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(54) ANNULAR DEVICE FOR SHAFTS IN WINDING MACHINES AND SHAFT EQUIPPED THEREWITH

(57) An annular locking device (10) for the winding of reels is intended to be arranged alongside a plurality of similar annular devices so as to form a winding shaft in a winding machine. The device comprises an inner ring (11) and an outer ring (12) which are concentric and engaging elements (13) which emerge through slots (14) on the peripheral surface of the outer ring. The outer ring is rotatable relative to the inner ring between a first angular rest position, in which the engaging elements (13) may retract inside the outer ring by a first amount, and a second angular position, in which the engaging elements (13) may retract by a smaller amount than in the first angular rest position. The engaging elements (13) are in the form of cylinders with rounded bases. A shaft assembly with such devices is also described.

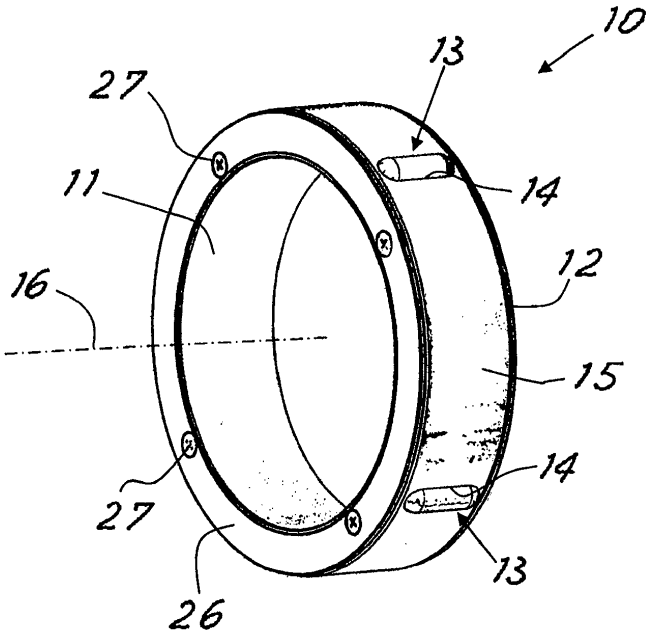

Fig.1

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Description

[0001] The present invention relates to an innovative device for locking and winding reels of strip-like material in multiple winding machines. The invention also relates to a shaft with a plurality of such devices.

[0002] In the technical sector of multiple winding machines shafts with a plurality of adjacently arranged annular devices which allow rapid mounting and locking of the cores of the reels to be wound are well known.

[0003] These devices comprise two concentric rings between which the engaging elements are inserted, said elements projecting from the outermost ring so as to engage with the cores which are fitted onto the shaft.

[0004] The outer ring may be rotated on the inner ring between a working position and a rest position, for locking or allowing a radial movement of the engaging elements such as to engage or release the inner surface of the cores which are mounted on them.

[0005] When the outer ring is in the angular rest position, the cores of the reels may slide easily along the shaft so that they may be mounted or removed. In the working position, the cores of the reels are instead locked by the engaging elements so as to rotate together with the shaft.

[0006] In the known devices, the engaging elements are usually in the form of balls so as to facilitate axial sliding of the cores along the shaft when the devices are in the rest position. On the other hand, the balls provide only a small contact area with the cores when the devices are in the locked position and this gives rise to various drawbacks. For example, in order to prevent the core from being arranged inclined on the shaft it is necessary to have at least two rows of parallel balls for each core. Moreover, in the case of fragile cores, the inner surface of the core may be damaged by the balls and also start to rotate in an uncontrolled manner on them even if the device is in the locked position.

[0007] Moreover, since the balls must in any case remain safely inside their seats in the ring, the diameter of the hole from which they project from the outer ring must necessarily be much smaller than the diameter of the balls. In order to ensure that the balls project sufficiently when the device is in the locked position, the balls must therefore have a relatively large diameter. This is incompatible with the desire to have, for example, devices with a small thickness.

[0008] In order to overcome some of the problems caused by the use of balls devices have been proposed where the engaging elements are formed by cylinders with their axis parallel to the axis of the rings. This, however, increases only the area of the surface making contact with the cores, but does not solve the other drawbacks which were associated with the balls and which remain substantially the same. On the contrary, the use of cylinders gives rise to some further drawbacks. For example, the contact surfaces between cylinder and core must be perfectly parallel to the axis of the rotating shaft. This does not allow, for example, small irregularities on the inner surface of the cores to be compensated for.

