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(54) Title: THREADED CONNECTION DEVICE

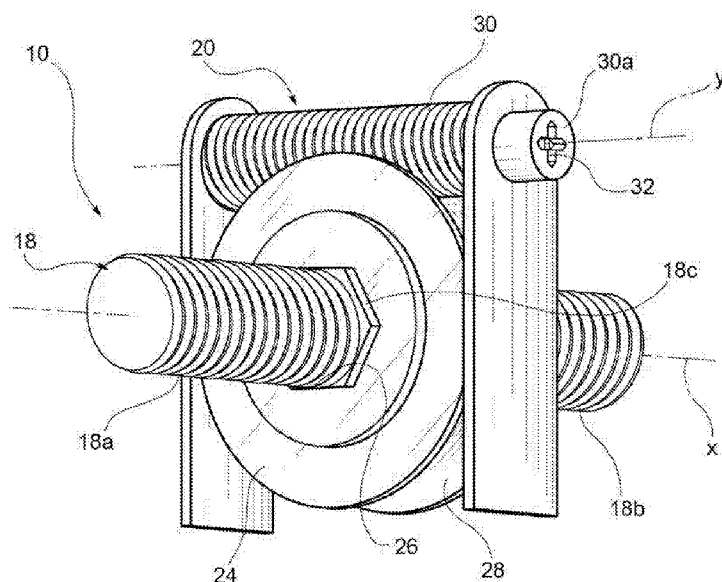


FIG. 3

(57) Abstract: The device (10) comprises a threaded member (18, 24) and a drive mechanism (20) designed to cause rotation of the threaded member (18, 24) about a first axis of rotation (x), wherein the drive mechanism (20) is housed in a casing (16) and comprises a driven member (28), which is rotationally supported by the casing (16) about the first axis of rotation (x) and is drivingly connected for rotation with the threaded member (18, 26), and a driving member (30), which is rotationally supported by the casing (16) about a second axis of rotation (y), which is skew with respect to the first axis of rotation (x). The driving member (30) and the driven member (28) cooperate with each other in such a way as to allow to cause rotation of the driven member (28), and together with it of the threaded member (18, 24), about the first axis of rotation (x) by causing rotation of the driving member (30) about the second axis of rotation (y).

Threaded connection device

The present invention relates to a threaded connection device for connecting together first and second parts, which can be used for example as a butt-connection device for performing the butt-connection of two parts provided with respective threaded holes, or as a bolt designed to be screwed into a corresponding threaded hole provided in one of the two parts to be connected, or also as a nut inside which a screw fixed to one of the two parts to be connected is screwed.

In order to perform, for example, a butt-connection between two parts it is known to use threaded connection members designed to engage on the one hand inside a threaded hole provided in one part and on the other hand inside a threaded hole provided in the other part. This connection mode, however, has the drawback that it is difficult to access the threaded connection members and therefore requires suitable openings inside which the screwing tools can be inserted, whereby said openings must be typically formed on one of the parts or both the parts to be connected together. This gives rise, on the one hand, to evident aesthetic problems and, on the other hand - in particular in the case where the opening is provided with dimensions which are as small as possible in order to minimize its aesthetic impact - to difficulties in manoeuvring the operating tool and therefore to long assembly times.

The object of the present invention is to provide a threaded connection device which allows two parts to be connected together easily and quickly and with a minimum aesthetic impact thereon and which may therefore be used where connection by means of bolts, nuts or other conventional threaded connection members is difficult or impossible owing to dimensional limitations, such as joints in confined spaces where there is limited possibility for manoeuvring, or where, for aesthetic reasons, the use of conventional threaded connection members is drastically limited.

This and other objects are fully achieved according to the present invention by means of a threaded connection device having the characteristic features specified in the accompanying independent Claim 1.

In short, the invention is based on the idea of providing a threaded connection device comprising a threaded member and a drive mechanism designed to cause rotation of the threaded member about a first axis of rotation coinciding with the longitudinal axis of the threaded member, wherein the drive mechanism comprises a driven member which is drivingly connected for rotation with the threaded member about the first axis of rotation and a driving member rotatable about a second axis of rotation, which is skew with respect to the first axis, the driving member and the driven member of the drive mechanism cooperating with each other so as to allow rotational operation of the driven member, and therefore of the threaded member, about the first axis of rotation by causing rotation of the driving member about the second axis of rotation. Owing to the use of such a drive mechanism, rotation of the (manual or automated) tool used to impart the movement to the driving member of the drive mechanism occurs about an axis of rotation which is skew with respect to the axis of rotation of the threaded member, and may therefore be performed more easily than in the prior art.

