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(54) Title: SIMPLIFIED ANNULAR LOCKING DEVICE FOR THE WINDING OF REELS

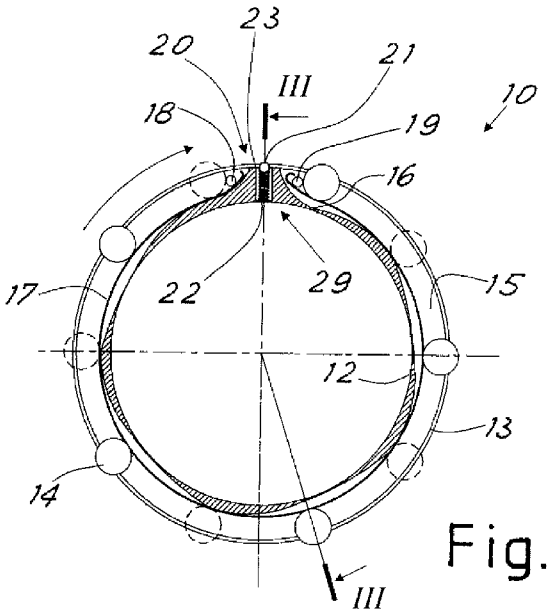

Fig.2

(57) Abstract: An annular locking device (10) for the winding of reels comprises an inner ring (12) and an outer ring (13) coaxial with each other and radially superimposed so as to be rotatable relative to each other. Between inner ring (12) and outer ring (13) there are arranged engaging elements (14) which protrude radially from openings in the outer ring, the outer ring being rotatable on the inner ring between a first angular rest position and a second angular locking position. In the first angular rest position the engaging elements (14) are elastically retractable against the action of elastic means by a greater amount than in the second angular locking position. The inner ring has a circumferential groove (15) which houses engaging elements (14) and which has a bottom (16) shaped so as to vary the depth of the groove along its extension around the inner ring with an alternation of deeper zones and shallower zones arranged so that, upon rotation of the outer ring between the angular rest position and the angular locking position, the engaging elements (14) in the groove all pass simultaneously from a deeper zone to a shallower zone. An elastic plate (17) which realizes said elastic means is provided between the bottom of the groove (15) and the engaging elements (14) housed therein.

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Title

"Simplified annular locking device for the winding of reels"

Description

The present invention relates to an annular device of the type used for locking and allowing the winding of reels of tape in multiple winding machines.

In the prior art relating to multiple winding machines so-called "friction shafts" are known, these comprising a plurality of annular devices arranged alongside each other for controlled locking of the cores of the reels mounted on the shaft.

In order to lock the cores of the reels the annular devices are provided with engaging elements which project radially in a controlled manner from the peripheral surface of the annular devices.

Usually, the annular devices each comprise two rings which are coaxial and radially superimposed, with the inner ring which is mounted on a rotational spindle and the outer ring which has projecting engaging elements (for example in the form of spheres or rolling cylinders).

The outer ring is rotatable through a certain angle on the inner ring, so as to move between a first angular rest position, in which the engaging elements are retracted or elastically retractable towards the inside of the outer ring, and a second angular locking position, in which the engaging elements are pushed outwards.

Usually elastic elements which push elastically the engaging elements outwards also when they are in the rest position are provided. This makes the rotational device less noisy and allows a controlled frictional movement of the cores on the shaft and precise axial centring of the cores. As the outer ring gradually rotates towards the locking position the elastic movement is gradually reduced until it is substantially eliminated when the ring reaches the locking position at the end of rotation.

Owing to the annular devices mounted on the shaft, in the angular rest position of the outer rings the cores of the reels may easily slide along the shaft so as to be able for example to be mounted or removed, while in the second position the cores of the reels are locked by the engaging elements so as to rotate together with the shaft.

A same shaft may be provided with as many as fifty or so annular devices, each with the outer ring rotatable independently of the other ones and a more or less large number of reel cores may be mounted on the friction shaft thus composed.

When the devices have the outer ring in the rest position, the cores may be mounted on the

shaft and slid along it until they reach they their correct position along the shaft.

Once all the cores have been loaded, a small rotation of the cores (performed manually or produced by the start of the winding rotation and therefore the start of pulling of the tape being wound) causes the rotation towards the locking position of the outer ring of all the devices which are situated inside the cores on which winding is to be performed.

