(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 713 948 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.05.1996 Bulletin 1996/22

(51) Int. Cl.[6]: **E05F 5/00**

(21) Application number: **95117507.4**

(22) Date of filing: **07.11.1995**

(84) Designated Contracting States:
DE FR GB

(30) Priority: **25.11.1994 IT TO940237 U**

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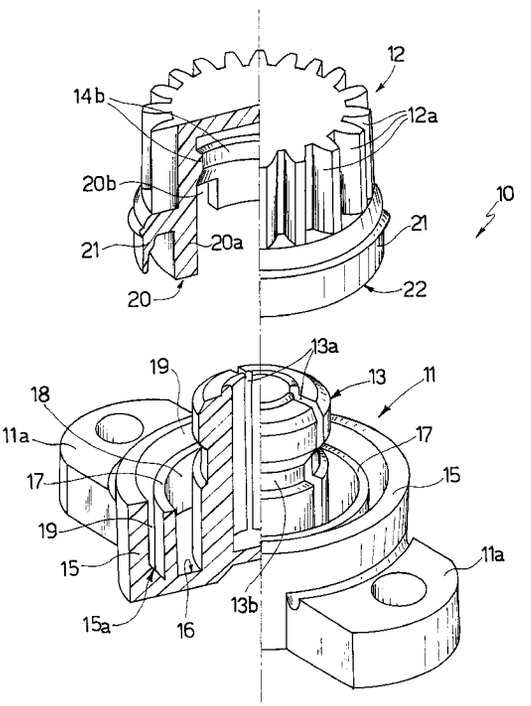
(54) Damping device for slowing doors, drawers and the like, that are subjected to powered-opening means

(57) The damping device comprises a stator (11) with a central pivot (13) that is flexible in a radial direction for the snap-on connection of a rotor (12) provided with a hole (14) for accommodating the pivot. The stator (11) is cup-shaped so as to internally accommodate part of the rotor (12) and comprises a single cylindrical ridge (17) that separates two annular chambers, respectively an inner one (18) and an outer one (19), which accommodate, with an appropriate clearance, corresponding inner and outer cylindrical portions (20, 21) of the rotor. The inner portion (20) is discontinuous and formed by spaced sectors. Grease is interposed in the annular spaces between the rotor and the stator and in the spaces that separate the sectors of the inner cylindrical portion (20) of the rotor, the grease having a slowing function. External grease seepage is prevented by a flexible edge lip (22) of the outer cylindrical portion (21) of the stator (12).

FIG.6



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Description

The present invention relates to a damping device for slowing or braking the motion of doors, drawers and the like, that are subjected to powered-opening means.

Doors and drawers in general are conventionally subjected to the action of elastic means adapted to produce their powered opening and to control the action of said means by virtue of slowing or braking devices that prevent the opening action from occurring in a sudden fashion, with consequent impact stresses both on the structure of the drawer or door and on the contents of the drawer or of the compartment protected by the door.

Systems for providing a powered opening by virtue of elastic means (or also by the action of gravity) are widespread in various fields of technology, particularly in household appliances, in audio-video sets such as magnetic tape or optical disk players, and in trims for motor vehicles, applied to retracting drawers and ashtrays, doors of storage compartments, and the like. In general, these systems use conventional slowing devices in which the slowing action is produced by a highly viscous fluid, typically grease, that is interposed between a stator and a rotor that are both cylindrical and provided with respective series of interpenetrating cylindrical ribs, or between a stator with a cylindrical chamber inside which a rotor disk provided with radial slots turns; both devices are provided with one or more elastomeric sealing rings, and the stator is rigidly coupled to the fixed structure, whereas the rotor, by virtue of appropriate linkages, is rigidly coupled to the drawer or door the opening whereof must be slowed.

These conventional devices are very well adapted to the purpose, but have some drawbacks. In particular, devices with interpenetrating cylindrical stator and rotor have a relatively large bulk, which is a consequence of the need to provide said rotor and said stator with a sufficiently large number of concentric ribs in order to create an effective grease retention labyrinth. On one hand, this limits the use of these devices, and, on the other hand, it increases the complexity of their structure, with considerable economical disadvantages.