According to an embodiment of the invention, which may be used in particular for the butt-connection of two parts, the threaded connection device comprises, as threaded member, a threaded bar with opposite double threading designed to engage on one side with a first threaded hole provided in one of the two parts to be connected together and on the other side with a second threaded hole provided in the other one of the two parts to be connected together. Preferably, the threaded connection device also comprises a disc which is drivingly connected for rotation with the driven member of the drive mechanism and has a non-threaded through-hole having a cross-section with a polygonal shape, designed to be engaged by a corresponding non-threaded portion of the threaded bar so as to be drivingly connected for rotation therewith, whereby the user may cause the threaded bar to rotate about its axis by means of the drive mechanism and therefore screw the threaded bar into the corresponding threaded holes provided in two parts to be connected together.

According to a further embodiment of the invention, the connection device is configured to operate as a nut and comprises, as threaded member, a disc with a threaded hole, the disc being designed to be rotated about its axis (coinciding with the axis of the threaded hole) by means of the aforementioned drive mechanism.

According to a further embodiment of the invention, the connection device is configured to operate as a bolt and comprises, as threaded member, a threaded shank designed to be rotated about its axis by means of the aforementioned drive mechanism.

5 Further features and advantages of the present invention will become clear from the following description provided purely by way of a non-limiting example, with reference to the accompanying drawings in which:

Figure 1 is a perspective view which shows a threaded connection device according to a first embodiment of the present invention, which can be used for the butt-connection
10 of two parts;

Figures 2 and 3 are perspective views of the drive mechanism of the threaded connection device shown in Figure 1, respectively with the casing and without the casing (or rather without a part of the casing);

Figure 4 is a perspective view which shows in schematic form another type of motion transmission mechanism which can be used in the drive mechanism of a threaded connection device according to the present invention;
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Figure 5 is a perspective view which shows a threaded connection device according to a second embodiment of the present invention; and

Figure 6 is a perspective view which shows a threaded connection device according to a third embodiment of the present invention.
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With reference initially to Figure 1, a threaded connection device for the butt-connection of two parts 12 (which in the example shown consists of parts with a cylindrical shape), having respective flat end faces 14 facing each other, is generally indicated 10 and comprises,
25 as threaded member, a threaded bar 18 with opposite double threading intended to engage in a pair of threaded holes (not shown) formed in the end faces 14 of the two parts 12, the axes of the threaded holes coinciding with the axes of the two parts 12 or being at least parallel thereto, as well as a drive mechanism 20 designed to cause rotation of the threaded bar 18 about its axis (axis of rotation x) so as to screw it into the threaded holes.

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With reference also to Figures 2 and 3, the drive mechanism 20 is housed inside a casing 16 which has preferably an overall parallelepiped shape, with a pair of parallel flat faces 22

oriented perpendicularly with respect to the axis of rotation x and therefore, in the assembled condition, parallel to the end faces 14 of the two parts 12 to be connected together. The casing 16 supports, rotatably about the axis of rotation x , a disc 24 having a central through-hole 26 through which the threaded bar 18 extends. The central hole 26 has preferably a cross-section with a polygonal shape which may be equally well regular (as in the example of embodiment shown in the figures, where the hole 26 has a cross-section with a regular hexagon shape) or irregular.

The threaded bar 18 therefore extends through the casing 16 and through the disc 24 with its axis coinciding with the axis of rotation x . The threaded bar 18 comprises a first threaded portion 18a projecting from one side of the casing 16, a second threaded bar portion 18b projecting from the opposite side of the casing 16, and a third non-threaded portion 18c arranged between the first and second threaded portions 18a and 18b and having a cross-section the shape of which mates that of the central hole 26 in the disc 24 so that the threaded bar 18 is drivingly connected for rotation with the disc 24 about the axis of rotation x , but movable with respect thereto along the direction of the axis of rotation x . The threads of the two threaded portions 18a and 18b of the threaded bar 18 have directions opposite to each other so that rotation of the threaded bar 18 in a given direction produces screwing together of both the threaded portions 18a and 18b in the respective threaded holes of the two parts 12 to be connected together, and thus the movement of these parts towards each other, while rotation of the threaded bar 18 in the opposite direction produces unscrewing of both the threaded portions 18a and 18b out of the respective threaded holes in the two parts 12 and therefore movement of these parts away from each other. The two threaded portions 18a and 18b of the threaded bar 18 may also be formed as self-tapping portions, so as not to require the provision of threaded holes in the two parts 12 to be connected together, or as tap screws, in the case where the parts to be connected together are made of soft material, such as wood. According to an alternative embodiment (not shown), the threaded bar could be firmly fixed to the disc 24, instead of being axially movable with respect thereto.