The reel may in turn rotate with friction relative to the shaft. As a result it is thus possible to obtain variations in the pulling force of the single reels while using the same winding shaft.

Once winding of the reels has been completed, a suitable reverse rotation of the reels causes the rotation, back towards the rest position, of the outer ring of all the devices on which a reel is mounted, so as to allow the removal of the reels by axially sliding them along the shaft as far as their free end.

In view of the number of devices which are used on each shaft it is essential that they should be as simple as possible to manufacture and mount and that they should be robust and operationally reliable. Among other things, malfunctioning of one of them, in addition to preventing correct winding of the reels concerned, may prevent loading and unloading of the reels onto/from the shaft.

In the prior art it has been proposed to perform the movement of the engaging elements, upon rotation of the outer ring, by means of grooves with an increasing depth which are formed in the circumferential surface of the inner ring and inside which the engaging elements slide upon rotation of the outer ring. The elastic thrust of the engaging elements outwards is obtained by means of a short elastic plate section which is arranged inside each groove and fixed at one of its ends by means of a rivet or a through-screw, while the other end (at the end of the groove which corresponds to the rest position) is left free.

This structure, however, is fairly complicated both in terms of construction and as regards assembly of the device, especially if a satisfactory number of engaging elements are to be provided along the circumference of the device.

Moreover, this solution, in addition to being complicated, limits the amount of sliding of the locking element inside the groove since an end section of the groove is occupied by the rivet. The elastic force generated moreover is not always satisfactory. The use of stronger plates would however complicate further the manufacture thereof and there are in any case dimensional constraints which must necessarily be complied with.

Moreover, since the grooves must be suitably spaced from each other, the number of engaging elements is limited and the grooves must often be arranged alternating in two rows in order to avoid limiting excessively the angle of rotation of the rings, said angle of rotation depending

on the length of the grooves.

The general object of the present invention is to provide a locking device which is simple to construct and assemble and has several satisfactory characteristics during use.

In view of this object the idea which has occurred, according to the invention, is to provide an annular locking device for the winding of reels, comprising an inner ring and an outer ring coaxial with each other and radially superimposed so as to be rotatable relative to each other, between inner ring and outer ring there being arranged engaging elements which protrude radially from openings in the outer ring, the outer ring being rotatable on the inner ring between a first angular rest position and a second annular locking position, in the first angular rest position the engaging elements being elastically retractable against the action of elastic means by a greater amount than in the second angular locking position, characterized in that the inner ring has a circumferential groove which houses engaging elements and which has a bottom shaped so as to vary the depth of the groove along its extension around the inner ring with an alternation of deeper zones and shallower zones arranged so that, upon rotation of the outer ring between the angular rest position and the angular locking position, the engaging elements in the groove all pass simultaneously from a deeper zone to a shallower zone, an elastic plate which realizes said elastic means being provided between the bottom of the groove and the engaging elements housed in the groove.

A rotational shaft with a plurality of these devices is also claimed.

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 attached drawings, in which:

- Figure 1 shows a partial schematic perspective view of a shaft provided with annular devices according to the invention;
- Figure 2 shows a cross-sectional view of an annular device provided according to the invention, along the line II-II of Figure 3;
- Figure 3 is a cross-sectional view of the device according to the invention along the line III-III of Figure 2;
- Figure 4 is a schematic side view of a part of the device.

With reference to the figures, Figure 1 shows in schematic form devices 10 according to the invention which are mounted side-by-side on a rotational shaft 11 of a known multiple winding machine (not shown). The devices will obviously be used in a variable number depending on whether longer or shorter shafts are to be provided or a greater or smaller number of adjacent reels are to be wound (a reel, denoted by 30, is schematically shown in

cross-section in Figure 1), as will be obvious to the person skilled in the art.

The device 10 comprises two superimposed coaxial rings 12 and 13. The innermost ring 12 is intended to be mounted on the rotational shaft, optionally with the arrangement, in between, of known friction elements (for example a layer of felt or the like) and, if required, with known controlled friction adjustment means (such as pneumatic chambers or the like) which may be easily imagined by the person skilled in the art and therefore are not further described or shown here.