In devices with a stator shaped like a cylindrical chamber and with a disk-shaped rotor, it is possible to reduce and contain the bulk within even narrow limits, but at the cost of a further considerable increase in structural complexity that is a consequence of the difficulty of providing an effective seal against grease seepage; this difficulty increases as the size of the device decreases, and this structural complexity leads to excessive manufacturing costs that limit the use of these devices, especially in motor vehicle trims.

A principal aim of the present invention is to eliminate the above-mentioned drawbacks of conventional slowing devices, and within the scope of this general aim it has the important object of providing a damping device in which the slowing action is produced exclusively by grease, which is structured and configured so as to allow significant bulk reductions and high operating reliability.

Another object of the invention is to provide a damping device that is highly simplified, and in particular is composed of two parts only, that can be mass-produced with low manufacturing and assembly costs and is therefore particularly suitable for installations in trims even for low-cost motor vehicles.

Another object of the invention is to provide a damping or slowing device that is based on the slowing action of mineral fluid as specified and is capable of ensuring, despite its great structural simplicity, effective tightness against seepages of said fluid even in demanding operating conditions, particularly in case of high ambient temperature.

According to the present invention, this aim as well as these important objects and others which will become apparent hereinafter are achieved by a slowing device as defined in the appended claims.

Substantially, according to the invention, the damping device comprises a stator, made of thermoplastic material, with a central pivot that is flexible in a radial direction, for the snap-on connection of a rotor, also made of thermoplastic material, which is provided with a blind hole for accommodating the pivot. The stator is in turn cup-shaped so as to internally accommodate part of the rotor and comprises a single cylindrical ridge, which is concentric to the central pivot and separates two annular chambers, respectively an inner chamber and an outer chamber. These chambers accommodate, with an appropriate clearance, corresponding inner and outer cylindrical portions of the rotor; the inner portion is discontinuous and is shaped by cylindrical sectors separated by empty spaces.

Grease is interposed in the annular spaces that lie between the chambers of the stator and the cylindrical portions of the rotor and in the spaces between the sectors of the inner cylindrical portion of the rotor; the outward seepage of said grease is prevented by the action of a flexible edge lip of the outer cylindrical portion of the stator; said lip engages, by elastic deformation, a corresponding flared portion of the wall of the cavity of the rotor. The stator is provided with flaps, which may be of the snap-on type, for anchoring to the fixed structure, and the rotor is provided with an external set of teeth adapted to make meshing contact with a rack or with a toothed sector rigidly coupled to the drawer and respectively to the door the opening whereof is to be controlled.

Further characteristics and advantages of the device according to the present invention will become apparent from the following detailed description and with reference to the accompanying drawings, wherein:

figure 1 is a general diametrical sectional view of a slowing device according to the invention, taken along the plane I-I of figure 2;

figure 2 is a top plan view of the device of figure 1;

figure 3 is a diametrical sectional view of the stator alone;

figure 4 is a diametrical sectional view of the rotor alone;

figure 5 is a sectional view, taken along the multiple planes V-V of figure 4;

figure 6 is an exploded perspective view of the device of figure 1.

In the drawings, the reference numeral 10 generally designates the slowing or damping device, the reference numeral 11 designates the stator, and the reference numeral 12 designates the rotor of said device; both have a circular cross-section and are made of thermoplastic material; the stator is rigidly coupled to a generic fixed structure, by virtue of anchoring flaps 11a that are optionally of the snap-on type; the rotor is rigidly coupled to the drawer or door that is slideable with respect to said fixed structure or is hinged thereto respectively.

For this purpose, the rotor 12 is provided with a portion 12a shaped like a toothed pinion and adapted to mesh with a corresponding rack or respectively with a toothed sector that are supported by said drawers and door and are not shown in the figure.

The stator 11 is cup-shaped and is provided with a central pivot 13 radially flexible for the snap-on connection of the rotor 12; said rotor is in turn provided with a blind hole 14 for accommodating the pivot 13. The radial flexibility of the pivot 13 is achieved by virtue of longitudinal slots 13a formed on said pivot, and the mutual snap-together engagement of the pivot and of the rotor is achieved by providing a trapezoidal groove 13b on the pivot, said groove being engageable by a protruding collar 14b that correspondingly has a trapezoidal profile and is provided on the inner wall of the cavity 14 of the rotor.