[0009] Moreover, the angled edges of the two bases of the cylinder may prevent the axial sliding of the cores during mounting or removal of the cores onto/from the shaft and damage even more the inside of the cores.

[0010] In an attempt to solve this latter problem, US 2008/237388, JP 2012-111628, JP-H11-208942 and JP-H11-59981 describe cylinders which have rounded bases. The remaining problems, however, are still unsolved.

[0011] The general object of the present invention is to overcome the drawbacks of the prior art by providing an improved annular device for winding machines.

[0012] In view of this object the idea which has occurred is to provide, according to the invention, an annular locking device for the winding of reels, intended to be arranged alongside a plurality of similar annular devices so as to form a winding shaft in a winding machine, according to claim 1. In particular, the device comprises an inner ring and an outer ring which are concentric and engaging elements which emerge through slots on the peripheral surface of the outer ring, the outer ring being rotatable with respect to the inner ring between a first angular rest position, in which the engaging elements may retract inside the outer ring by a first amount, and a second angular position, in which the engaging elements may retract by a smaller amount than in the first angular rest position, and the engaging elements are in form of cylinders with rounded bases.

[0013] Still in accordance with the invention a shaft assembly for winding reels on reel cores in a multiple winding machine is also described, said assembly comprising a shaft on which a plurality of annular devices designed according to the invention are mounted, said devices being arranged coaxially alongside each other along the shaft so as to receive on them reel cores to be wound.

[0014] In order to illustrate more clearly the innovative principles of the present invention and its advantages compared to the prior art, an example of embodiment applying these principles will be described below with the aid of the accompanying drawings. In the drawings:

- Figure 1 shows a schematic perspective view of an annular device according to the invention;
- Figure 2 shows a schematic perspective view of a winding machine shaft with the annular devices according to Figure 1;
- Figure 3 shows a schematic cross-sectional view of the device according to Figure 1;
- Figure 4 shows a schematic cross-sectional view of the device according to Figure 1, along the line IV-IV of Figure 3;
- Figure 5 shows a schematic perspective view of an inner ring of the device according to Figure 1;
- Figure 6 shows a schematic view, on a larger scale, of a cross-section close to an engaging element of the device according to Figure 1.

[0015] With reference to the figures, Figure 1 shows, denoted generally by 10, an annular locking device which is intended to be mounted on a winding shaft of a known winding machine (not shown here or described in detail since it is well known per se and may be easily imagined by the person skilled in the art).

[0016] The device 10 comprises an inner ring 11 and an outer ring 12 which are coaxial with each other. Engaging elements 13 emerge from the peripheral surface 15 of the outer ring through shaped slots 14 arranged at intervals, which are preferably equidistant, around the circumference of the ring.

[0017] As will be explained below, the engaging elements 13 are movable radially with respect to the rings depending on the relative angular position of the two rings, which may be rotated relative to each other between a first angular rest position and a second angular locking position. In the first angular rest position the engaging elements 13 are radially retracted or elastically retractable, while in the second angular position the engaging elements 13 are retractable or retracted by a smaller amount than in the first angular rest position. In this way, in the first position, the cores 18 on the devices 13 may be slid axially along the shaft, while in the second position they are forced to rotate together with the annular devices.

[0018] Figure 2 shows in schematic form a shaft assembly 29 of a winding machine which comprises a shaft 17 on which a plurality of annular devices 10 arranged axially adjacent are mounted. These annular devices 10 are mounted on the shaft so as to be preferably rotatable with friction on the axis of the said shaft, using systems known in the sector and therefore not shown since they may be easily imagined by the person skilled in the art.

[0019] With this frictional rotation it is possible to compensate for variations in the pulling force between the single reels which are being wound even though a same winding shaft is used.

[0020] Figure 2 also shows, by way of example, partially cross-sectioned, a core 18 of a reel to be wound in the winding machine. The use of annular devices on such a machine is known per se and therefore will not be further described or shown.

[0021] Figure 3 shows a cross-sectional view of a possible embodiment of a device 10.

[0022] As can be seen in this figure, the device 10 may have an inner ring 11 with a peripheral surface which forms for each engaging element 13 a sliding surface 19 with a variation in height with respect to the outer ring so that, at one end 20 of the sliding surface (corresponding to the angular rest position), the element 13 may be retracted more than at the opposite end 21 of the sliding surface. Advantageously, a stop allows relative rotation of the rings only through a small angle, corresponding to the sliding of the engaging elements 13 between the first and second ends of the sliding surface 19.