The drive mechanism 20 comprises a driven member 28, which is arranged coaxially with the disc 24 and is drivingly connected for rotation therewith about the axis of rotation x ,

and a driving member 30, which is supported by the casing 16 rotatably about an axis of rotation y skew with respect to the axis of rotation x, in particular lying in a plane perpendicular to the axis of rotation x, and cooperates with the driven member 28 in such a way that the rotation of the driving member 30 about the axis of rotation y in one direction or the other produces the rotation of the driven member 28 and, along with it, of the disc 24 and the threaded bar 18, about the axis of rotation x in one direction or the other.

In the embodiment shown in Figures 1 to 3, the drive mechanism 20 is formed as a worm and helical ring gear mechanism, in which the driven member 28 is formed by a helical ring gear and the driving member 30 is formed by a worm meshing with the helical ring gear. An end portion 30a of the worm 30 projects from the casing 16 so as to allow coupling with an operating tool, such as a hand- or electrically-operated screwdriver. In the embodiment shown in Figures 1 to 3, the end portion 30a has a notch 32 (in particular a cross-like notch) for coupling with a screwdriver acting as an operating tool. Alternatively, the end portion 30a may have a recess with a hexagonal shape for insertion of a wrench or have an outer profile with a hexagonal shape for coupling with a hexagonal spanner. As shown clearly in Figure 1, in order to ensure access of the screwdriver to the end portion 30a of the worm 30 with associated notch 32, it is sufficient to provide a small radial access hole 34 formed partly on the end face 14 of one part 12 and partly on the end face 14 of the other part 12. Moreover, the end faces 14 of the two parts 12 to be connected together will be provided with suitably dimensioned cavities 36 for receiving the casing 16, allowing the two end faces 14 to abut against each other. It is also possible to provide a cavity in only one of the two parts, in which case the radial access hole will be entirely formed in this part.

An alternative of embodiment of the drive mechanism 20 is shown in Figure 4 of the accompanying drawings, in which the same reference numbers have been assigned to parts and elements which are identical or corresponding to those shown in Figures 1 to 3. According to this alternative embodiment, the drive mechanism 20 is formed as a hypoid bevel gear, in which the driven member 28 is formed by a ring gear and the driving member 30 is formed by a pinion. The pinion 30 is mounted on a shaft 38 so as to be drivingly connected for rotation with the latter about the axis of rotation y. One end of the shaft pro-

jecting from the casing will in this case be provided with coupling means (not shown), for example a notch of the type indicated by 32 in Figures 1 to 3, so as to allow to cause the shaft 38, and together with it the pinion 30 to rotate, about the axis of rotation y by means of a common operating tool, such as a hand- or electrically-operated screwdriver.

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A second embodiment of a threaded connection device according to the present invention is shown in Figure 5 of the accompanying drawings, in which the same reference numbers have been assigned to parts and elements which are identical or corresponding to those shown in Figures 1 to 3.

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The connection device of Figure 5 can be used as a nut to be screwed onto the threaded shank of a bolt or onto a similar threaded connection element. For this purpose, the connection device comprises, as threaded member, the hole 26 in the disc 24, which in this case is formed as a threaded cylindrical hole and which may be equally well formed as a blind hole or a through-hole. The hole 26 may be formed either directly in the disc 24 or in an insert which is separate from the disc 24 and drivingly connected for rotation with the latter. In this latter case, the insert is for example inserted in a central hole with a polygonal cross-section provided in the disc 24, as shown in Figures 1 to 3, so as to be drivingly connected for rotation with the disc itself about the axis of rotation x. The insert could also consist of a conventional nut.

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As regards the drive mechanism, the drive mechanism of the connection device shown in Figure 5 has a structure similar to that of the connection device shown in Figures 1 to 3, a detailed description of which has already been provided above and may be referred to. In this case also, therefore, the drive mechanism is formed as a drive mechanism with skew axes (which may also be of the same type as that shown in Figure 4) which allows to cause rotation of the disc 24, and therefore of the hole 26, about the axis of rotation x, imparting by means of a common operating tool, such as a hand- or electrically-operated screwdriver, a rotational movement about the axis of rotation y which is skew with respect to the axis of rotation x.

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Finally, a third embodiment of a threaded connection device according to the present in-

vention is shown in Figure 6 of the accompanying drawings, in which the same reference numbers have been assigned to parts and elements which are identical or corresponding to those shown in Figures 1 to 3.