As clearly shown in the figure, the cup-shaped profile of the stator 11 is delimited by an outer cylindrical wall 15 that lies concentrically to the pivot 13 is connected to the closed bottom 16 of the stator, by means of a frustum-shaped chamfered portion 15a that tapers towards said bottom.

A cylindrical ridge 17 furthermore protrudes from the bottom 16 and is also concentric to the pivot 13; said ridge, together with the pivot 13 and the wall 15, separates and delimits two annular chambers 18 and 19, respectively an inner chamber and an outer chamber.

Preferably, in order to contain the axial bulk of the device, the axial extension of the ridge 17 is 80-85% of the corresponding axial extension of the cylindrical wall 15.

As shown in figure 1, the annular chambers 18 and 19 receive, with an appropriate clearance, corresponding inner and outer cylindrical portions 20 and 21 of said rotor 12, so that said rotor and said stator, when assembled, mutually interpenetrate. The inner portion 20 of the rotor 12 is discontinuous and is formed by cylindrical sectors 20a, separated by spacing gaps 20b (figure 5).

The clearance between the mutually interpenetrating elements 18,19,20,21 of said stator and rotor, which is advantageously between 10 and 20 tenths of a millimeter, and the empty spaces 20b of the cylindrical portion 20 of the rotor, are filled with grease G, preferably injected in a vacuum into said clearances and spaces to avoid the formation of air bubbles. The layer of grease interposed between the stator 11 and the rotor 12 acts as a means for slowing the mutual rotation of said elements, producing, substantially by virtue of the spaces 20b, a braking torque that is a direct function of the density of said grease.

For rotor diameters between 10 and 15 mm, the density of the grease is chosen between 1 and 1.5 grams per cubic centimeter at 20°C. The injected grease can receive the addition of anhydrous aluminum oxide, in percentages that can vary between 10 and 20% by weight, which improves its stability in terms of variations in viscosity produced by humidity and/or temperature.

Tightness against outward seepage of the grease is entrusted to the outer cylindrical portion 21 of the rotor 12. For this purpose, said portion ends with a lip 22 that is moderately sharp and flexible and is capable of cooperating, by deforming, in forced-contact engagement with the chamfered frustum-shaped portion 15a of the wall 15 of the stator (figure 1).

An additional sealing element is preferably provided on the outer face of the cylindrical portion 21 and is constituted by a protruding annular ridge 23 having a triangular profile and adapted to cooperate with a correspondingly profiled groove 24 provided on the inner face of the wall 15 of the stator.

With the described arrangement it is possible to contain the size of the device within very narrow limits; in particular, the minimum diameter of the stator 11 can be between 5 and 15 mm and the minimum axial extension is between 15 and 20 mm, yet the device is capable of developing a braking torque that is sufficient for most applications, whereas the mutually cooperating lip 22 and wall 15a ensure excellent tightness against grease seepage, with absolutely no elastomeric gaskets and/or labyrinths with multiple concentric ridges that complicate conventional structures and prevent size containment within the specified limits.

The effects of the present invention of course also affect those that achieve equal utility by using the same innovative concept defined by the appended claims.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. Device for slowing doors, drawers and the like that are subjected to powered-opening means, characterized in that it comprises a stator (11) with a central pivot (13) that is flexible in a radial direction for the snap-on connection of a rotor (12) provided with a hole (14) for accommodating the pivot; in that the stator (11) is cup-shaped so as to internally accommodate part of the rotor (12) and comprises a single

cylindrical ridge (17) that separates two annular chambers, respectively an inner one (18) and an outer one (19), which accommodate, with an appropriate clearance, corresponding inner and outer cylindrical portions (20, 21) of the rotor; the inner portion (20) being discontinuous and formed by spaced sectors; and in that grease is interposed in the annular spaces between the rotor and the stator and in the spaces that separate the sectors of the inner cylindrical portion (20) of the rotor, said grease having a slowing function; external grease seepage being prevented by a flexible edge lip (22) of the outer cylindrical portion (21) of the stator (12).