Engaging elements 14 project radially at intervals along the periphery through holes in the outermost ring 13. Advantageously, the dimensions of the holes are such as to prevent the engaging elements from coming out completely.

The rings and the engaging elements are advantageously made of metal.

The outer ring is rotatable axially relative to the inner ring so as to move between a first angular rest position, in which the engaging elements project elastically by means of suitable elastic means, and a second locking position, in which the elements may retract elastically less than in the rest position so as to lock the core of a reel 30 fitted on a rotational shaft provided with the device. This smaller degree of retraction may also be reduced to zero and the engaging elements pushed outwards in a substantially rigid manner.

The rotation of the outer ring on the inner ring is limited between the angular rest position and the locking position.

The engaging elements 14 are preferably realized as rolling elements and, advantageously, are in the form of spheres. Rolling cylinders may also be used if required.

Preferably the engaging elements project in an equidistant manner along the circumference of the device. They are for example arranged along five generatrices of the outer ring, spaced at intervals of 72° from each other. Obviously, it is understood that the number of engaging elements may be different from that shown, depending on the specific requirements, as will also become clear below.

As will also become clear below and as can be seen for example in Figure 1, advantageously the engaging elements protrude from the outer ring 13 in pairs arranged side-by-side on the same generatrix of the outer ring. The engaging elements may therefore be for example ten in number.

Figure 2 shows a cross-sectional view of the device in a plane perpendicular to the axis of rotation of the rings. As can be seen in the Figure the engaging elements 14 are housed so as to slide inside a circumferential groove 15 which may also extend over most of the circumference of the inner ring 12. Preferably, the groove advantageously extends over all or

nearly all the circumference and is interrupted in only one zone 29 of the circumference.

As can be clearly seen again from Figure 2, the bottom 16 of the groove is shaped so as to vary the depth of the groove along its extension around the ring with alternating deeper zones and shallower zones, thus forming a cam surface. In particular, the passage between deeper zones has a continuous progression. The alternating arrangement has the same interval as the engaging elements around the ring.

Upon rotation of the outer ring, the engaging elements 14 all pass simultaneously from a deeper zone which corresponds to the angular rest position of the device (shown in solid lines in Figure 2) to a shallower position which corresponds to the angular locking position of the device (shown in broken lines in Figure 2).

In order to realize the elastic means, an elastic plate segment 17 (for example made of spring steel) is provided on the bottom of the groove 15. The plate is fastened inside the groove at its two ends. For example, two pins transverse to the groove may be used, the two ends of the plate being arranged underneath said pins. The ends may also be wound at least partially around the pins. In any case, to allow the elastic deformation of the plate during operation of the device, the ends of the plate must preferably have a certain amount of sliding play. Therefore the ends of the plate are rolled up at a certain distance after the plate has passed underneath the pins.

Preferably, the plate has a substantially circular progression inside the groove, advantageously resting on the bottom of the groove inside the shallower zones.

As can be seen in Figure 2, preferably one end of the plate 17 is close to a shallower zone, corresponding to an angular locking position for an engaging element 14 (at the top on the left in Figure 2), while the other end of the plate is close to a zone of the groove which is deeper, corresponding to an angular rest position of an engaging element 14 (at the top on the right in Figure 2) which is circumferentially close to the first engaging element.

With the groove and the plate extending over nearly the entire circumference of the inner ring, the opposite ends of the groove and the plate are close to each other.

The end-of-travel during rotation of the outer ring on the inner ring may consist of the pins 18 and 19 on which two engaging elements 14 alternately rest so as to determine respectively the two locking and rest positions.

As can be clearly seen in Figure 2, when the outer ring is rotated between its two angular positions, each engaging element slides on the plate 17 between its rest position (shown in solid lines in Figure 2), where the plate is further removed from the bottom of the groove, and the engaging element, if pushed from the outside, may retract elastically towards the inside of

the ring, and its locking position (shown in broken lines in Figure 2), where the plate is less removed from the bottom of the groove, or substantially resting on the bottom of the groove and the engaging element is substantially in its locking position without any (or with less) possibility of retracting elastically.