- 5 The connection device shown in Figure 6 can be used as a bolt for being screwed into a threaded hole provided in one of the parts to be connected together. For this purpose, the connection device comprises, as threaded member, a threaded shank 18 which is fixed to the disc 24 and is therefore drivingly connected for rotation with the latter about the axis of rotation x. The threaded shank 18 could also be formed with a self-tapping thread, in which
10 case the threaded connection device could be used as a screw.

The drive mechanism of the connection device shown in Figure 6 has a structure similar to that of the connection device shown in Figures 1 to 3, a detailed description of which has already been provided above and may be referred to. In this case also, therefore, the drive
15 mechanism is formed as a drive mechanism with skew axes (which may also be of the same type as that shown in Figure 4) which allows to cause rotation of the disc 24, and therefore of the threaded shank 18, about the axis of rotation x, imparting by means of a common operating tool, such as a hand- or electrically-operated screwdriver, a rotational movement about the axis of rotation y which is skew with respect to the axis of rotation x.

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As can be seen from the description provided above and the figures, owing to the fact that the threaded member of the connection device is rotationally operated by means of a drive mechanism having a driven member, the axis of which coincides with the axis of rotation of the threaded member, and a driving member, the axis of rotation of which is skew with
25 respect to the axis of the rotation of the driven member, in particular lying in a plane perpendicular to the latter, the threaded member may be rotationally operated in an extremely easy and quick manner by means of a screwdriver or other operating tool.

Obviously, without departing from the principle of the invention, the embodiments and the
30 constructional details may be greatly varied with respect to those described and illustrated purely by way of a non-limiting example.

CLAIMS

1. Threaded connection device (10) for connecting together first and second parts (12), comprising a threaded member (18, 24) and a drive mechanism (20) designed to rotate the threaded member (18, 24) about a first axis of rotation (x),

wherein the drive mechanism (20) is housed in a casing (16) and comprises a driven member (28), which is rotationally supported by the casing (16) about the first axis of rotation (x) and is drivingly connected for rotation with the threaded member (18, 26), and a driving member (30), which is rotationally supported by the casing (16) about a second axis of rotation (y), which is skew with respect to the first axis of rotation (x),

wherein a portion (30a) of the driving member (30) projects from the casing (16) and has coupling means (32) for coupling with an operating tool, and

wherein the driving member (30) and the driven member (28) cooperate with each other in such a way as to allow to cause rotation of the driven member (28), and together with it of the threaded member (18, 24), about the first axis of rotation (x) by causing rotation of the driving member (30) about the second axis of rotation (y).

2. Device according to Claim 1, wherein the drive mechanism (20) is a worm and helical ring gear mechanism, the driven member (28) being formed by a helical ring gear having an axis coinciding with the first axis of rotation (x) and the driving member (30) being formed by a worm having an axis coinciding with the second axis of rotation (y).

3. Device according to Claim 2, wherein said coupling means (32) are provided on an end portion (30a) of the worm (30) projecting from the casing (16).

4. Device according to Claim 1, wherein the drive mechanism (20) is a hypoid bevel gear comprising a ring gear (28) as driven member and a pinion (30) as driving member.

5. Device according to Claim 4, wherein the drive mechanism (20) further comprises a shaft (38), on which the pinion (30) is mounted so as to be drivingly connected for rotation therewith, and wherein said coupling means (32) are provided on an end portion of said shaft (38) projecting from the casing (16).

6. Device according to any one of the preceding claims, wherein the casing (16) has a pair of parallel flat faces (22) and wherein the first axis of rotation (x) is oriented perpendicularly with respect to said parallel flat faces (22).

5 7. Device according to any one of the preceding claims, wherein the threaded member (18) is a threaded bar comprising a first threaded portion (18a) designed to be screwed into a first threaded hole provided in the first part (12) and a second threaded portion (18b) designed to be screwed into a second threaded hole provided in the second part (12) and having a thread direction opposite to that of the first threaded portion (18a).

10 8. Device according to Claim 7, wherein the threaded bar (18) further comprises a third non-threaded portion (18c) arranged between the first and second threaded portions (18a, 18b), wherein the device further comprises a disc (24) which is rotatably supported by the casing (16) about the first axis of rotation (x) integrally with the driven member (28)
15 and which has a through-hole (26) having an axis coinciding with the first axis of rotation (x) and wherein the third non-threaded portion (18c) of the threaded bar (18) is engageable so as to be drivingly connected for rotation with the disc (24) about the first axis of rotation (x).

20 9. Device according to Claim 7 or Claim 8, wherein the first and second threaded portions (18a, 18b) of the threaded bar (18) are formed as self-tapping portions.