2. Device according to claim 1, characterized in that the stator (11) and the rotor (12) are both made of thermoplastic material, the stator being provided with flaps (11a) for anchoring to the fixed structure, the rotor being provided with an external set of teeth (12a) adapted to mesh with a rack or with a toothed sector that are rigidly coupled respectively to the drawer or to the door the opening whereof is to be controlled.

3. Device according to claims 1 and 2, characterized in that the inner cylindrical portion (20) of the rotor is formed by cylindrical sectors (20a) that are separated by separator spaces (20b).

4. Device according to the preceding claims, characterized in that the cup-shaped stator (11) is delimited by an outer cylindrical wall (15) that blends with a closed bottom (16) of the stator by virtue of a portion of a frustum-shaped chamfered surface (15a) that tapers towards said bottom, and in that the edge lip (22) of the outer cylindrical portion (21) of the rotor (12) cooperates with said chamfered portion (15a) by deforming so as to form a seal.

5. Device according to the preceding claims, characterized in that the snap-together connection between the stator (11) and the rotor (12) is provided by the mutual engagement of a trapezoidal groove (13b) provided on the central pivot (13) of the stator and of a protruding annular ridge (14b) having a corresponding profile and provided on the inner surface of the blind cavity (14) of the rotor (12).

6. Device according to the preceding claims, characterized in that the grease (G) interposed between the stator (11) and the rotor (12) has a density between 1 and 1.5 grams per cubic centimeter.

7. Device according to claim 6, characterized in that said grease (G) receives the addition of anhydrous aluminum hydroxide.

8. Device according to claims 1, 6, and 7, characterized in that said interposed grease (G) is injected in vacuum between said stator and said rotor.

9. Device according to claims 1 to 8, characterized in that the minimum diameter of the stator (11) is between 5 and 15 millimeters and the minimum axial extension of the device is between 15 and 20 millimeters.

10. Device for slowing drawers, doors, and the like which are subjected to powered-opening means, substantially as described and illustrated, and for the specified purposes.