[0023] For example, the stop may be formed with a pin 22 which projects inside the outer ring 12 so as to be inserted and slide inside a circumferential recess 23 of suitable length formed in the peripheral surface of the inner ring. In order to allow relative assembly and disassembly of the two rings 11 and 12, the circumferential recess 23 may have a passage 24 towards one side of the inner ring, as can be clearly seen in Figure 5, so as to allow the passage of the end of the pin 22 with a relative movement of the two rings in the axial direction.

[0024] The rings are fastened so to rotate without coming loose. For example, the inner ring may have on one side a shoulder 25 which projects radially and against which a corresponding side face of the outer ring rests slidably. A circular rim 26 may also be fixed onto the opposite side of the inner ring. The circular rim 26 may for example be fixed in position by means of screws 27, as shown in Figure 1. Alternatively, it is also possible to imagine using other known means, such an elastic ring which is seated inside a suitable recess between the rings.

[0025] Other known systems for rotatably mounting the rings may in any case be used.

[0026] As can be clearly seen in the figures, the engaging elements 13 have the form of a cylindrical body with rounded bases, with the main axis parallel to the axis 16 of rotation of the rings.

[0027] In particular, the engaging elements have advantageously a form defined by the geometrical composition of a cylinder and two semi-spheres which project from the two bases of the cylinder so as to be connected to the side wall of the cylinder. In particular, the radius of the semi-spheres may be advantageously the same as the radius of the cylinder.

[0028] As can be clearly seen also in Figure 6, each engaging element 13 is seated inside a seat 28 in the outer ring which is open radially with respect to the ring so that the engaging element may project externally from the peripheral surface 15 of the outer ring through the slot 14 and may also rest against the sliding surface 19 of the inner ring.

[0029] The slot 14 has a perimeter which is advantageously obtained by means of the intersection between the peripheral surface 15 of the outer ring and the engaging element arranged with its main axis parallel to the axis 16 of the ring, but offset towards the inside of the ring. In this way the engaging element is seated inside the seat 28 without being able to come out through the slot 14.

[0030] As can be seen again in Figure 6, the seat 28, at least at the rounded ends of the engaging element 13, may advantageously be connected with the edge of the slot 14 on the peripheral surface 15 of the outer ring so as to allow inclination of the engaging element with respect to the peripheral surface 15 of the outer ring.

[0031] In particular, the seat 28 may have advantageously a width, transverse to the ring, which is substantially the same as or slightly greater than the length of the engaging element, with a constriction towards the opening of the slot 14 which is rounded with a radius

substantially similar to the radius of the corresponding rounded ends of the engaging element, with only a small amount of play.

[0032] In this way, the engaging elements, in addition to rotating inside the seat about their axis, may rotate slightly inside the seat also in a plane which is longitudinal in relation to the engaging element and radial with respect to the ring, as shown in broken lines in Figure 6, and preferably about one of the two ends, so as to be inclined at least in the rest position of the device, as can be seen from the figures. This allows the contact surface to be better adapted to the inner surface of the core and also facilitates the mounting and extraction of the cores onto/from the shaft.

[0033] At this point it is clear how the objects of the invention are achieved. Owing to the innovative cylindrical form with rounded ends, sliding, supporting and locking of the cores are facilitated and more reliable results achieved compared to the known solution. Moreover, the degree of projection and the engaging area of the engaging elements may be increased, while keeping the same dimensions of the device, compared to the devices of the prior art. The radial thickness of the device may also be kept very small and this facilitates for example the production of devices which are suitable for mounting cores with a small diameter or in any case with a diameter differing by only a small amount from that of the rotating shaft.

[0034] Obviously the above description of embodiments applying the innovative principles of the present invention is provided only by way of example of these innovative principles and must therefore not be regarded as limiting the scope of the rights claimed herein.

[0035] For example, known elastic means may be provided for radially pushing the engaging elements outwards so that in the rest position the engaging elements may retract elastically against the action of these elastic means. This reduces for example the free movement of the engaging elements and, consequently, the noise, when the devices in the rest position rotate with the winding shaft.

[0036] The elastic means may be for example elastic strips which are positioned on top of the sliding surfaces of the inner ring, as may be easily imagined by the person skilled in the art.