10. Device according to any one of Claims 1 to 6, wherein the threaded member (18) is a threaded shank.

25 11. Device according to Claim 10, further comprising a disc (24) supported rotationally by the casing (16) about the first axis of rotation (x) integrally with the driven member (28), wherein the threaded shank (18) is fixed to the disc (24).

30 12. Device according to any one of Claims 1 to 6, wherein the threaded member (24) is a disc which is rotationally supported by the casing (16) about the first axis of rotation (x) integrally with the driven member (28) and which has a threaded hole (26) having an axis

coinciding with the first axis of rotation (x).

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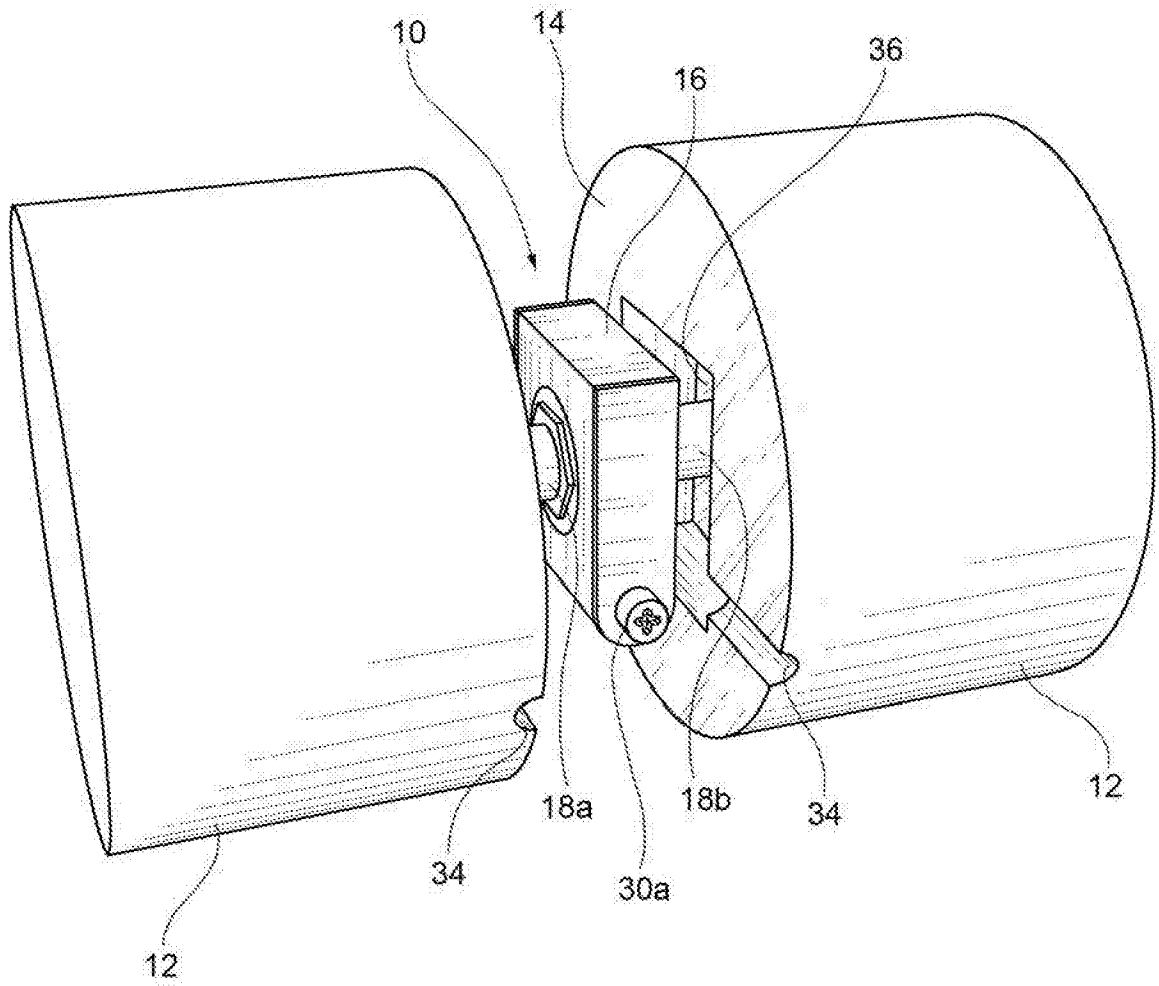