As can be clearly seen in Figure 3, the engaging elements may be arranged side-by-side in pairs on the same plate along two circumferential lines. Alternatively, they may be arranged in a single row or be arranged alternately staggered on two circumferential lines. In the even of elements arranged side-by-side or staggered, two parallel elastic plates may also provided, i.e. one for each circumferential line of engaging elements 14. Other combinations of engaging elements may be easily provided by suitably positioning the holes on the outer ring through which the engaging elements protrude.

As can be clearly seen in Figures 2 and 3 a device 20 for elastically coupling together the two rings in the rest position has also been provided. This coupling device is advantageously located in the interrupted zone of the groove 15 at the two ends of the plate 17 and preferably comprises a coupling element 21 (for example a small sphere) which is pushed by a spring 22 (for example a helical spring housed inside a suitable seat in the inner ring) so as to project radially from the inner ring and engage inside a matching seat 23 (for example a small hole) in the outer ring. A suitable rotational torque applied to the rings disengages the coupling element 21 from the seat and allows the normal relative rotation of the rings. With the return of the outer ring into the rest position the coupling element 21 returns elastically into its seat in the outer ring and the rings are again elastically engaged so as to prevent their free relative rotation.

The elastic thrust of the spring 22 will be chosen depending on the desired rotational torque necessary for moving the outer ring from the rest position on the inner ring. This torque will be preferably chosen so that it may be overcome at the start of the winding operations for a reel on the device 10, but such that at the same time it cannot be overcome by the normal forces which during use act on the devices 10 which do not support any reels and which therefore would otherwise be able to rotate freely.

In this way the rest position is prevented from becoming unstable and it is possible to limit or prevent altogether the problem that, during mounting or extraction of the cores onto/from the shaft provided with the annular devices, any annular devices not in the rest position along the shaft may prevent extraction or mounting of the cores.

Although the elastic coupling device 20 as illustrated has been found to be particularly advantageous, it may also be realized with a different elastic element, for example an elastic

plate, and the coupling element may have a different form, as may be now easily imagined by the person skilled in the art. For example, in the case of a plate, the coupling element may also be a pin with a rounded head which is fixed onto the plate itself so as to project towards a matching engaging seat on the ring. Assembly of the device may also be reversed as regards the inner ring and outer ring, namely with the engaging seat in the inner ring and the elastic element and coupling element on the outer ring.

As can be clearly seen in Figure 3, in order to block the axial displacement of the outer ring on the inner ring during use of the device, allowing at the same time the desired angular rotation, the inner ring has advantageously, on one side, a step 24 along a circumferential edge thereof, while a locking insert 25 with wall transverse to the axis of the rings is engaged with the inner ring on the other side. As shown in Figure 3, the locking insert 25 may be realized in the form of a flat ring fastened to the side wall of the inner ring (for example by means of a force-fit onto a suitable circumferential side edge 26 of the inner ring). Alternatively, the locking element could comprise a suitable tubular portion which is force-fitted inside the inner ring.

The outermost peripheral edge of the locking insert and the opposite step 24 of the inner ring form a channel inside which the outer ring is rotatably seated.

As can be clearly seen in Figure 4, which shows one side of the device without the locking insert 25, for easier assembly of the device 10 each engaging element is provided with a transverse passage 31 inside the groove 15 which connects the inside of the groove to the side wall of the inner ring. The dimensions and the position of the passage, which is realized advantageously as an open channel radially in relation to the ring, are such as to allow the engaging element (or two adjacent engaging elements) to pass through towards the groove when the outer ring, together with the engaging elements, is slid axially on top of the inner ring.

For assembly of the device 10, after inserting the plate inside the respective groove and fixing it at the ends, it is sufficient to mount axially the outer ring with the engaging elements on the inner ring and then engage the locking insert 25 with the inner ring.

In the case where the elastic coupling device 20 is provided, it is inserted on the inner ring before mounting the outer ring.

At this point it is clear how the predefined objects have been achieved, providing an annular device of the type used for locking and allowing winding of reels of tape, which has a simple and reliable structure and which allows a suitable elastic force to be exerted on the engaging elements. The long plate furthermore allows more precise adjustment of the elastic pressing

force of the plate during the whole movement of the engaging elements. The plate is moreover curved elastically around the inner ring, thus providing a leaf spring effect. Moreover, the device may reduce or also eliminate the problem of the devices according to the prior art which have an unstable rest position. The device may also have a large number of engaging elements without substantially increasing the complexity.

