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(54) **Driver assembly for a powered window regulator**

(57) Driver assembly for a powered window regulator comprising a support (1), a coupling shaft (2), a winding drum (3) and a reduction gearbox motor (4) joined to the coupling shaft (2), the winding drum (3) being connected with angular clearance to the coupling shaft (2); the driver assembly also comprises a locking spring (5) and a cylindrical spring housing (6) for said locking spring (5), which has two ends (5.1,5.2) that bend towards the inside of the cylindrical spring housing (6) and an expandable central section (5.3), said cylindrical spring housing (6) being joined to the support (1) and housing the locking

spring (5) compressed such that the outer surface of the expandable central section (5.3) contacts the inner surface of the cylindrical spring housing (6) ; the coupling shaft (2) includes two unlocking surfaces (2.1,2.2) and two first pushing surfaces (2.3,2.4); the winding drum (3) includes two locking surfaces (3.1,3.2) and two second pushing surfaces (3.3,3.4); each of the ends (5.1,5.2) of the locking spring (5) is placed between an unlocking surface (2.1,2.2) of the shaft and a locking surface (3.1,3.2) of the winding drum (3), providing compactness and efficiency.

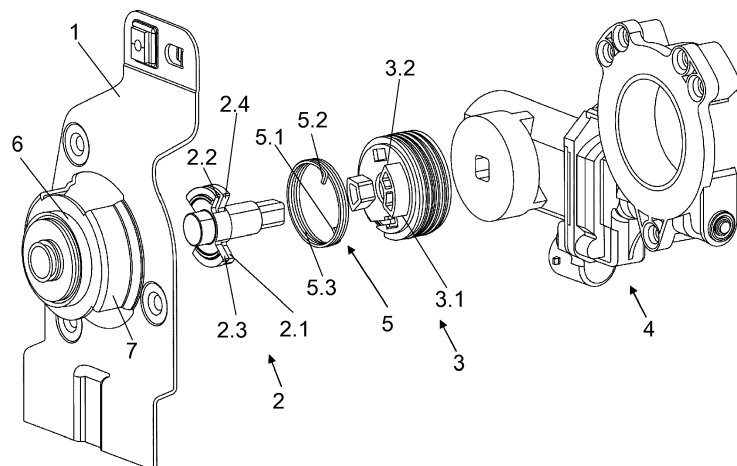


Fig.1

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention lies in the field of window regulators that are driven by an electric motor and include a winding drum around which is wound or unwound a window regulator cable in order to raise or lower side windows of vehicles.

[0002] The invention is a driver assembly for a powered window regulator that includes a support, a coupling shaft, a winding drum, a reduction gearbox motor, a locking spring with two ends and an expandable central section, and a spring housing joined to the support, this housing being cylindrical in shape.

[0003] The ends of the locking spring are bent towards the inside of the spring housing; said spring is compressed such that the outer surface of its expandable central section is in contact with the inner surface of the spring housing.

[0004] The coupling shaft includes two unlocking surfaces and two first pushing surfaces, while the winding drum includes two locking surfaces and two second pushing surfaces, so that each end of the locking spring will be positioned between an unlocking surface of the coupling shaft and a locking surface of the winding drum.

BACKGROUND OF THE INVENTION

[0005] Window regulators for vehicles are known in which the driver assembly includes a reduction composed of a worm and a worm wheel that engages it with threading and worm wheel tooth inclination angles preventing its reversal motion, this is, the motion of the window when it is operated directly instead of under the action of the motor, for example in case of undesired access from outside the vehicle, in what is known as irreversibility.

[0006] The drawbacks of these solutions are that they have a low efficiency and poor performance, as the driver power is wasted in overcoming the high friction present in this type of worm gear reduction. This means that the drivers are oversized to overcome this reduction with irreversibility, resulting in the use of larger and heavier drivers that are more expensive than they would need to be in the absence of friction and are less energy efficient.

[0007] Other solution incorporate the irreversibility function in the elements near the driver, so that they can include reduction with low retention, as in the solutions described in the patents cited below.

[0008] US Patent 3,930,566 describes a driver assembly with incorporated reduction and irreversibility function, the 'output' of which is a pinion gear meant to drive a window regulator mechanism, wherein the driver moves a worm gear coupled to a worm wheel that also includes overload damping elements to transmit the movement to a cylindrical piece around which moves freely a coiled spring.

[0009] Said cylindrical piece is joined to an output piece with a splined orifice and a projection that corresponds to and is smaller than a cut away section made in the cylindrical piece.

