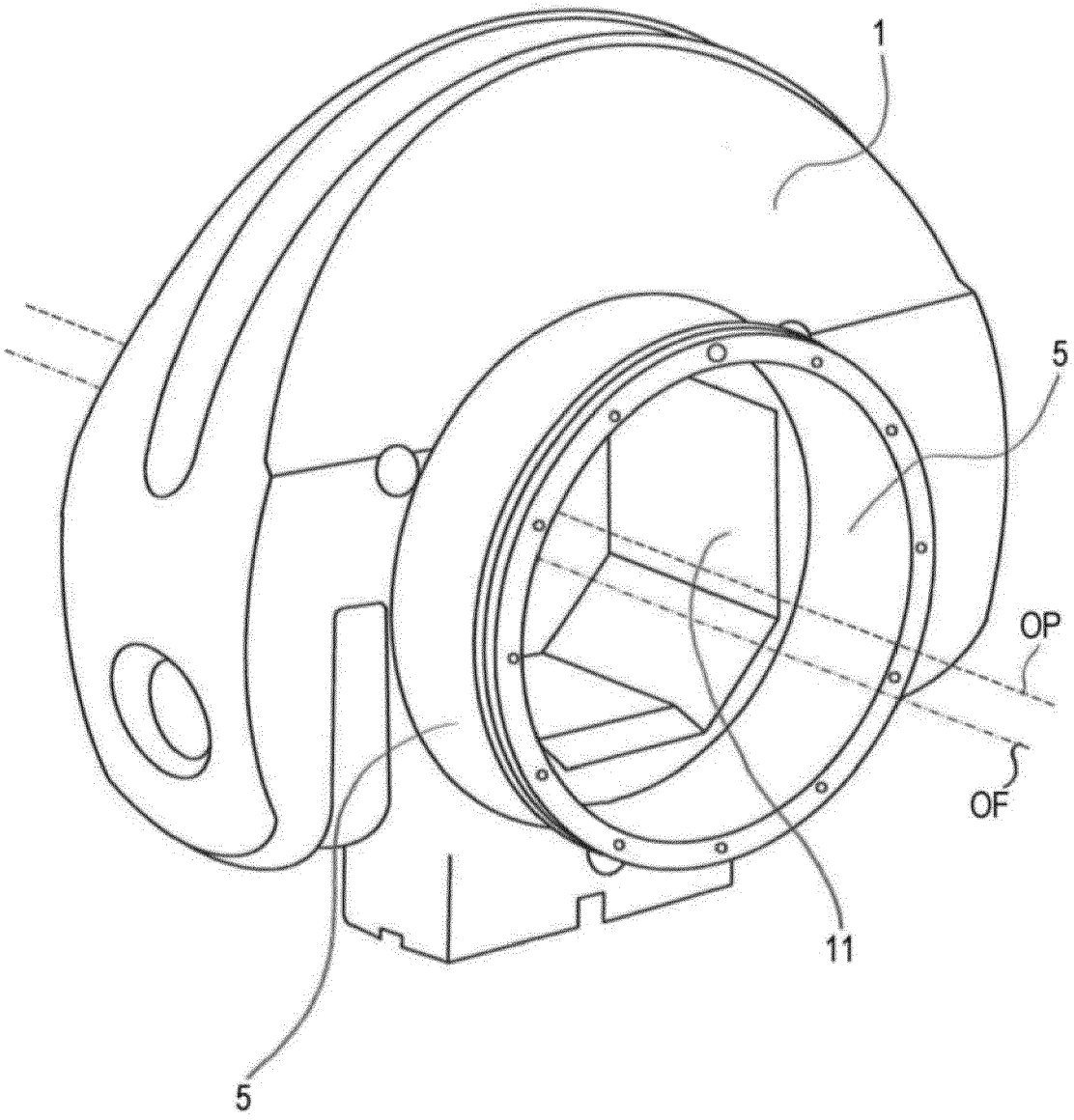


FIG. 2

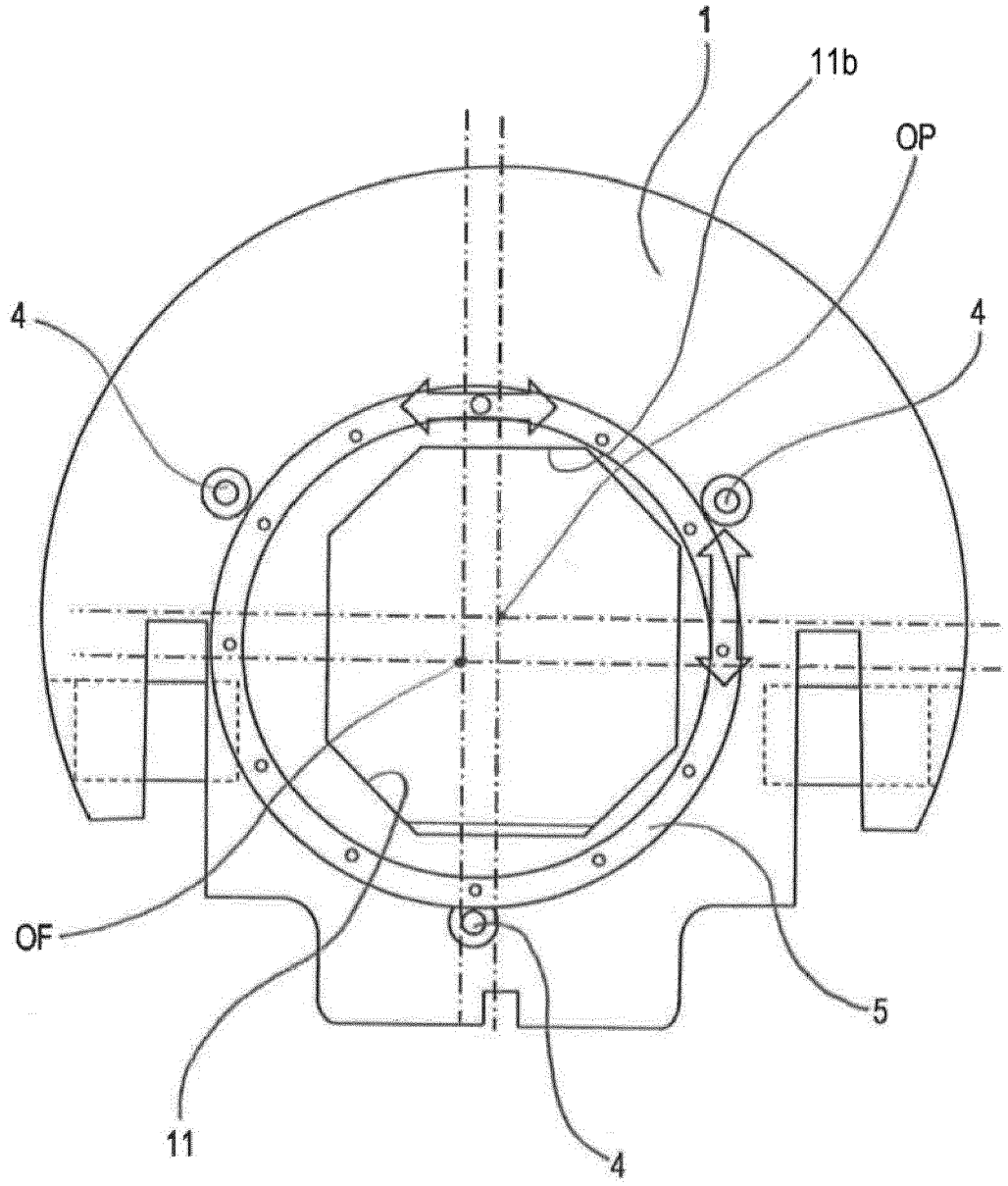
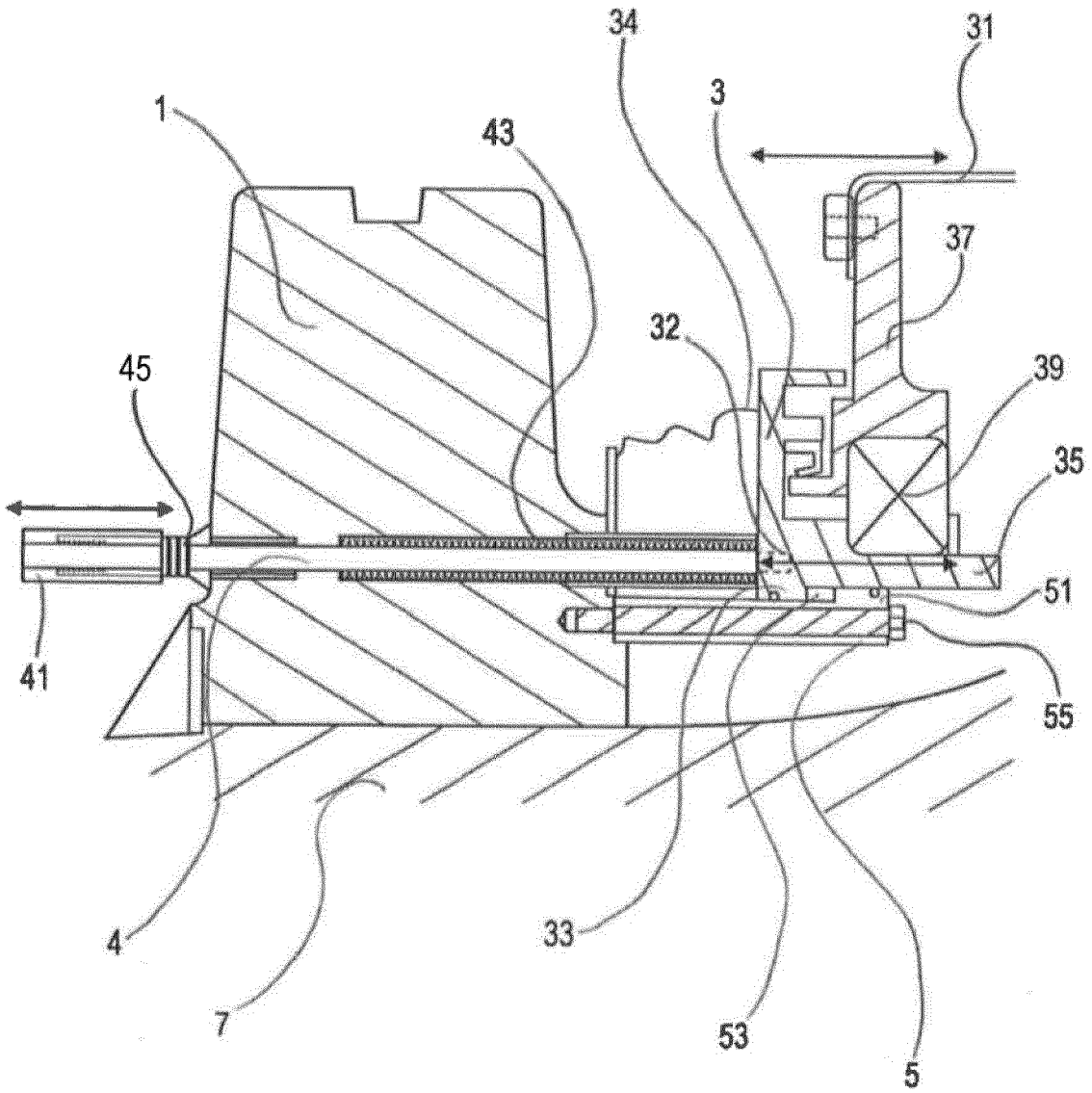


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 1555

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TECHNICAL FIELDS SEARCHED (IPC)

D21F
D21G

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

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