FIG. 1

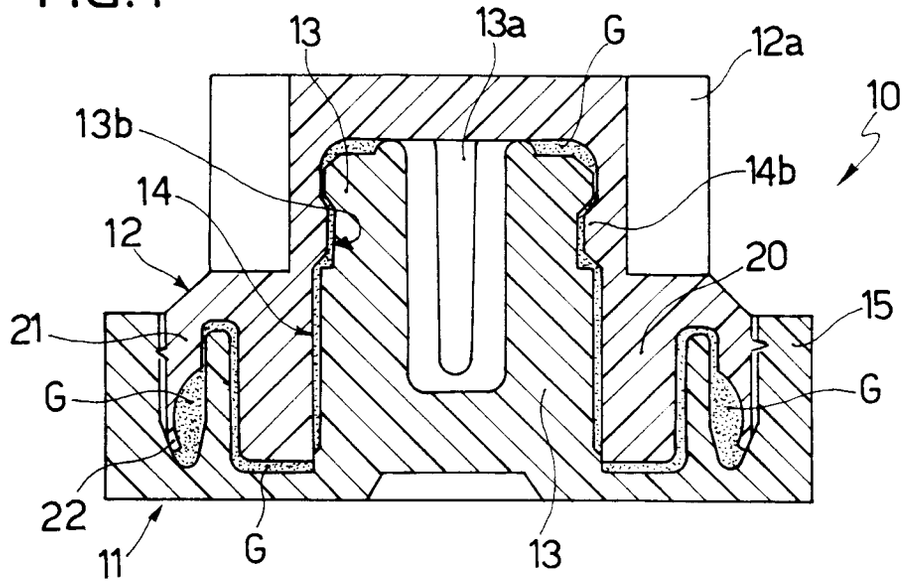


FIG. 2

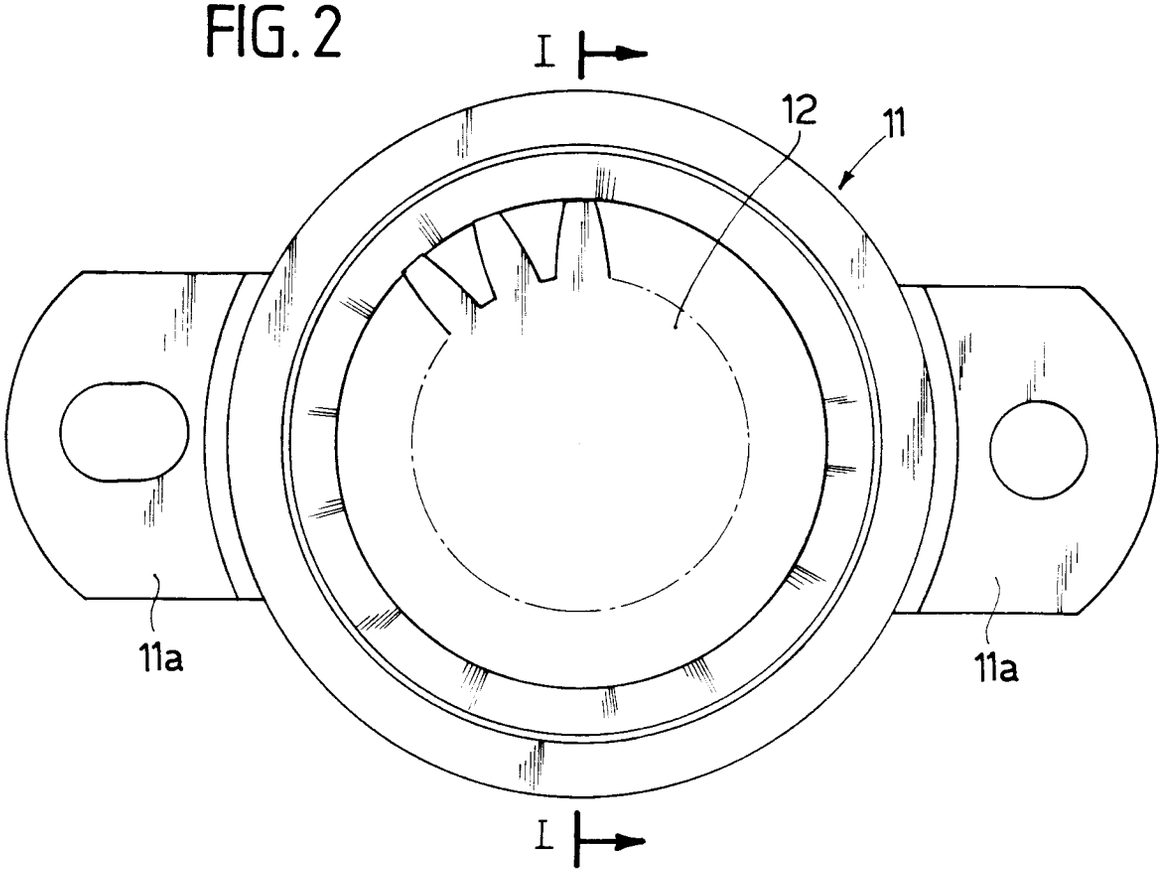


FIG.3

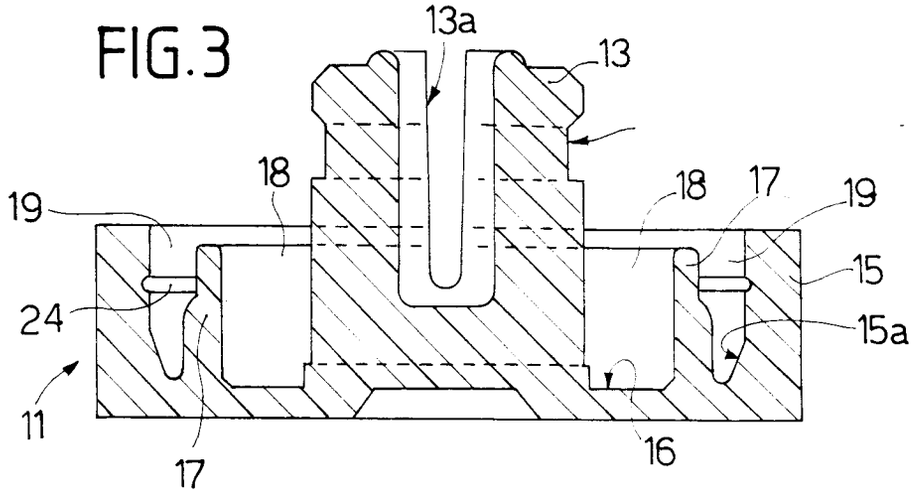


FIG.4

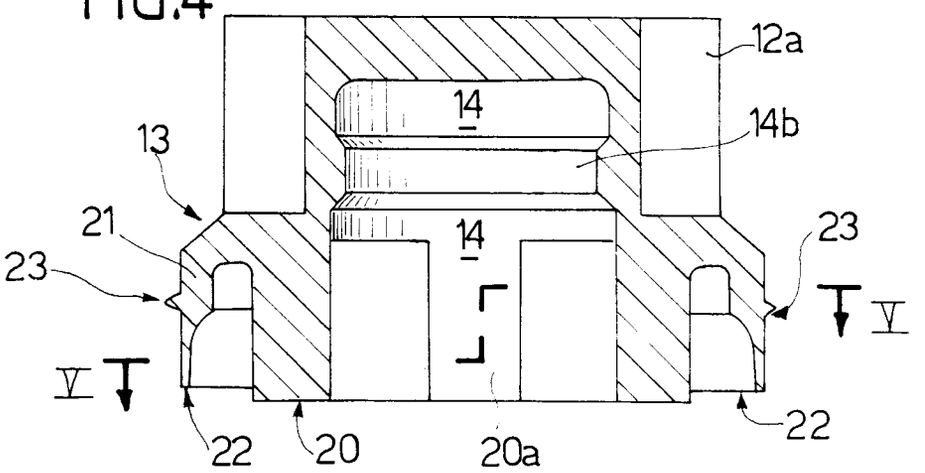


FIG.5

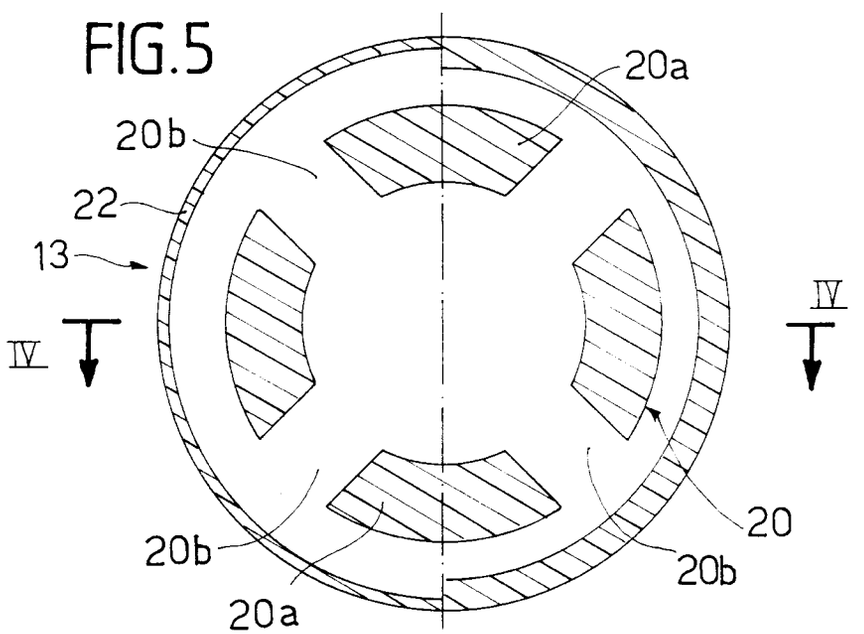