[0010] In said patent, the ends of the coiled spring are located between the projection of the output piece and the recess of the cylindrical piece. This spring is located in a housing such that the outer surface of the spring contacts the inner surface of said housing in order to cause a friction and locking force. A shaft is inserted in the splined orifice of the output piece that crosses all of the aforementioned pieces up to the worm gear, where the shaft has a pinion gear coupled to a toothed sector.

[0011] In this patent, the arrangement of the elements creates a drive chain at the end of which is placed the window regulator mechanism, which is physically separated and not in contact with the spring that provides the locking function or permits transmission of the motion.

[0012] Thus, in this patent the locking that guarantees irreversibility is performed on the components closest to the driver and not directly on the element to lock.

[0013] In addition, another drawback of this patent is that it is not designed for a winding drum, so that its use for this purpose is not adapted to it and is more complex and bulky, with a reduced effectiveness than if it were adapted for this purpose.

[0014] A further drawback of the drive chain of said US Patent 3,930,566 is that the window regulator mechanism is placed externally to the driver assembly itself, reducing the compactness of the assembly, a matter of great importance in the doors of vehicles, where the available space for housing these mechanisms and for assembly operations is limited.

[0015] Another drawback resulting from the above is that the driver assembly of said patent is complex, due to the relatively high number of parts, which implies an increased likelihood of operation noises, clearances and potential faults during its lifetime.

[0016] Patent with publication number W02006100174 describes a driver assembly in which integrally joined to the worm wheel is a piece with a cylindrical sector shape that acts on a coiled spring, which in turn acts on a union element in the form of an output shaft that includes the teeth of a pinion gear.

[0017] Similarly to the previously cited patent, this patent W02006100174 has the drawback that the locking that ensures irreversibility is performed on the components closest to the driver, not directly on the element to lock, so that a drive chain is created in which the element to lock is physically separated and not in contact with the spring that provides the locking function or allows transmission of the motion.

[0018] To overcome the aforementioned drawbacks of the state of the art, the following invention is proposed for a driver assembly for a powered window regulator.

DESCRIPTION OF THE INVENTION

[0019] The present invention is established and characterised in the independent claims, while the dependent claims describe additional characteristics thereof.

[0020] The object of the invention is a driver assembly that transmits a torque and a winding motion to a cable of a vehicle window regulator in order to raise or lower the side windows of the vehicle, as well as to prevent the reversal of the motion of the vehicle windows that can occur when they are acted on manually, that is compact and energy efficient.

[0021] In view of the foregoing, the present invention relates to a driver assembly for a powered window regulator wherein said assembly comprises a support, a coupling shaft, a winding drum, and a reduction gearbox motor connected to the coupling shaft. The winding drum is connected to the coupling shaft with some angular clearance.

[0022] The union with angular clearance between the drum and the shaft consists in a union that transmits the rotation between them, in a manner such that there is a dead angle, that is, an angular clearance that allows a certain relative free rotation between them.

[0023] The driver assembly also comprises a locking spring and a spring housing, this housing being cylindrical. In addition, the locking spring comprises two ends and an expandable central section.

[0024] The ends of the locking spring are bent towards the inside of the spring housing, which is rigidly joined to the support and houses the locking spring, which in turn is compressed such that the outer surface of its expandable central section is in contact with the inner surface of the spring housing, generating a degree of friction between them.

[0025] The coupling shaft includes two unlocking surfaces and two first pushing surfaces, while the winding drum includes two locking surfaces and two second pushing surfaces, so that each end of the locking spring will be positioned between an unlocking surface of the coupling shaft and a locking surface of the winding drum.

[0026] The first pushing surfaces of the locking shaft and the second pushing surfaces of the winding drum are in a two-by-two correspondence to transmit torque and motion from said shaft to said drum, so that this transmission will be effected by a pair of surfaces or another depending on the direction of rotation of the transmitted motion.

[0027] To transmit the motion, when the coupling shaft rotates one of its unlocking surfaces contacts and pushes an end of the locking spring, compressing it and releasing the force that the body of the spring exerts against its housing, reducing friction and allowing the rotation of the aforementioned locking spring together with the coupling shaft until a first pushing surface of the shaft contacts the corresponding second pushing surface of the winding drum, pushing it and making it rotate.

[0028] To prevent reversal, when the winding drum is

rotated one of its locking surfaces contacts and pushes one end of the locking spring, expanding it and increasing the friction exerted by this spring against its housing, locking it and preventing the rotation of the aforementioned locking spring and as a result of the winding drum.

[0029] An advantage of the invention is that the driver assembly is compact, occupying a small space, which is an important characteristic in view of where it is installed, namely side doors of vehicles where space is limited.

[0030] Another advantage is that it is efficient, as the reduction gearbox motor assembly can have a low retention, which in turn implies a reduction of most losses due to friction, thereby allowing a more efficient use of the work generated and transmitted by the driver.