FIG. 1

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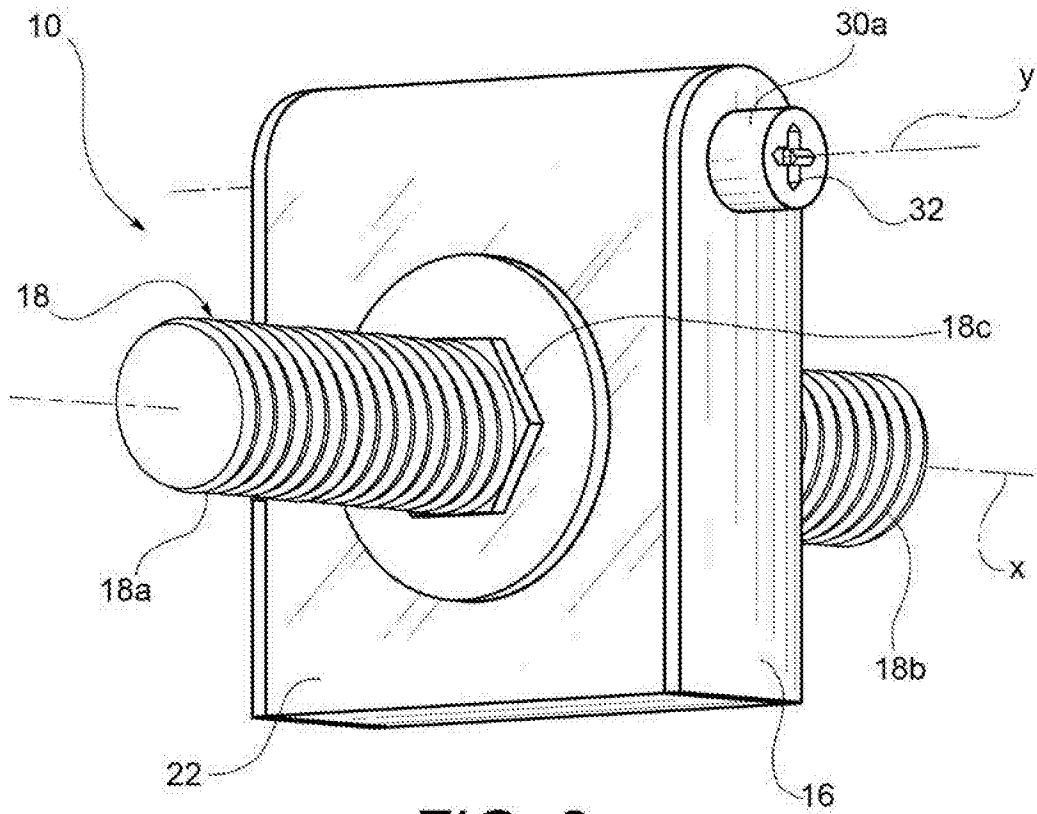