Claims

1. An annular locking device (10) for the winding of reels, intended to be arranged alongside a plurality of similar annular devices so as to form a winding shaft in a winding machine, comprising an inner ring (11) and an outer ring (12) which are concentric, and engaging elements (13) which emerge through slots (14) on the peripheral surface of the outer ring, the outer ring being rotatable relative to the inner ring between a first angular rest position, in which the engaging elements (13) may retract inside the outer ring by a first amount, and a second angular position, in which the engaging elements (13) may retract by a smaller amount than in the first angular rest position, **characterized in that** the engaging elements (13) are in the form of cylinders with rounded bases and the engaging element (13) is seated inside a seat (28) in the outer ring which, at least at the rounded ends of the engaging element (13), is connected to the edge of the slot (14) on the peripheral surface (15) of the outer ring so as to allow, in the said first angular rest position, an inclination of the engaging element with respect to the peripheral surface (15) of the outer ring.

2. Annular device according to claim 1, **characterized in that** the engaging elements (13) are geometrically formed by the composition of a cylinder and two semi-spheres projecting from the bases of the cylinder.

3. Annular device according to claim 1, **characterized in that** the slot (14) has a perimeter with a progression defined by the intersection between the peripheral surface (15) of the outer ring and the engaging element (13) arranged with a main axis offset towards the inside of the outer ring.

4. Annular device according to claim 1, **characterized in that** the seat (28) has a width transverse to the ring which is substantially the same as or slightly greater than the length of the engaging element (13), with a constriction towards the opening of the slot (14) which is rounded with a radius substantially similar, with a small amount of play, to the radius of the corresponding rounded bases of the engaging element.

5. Annular device according to claim 1, **characterized in that** the inner ring (11) comprises surfaces (19) with a variation in height for sliding of the engaging elements (13) during the movement between the first angular position and the second angular position.

6. Annular device according to claim 1, **characterized in that** a stop for ensuring a limited relative rotation of the rings is present between the inner ring (11) and the outer ring (12).

7. Annular device according to claim 1, **characterized in that** the stop comprises a recess (23) extending circumferentially on the inner ring (11) and a pin (22) which projects into this recess (23) from an inner surface of the outer ring.

8. Shaft assembly (29) for winding reels on reel cores (18) in a multiple winding machine, comprising a shaft (17) on which a plurality of annular devices (10)

designed according to any one of the preceding claims are mounted, said devices being arranged coaxially alongside each other along the shaft so as to receive on them reel cores to be wound.