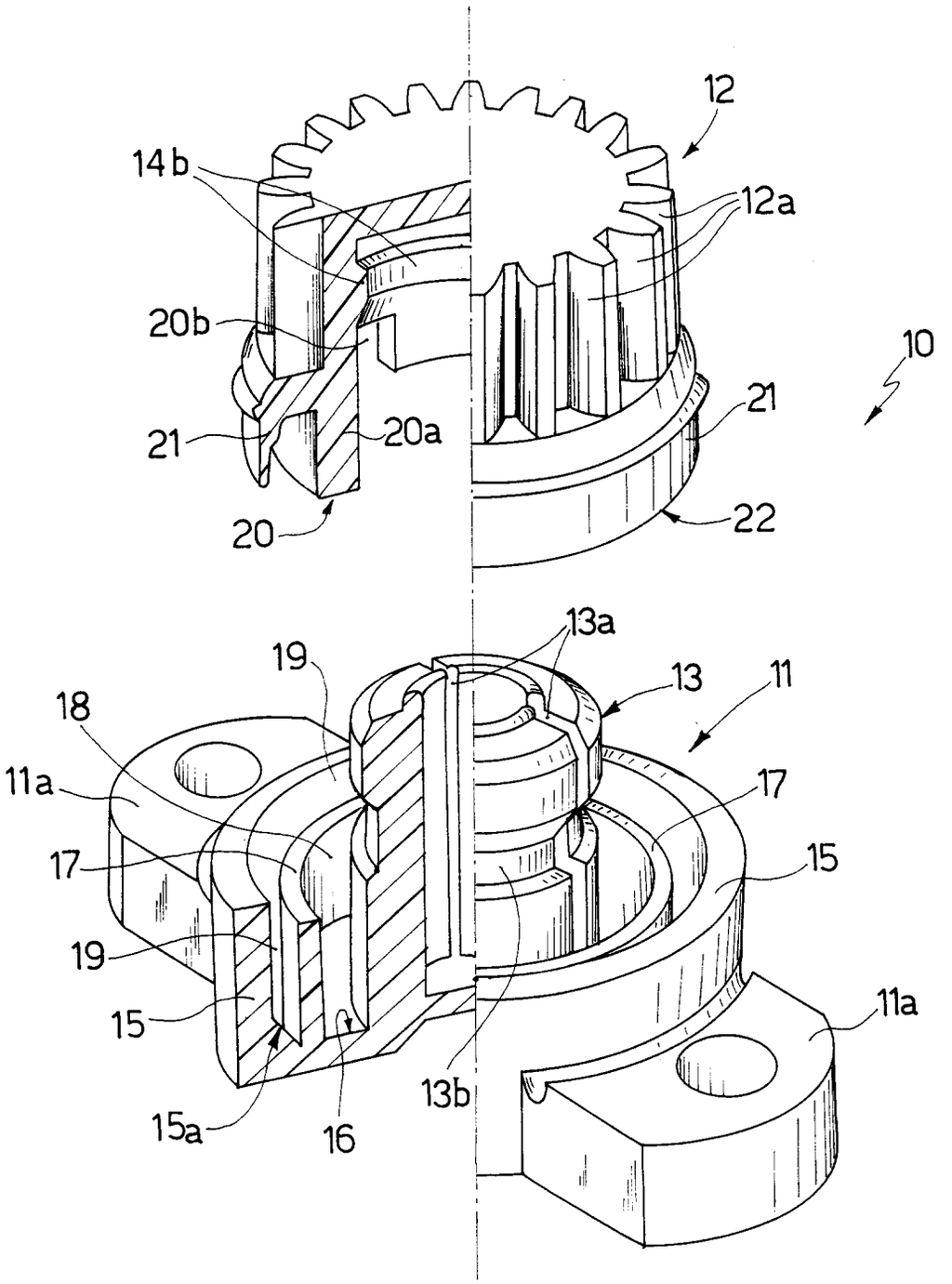


FIG. 6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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 7507

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 199 242 (FOGGINI PROGETTI) * page 3, line 27 - page 5, line 7; figure 3 *	1,2,4,6, 9,10	E05F5/00
A	DE-A-41 19 090 (NIFCO) * column 1, line 1 - line 33; figure 3 *	1,2,5,6, 10	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 January 1996	Guillaume, G

CATEGORY OF CITED DOCUMENTS

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