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

For example, dimensions and proportions of the various parts may vary depending on the specific requirements or preferences. Although the use of a single plate is particularly advantageous, the groove 15 may also be divided into one or more parts, so as to have for example a series of plates 17, each of which acts on a certain series of engaging elements along the circumference of the annular device.

Claims

1. Annular locking device (10) for the winding of reels, comprising an inner ring (12) and an outer ring (13) coaxial with each other and radially superimposed so as to be rotatable relative to each other, engaging elements (14) which radially protrude from openings in the outer ring being arranged between inner ring (12) and outer ring (13), the outer ring being rotatable on the inner ring between a first angular rest position and a second angular locking position, in the first angular rest position the engaging elements (14) being elastically retractable against the action of elastic means by a greater amount than in the second angular locking position, characterized in that the inner ring has a circumferential groove (15) which houses engaging elements (14) and which has a bottom (16) shaped so as to vary the depth of the groove along its extension around the inner ring with an alternation of deeper zones and shallower zones arranged so that, upon rotation of the outer ring between the angular rest position and the angular locking position, the engaging elements (14) in the groove all pass simultaneously from a deeper zone to a shallower zone, between bottom of the groove (15) and engaging elements (14) housed in the groove there being present an elastic plate (17) that realizes said elastic means.

2. Annular locking device (10) according to Claim 1, characterized in that the groove (15) and the plate (17) extend over most of the circumference of the inner ring.

3. Annular locking device (10) according to Claim 2, characterized in that the groove is interrupted in only one zone where the ends of the plate also terminate.

4. Annular locking device (10) according to Claim 1, characterized in that the plate (17) has ends which are slidably fastened in the groove, preferably by means of pins (18, 19) which are transverse to the groove.

5. Annular locking device (10) according to Claim 1, characterized in that the plate is substantially wrapped around the bottom of the groove so as to be arranged in a substantially circular shape.

6. Annular locking device (10) according to Claim 1, characterized in that there is one groove and/or plate is for all the engaging elements (14).

7. Annular locking device (10) according to Claim 1, characterized in that the groove (15) has lateral passages (31) in the wall of the inner ring which are intended to allow the entry of the engaging elements (14) when the inner ring is axially inserted in the outer ring.

8. Annular locking device (10) according to Claim 1, characterized in that the engaging elements are spheres.

9. Annular locking device (10) according to Claim 1, characterized in that a device (20) for

elastically coupling together the two inner and outer rings in the rest position is provided.

10. Annular locking device (10) according to Claim 7, characterized in that the elastic coupling device (20) comprises a coupling element (21) which is pushed by a spring (22) so as to engage inside a seat (23) in the outer ring.

11. Annular locking device (10) according to Claim 10, characterized in that the elastic coupling device is located in a zone where the groove is interrupted at the ends of the plate.

12. Rotational shaft (11) of a winding machine for reels, characterized in that it comprises a plurality of annular locking devices according to any one of the preceding claims arranged side-by-side so as to accommodate thereon cores of reels to be wound.