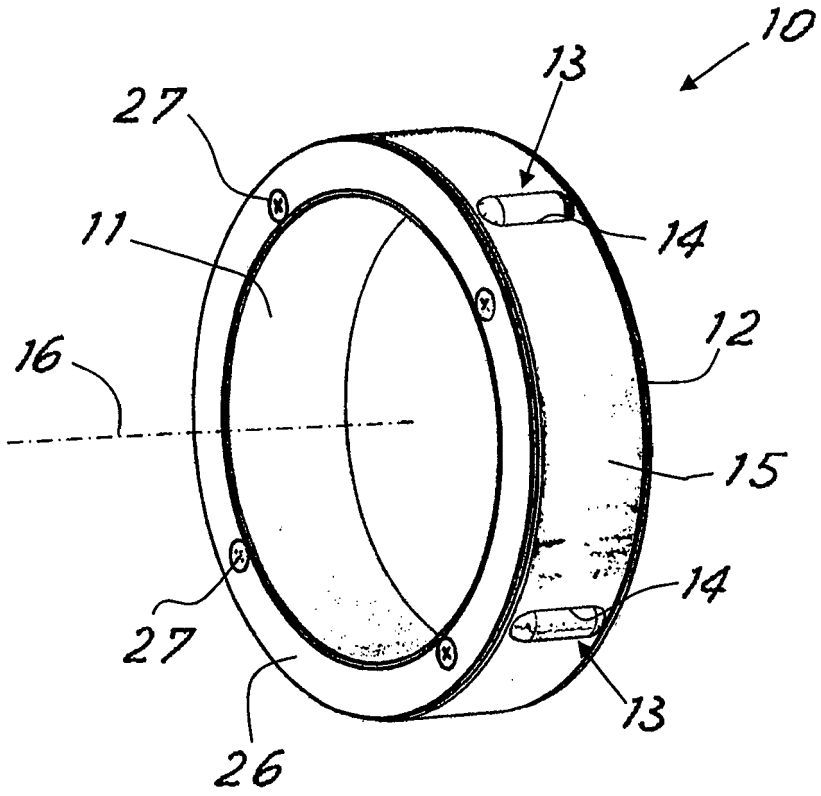

Fig.1

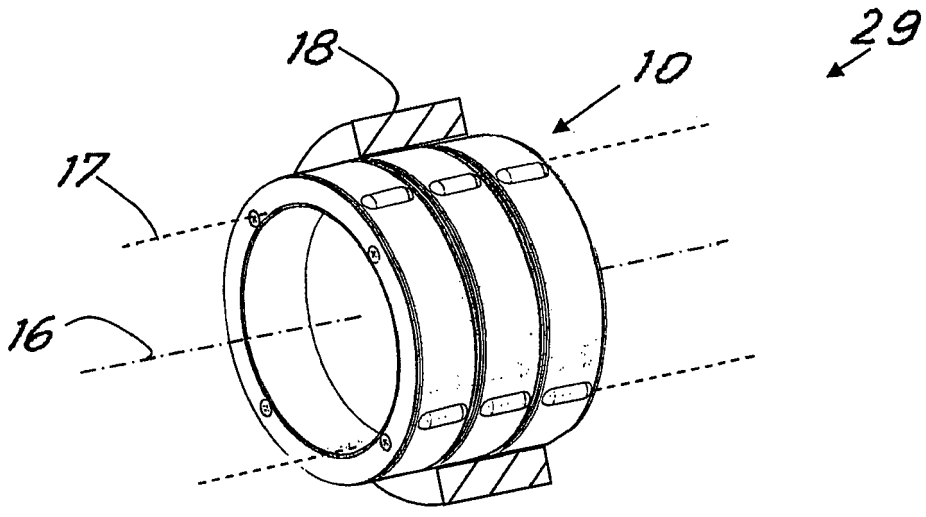

Fig.2

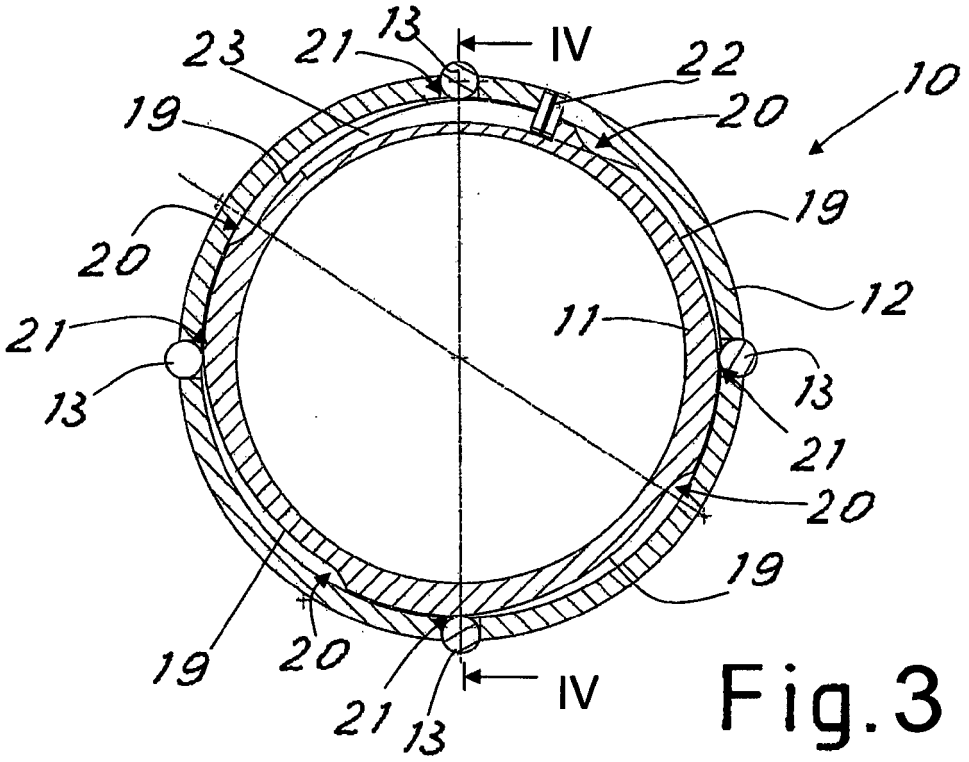
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Fig.3