FIG. 2

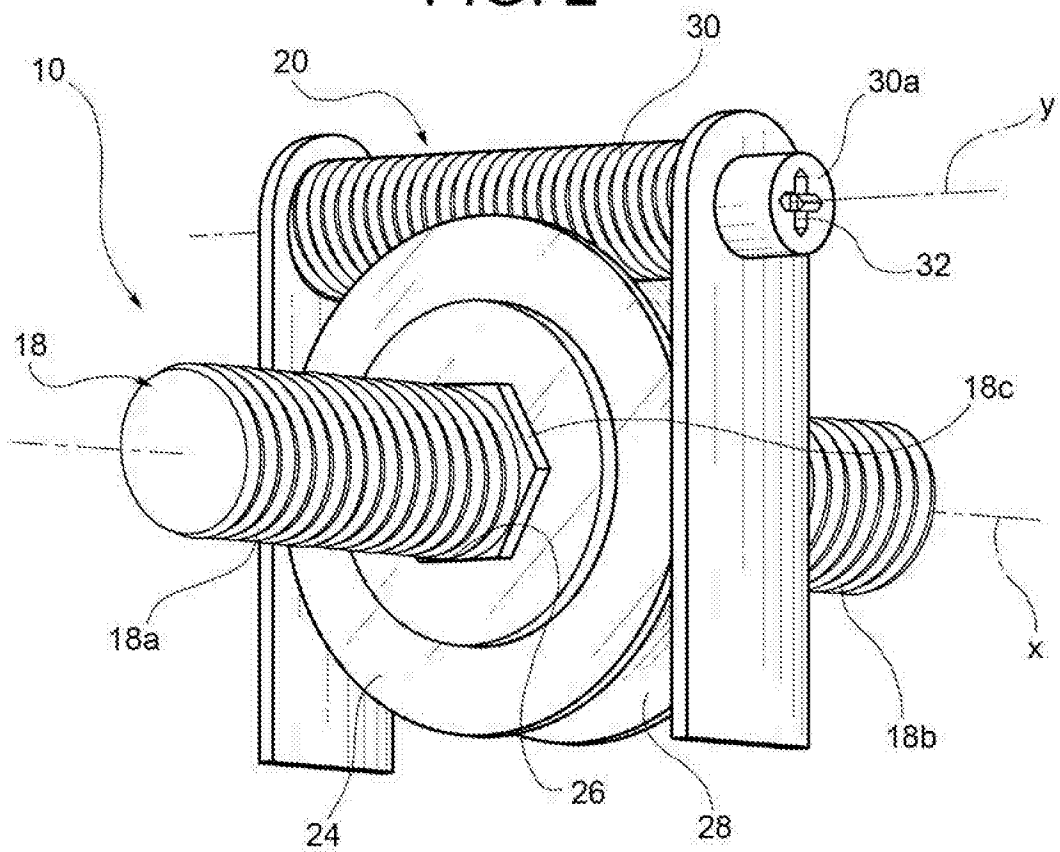


FIG. 3

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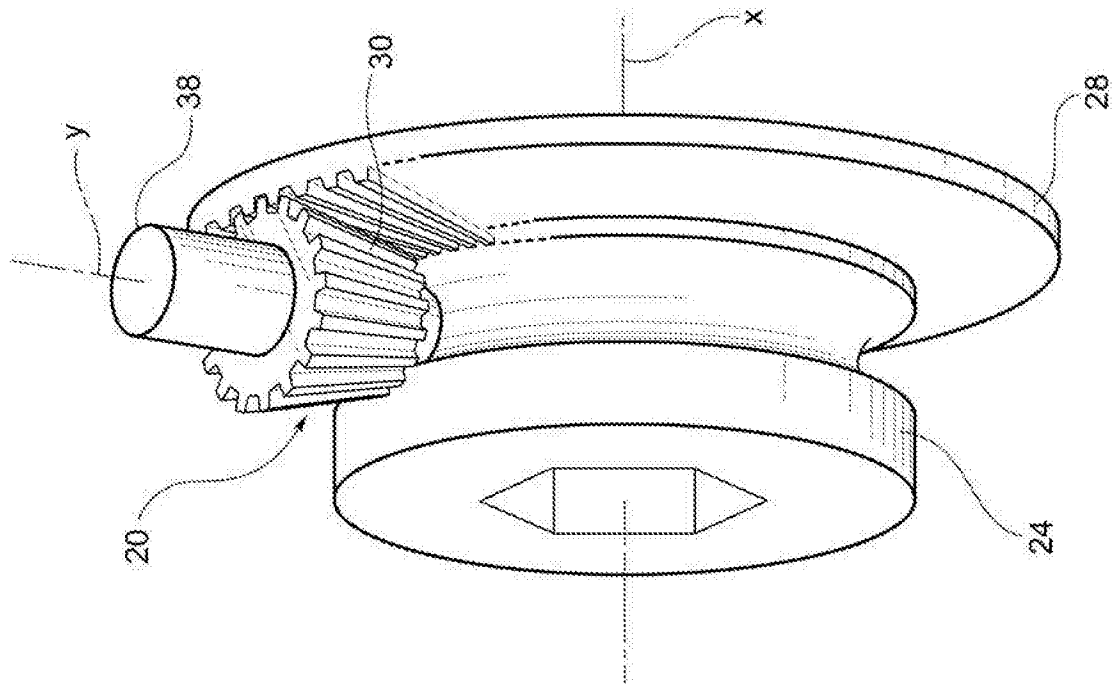