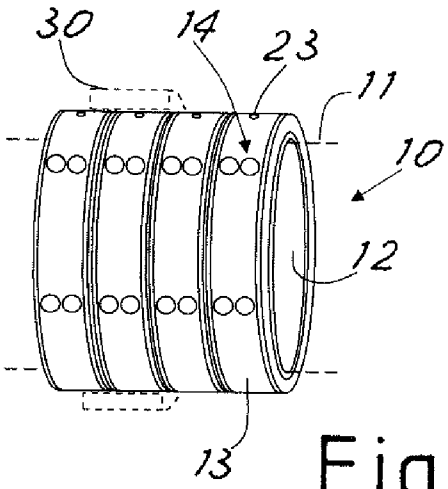

Fig.1

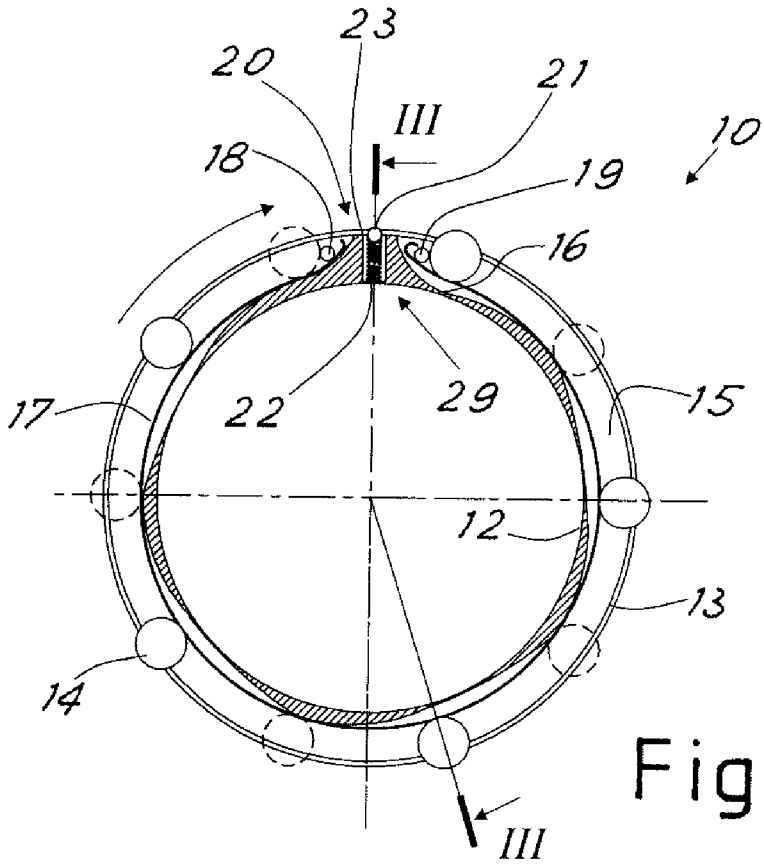

Fig.2

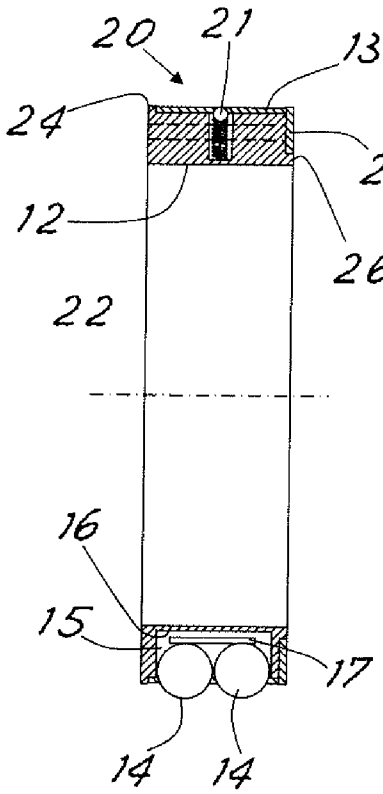

Fig.3

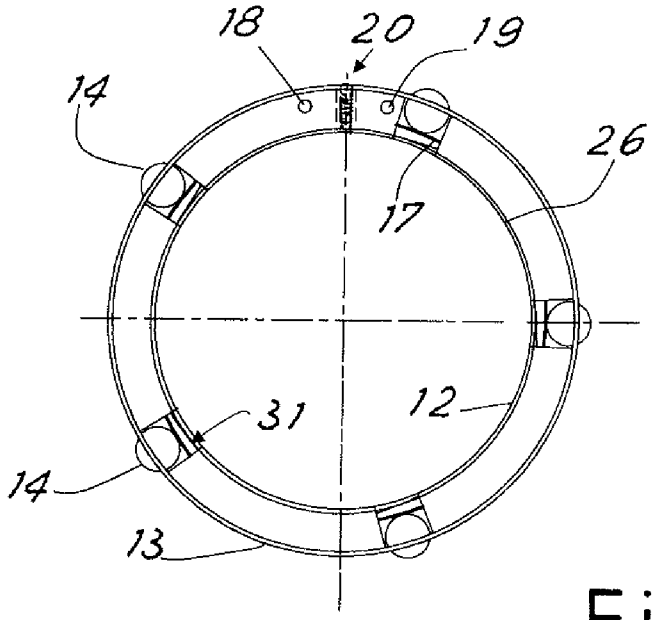

Fig.4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/057562

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H75/24
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
31 January 2017	07/02/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Lemmen, René

INTERNATIONAL SEARCH REPORT

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