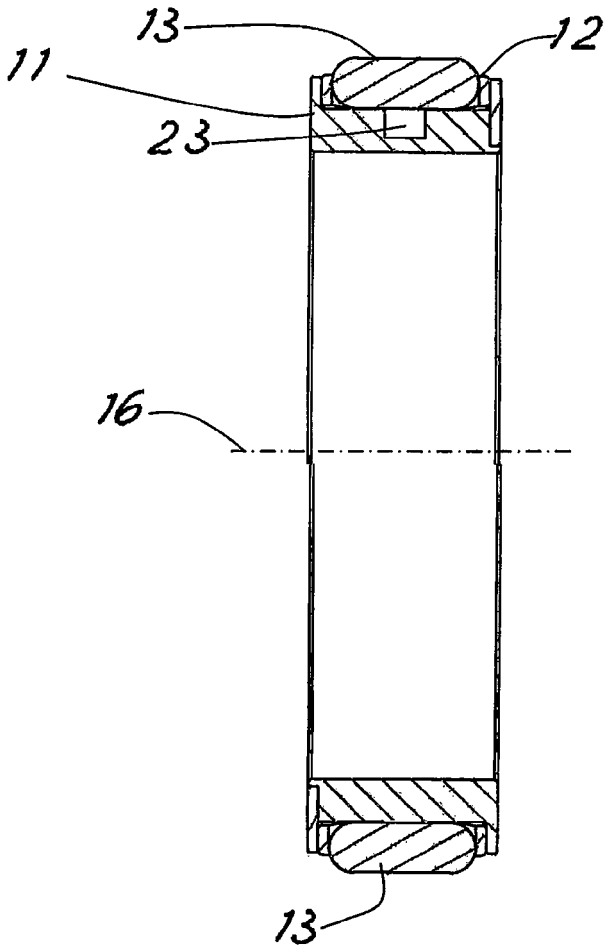
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Fig.4

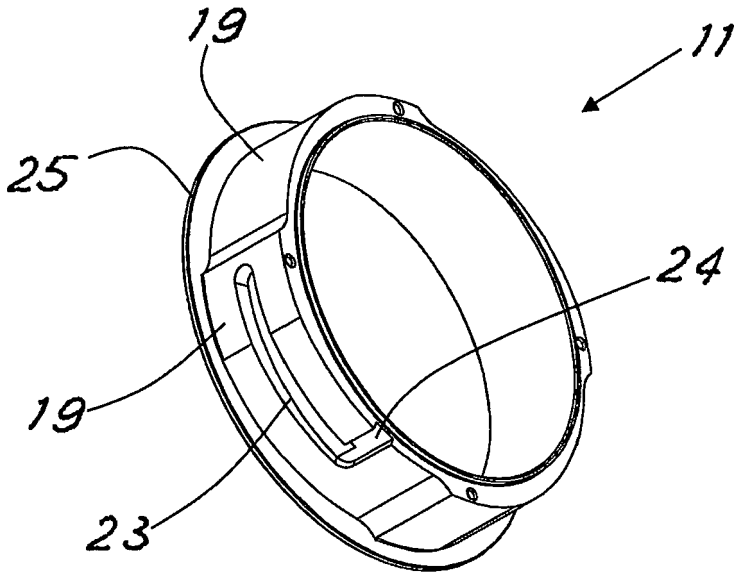

Fig.5

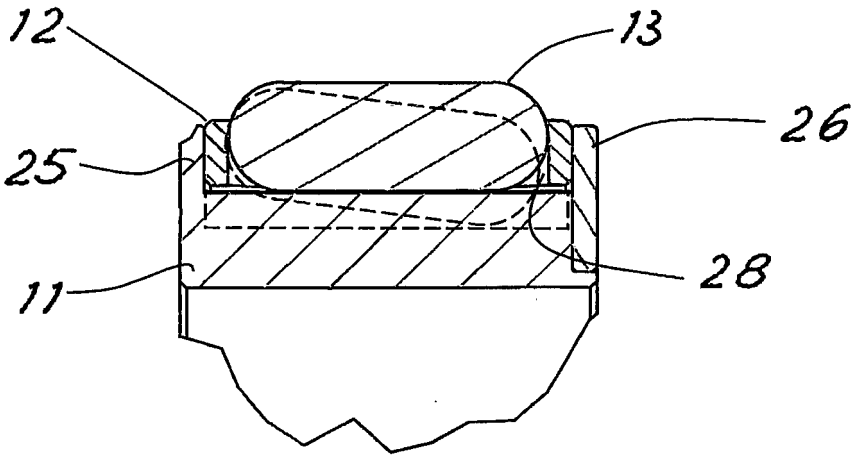

Fig.6

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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 8835

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 August 2019	Lemmen, René

CATEGORY OF CITED DOCUMENTS

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20-08-2019

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

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