FIG. 4

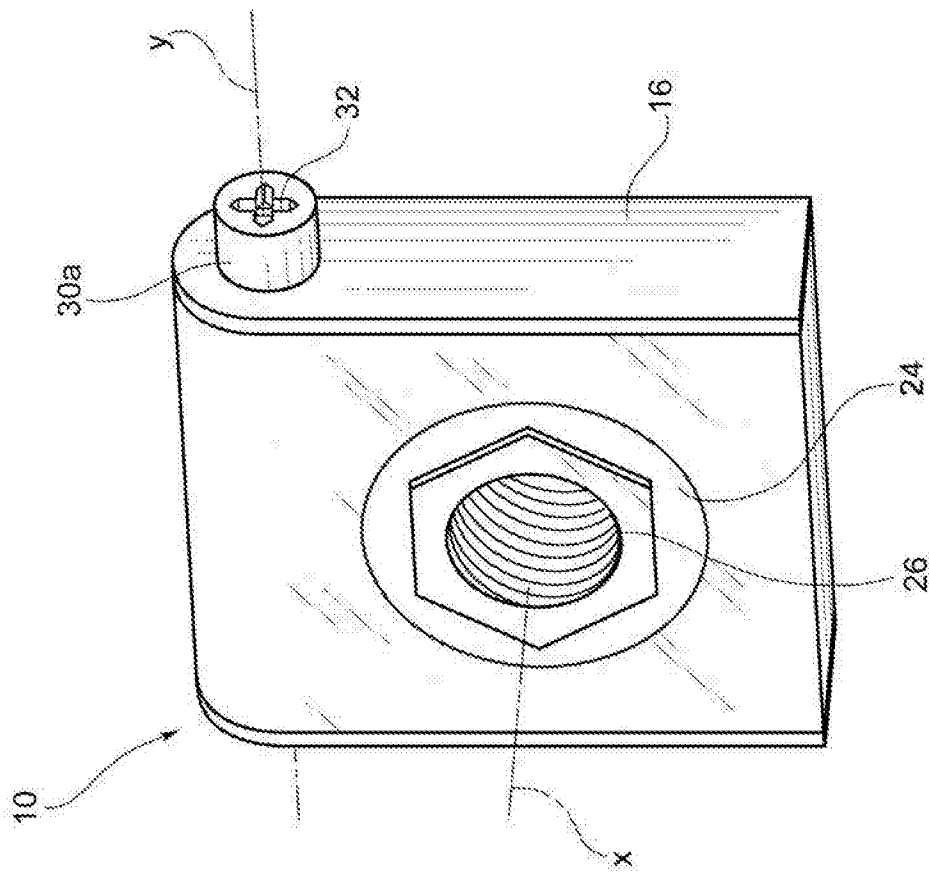


FIG. 5

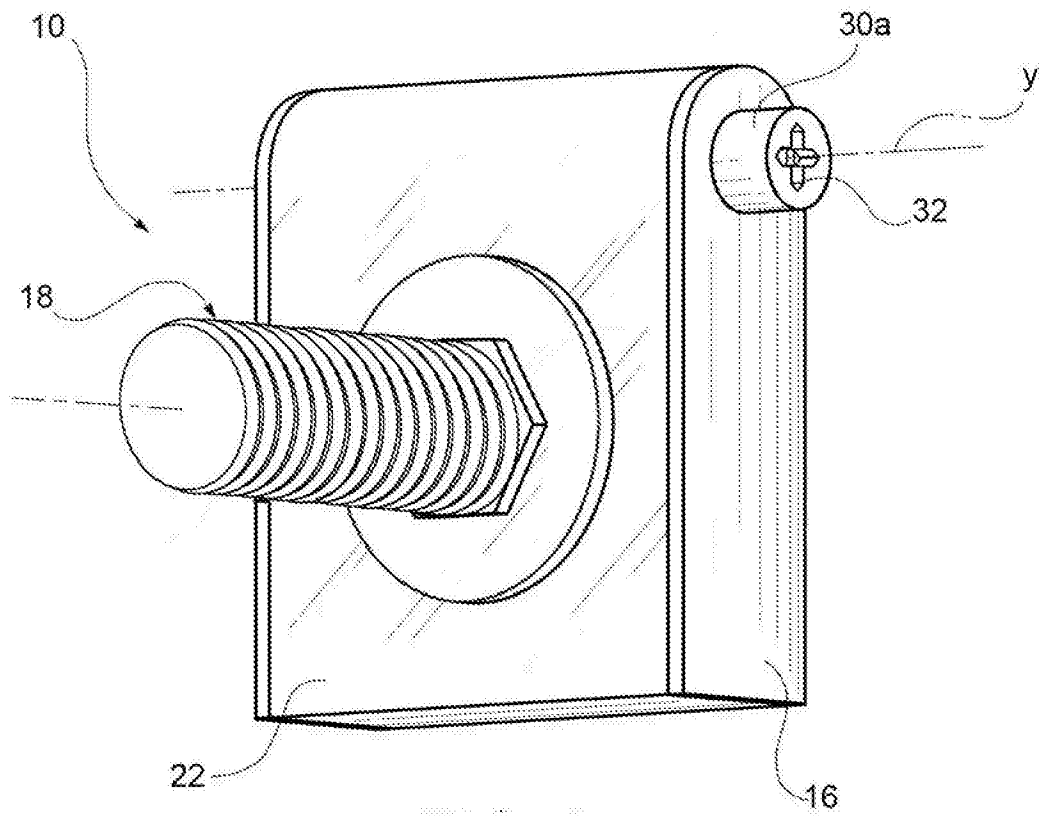


FIG.6

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/061314

A. CLASSIFICATION OF SUBJECT MATTER
INV. B25B17/00 B25B17/02
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)
B25B F16H F16B

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)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/061314

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2013/061314

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