[0031] Another advantage is that said driver assembly is simple, as it reduces to a minimum the number of elements needed to ensure its operation.

[0032] A further advantage is that it allows using smaller drivers than those normally used, as due to the previously cited advantage and the lower energy consumption, it is possible to provide a window regulator with a performance similar to that of a current driver assembly with reduction gearbox motor using a smaller driver.

[0033] Yet another advantage is that said driver assembly has a light weight, a direct consequence of the previously cited advantage and the simplicity of the assembly.

[0034] One more advantage is that it is quiet, due to the low number of elements and that there are no complex unions between them such as gears.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] This specification is supplemented with a set of drawings illustrating the preferred embodiment, which are never intended to limit the invention.

Figure 1 is an exploded perspective view in which the drum housing and a housing of the spring are joined and integrated in the support, adjacent to each other and placed on the same side with respect to the drum.

Figure 2 is an exploded perspective view of an embodiment in which the drum housing and the spring housing are placed in the support and the spring housing is placed inside the drum housing and concentric with it.

Figure 3 is an exploded perspective view of an embodiment in which the spring housing is joined to the support, said spring housing being projected from the support surface towards the inside of a space provided in one of the faces of the drum, and the drum housing is an additional piece attached to the support at the drum face opposite the space in which the spring housing is placed.

Figure 4 is a cross-sectional view of figure 1.

Figure 5 is a cross-sectional view of figure 2.

Figure 6 is a cross-sectional view of figure 3.

Figure 7A is a cross-sectional view of the coupling shaft and the winding drum, which also shows the ends and part of the locking spring body, in an option wherein the unlocking surfaces and second pushing surfaces of the drum are in different planes. Figure 7B is the same view as figure 7A, wherein the shaft advances until it contacts one end of the spring and unlocks it, and the first pushing surface of the shaft contacts the second pushing surface of the drum.

Figures 8A and 8B are cross-sectional views of a profile of the locking surfaces and second pushing surfaces of the drum and of the locking surfaces and first pushing surfaces of the shaft, in the option wherein said surfaces of the drum are in the same plane and said surfaces of the shaft are in different planes, when the coupling shaft is actuated respectively before and after the second pushing surfaces of the drum and first pushing surfaces of the shaft come in contact, when the driver assembly is unlocked.

Figures 9A and 9B are cross-sectional views of a profile of the locking surfaces and second pushing surfaces of the drum and of the locking surfaces and first pushing surfaces of the shaft, in the option wherein said surfaces of the drum are in different planes and said surfaces of the shaft are in the same plane, when the coupling shaft is actuated respectively before and after the second pushing surfaces of the drum and first pushing surfaces of the shaft come in contact, when the driver assembly is unlocked.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

[0036] The present invention relates to a driver assembly for a powered window regulator wherein said assembly comprises a support (1), a coupling shaft (2), a winding drum (3), and a reduction gearbox motor (4) connected to the coupling shaft (2).

[0037] In the described embodiment, the support (1) consists in an embedded plate and the union between the reduction gearbox motor (4) and the coupling shaft (2) is achieved by inserting an end of said shaft (2) with a square cross-section into an orifice with the same cross-section of the reduction gearbox motor (4), as shown in figure 1. The shaft (2) can also be hollow, as shown in figures 2 and 3, so that it revolves about a fixed stem, not shown, joined to the reduction gearbox motor (4).

[0038] The winding drum (3) is connected with angular clearance to the coupling shaft (2), said shaft (2) being inserted in an orifice of the winding drum (3), the segment of the shaft (2) and the orifice of the drum (3) having a circular cross-section, such that there is a dead angle providing an angular clearance that allows an extent of relative rotation between them.

[0039] The driver assembly also comprises a locking spring (5) and a cylindrical spring housing (6). In the represented embodiment said spring (5) is a coil spring, but it can have a different configuration such as a curved strip.

[0040] The locking spring (5) comprises two ends (5.1,5.2) and an expandable central section (5.3), these ends (5.1,5.2) being bent towards the inside of the spring housing (6).

[0041] Said spring housing (6) is rigidly joined to the support (1) and houses the locking spring (5) compressed in such a manner that the outer surface of the expandable central section (5.3) of said spring (5) remains compressed and contacts and pushes against the inner surface of the spring housing (6), generating certain friction between them.

[0042] The coupling shaft (2) includes two unlocking surfaces (2.1,2.2) and two first pushing surfaces (2.3,2.4), and the winding drum (3) includes two locking surfaces (3.1,3.2) and two second pushing surfaces (3.4,3.4), so that each end (5.1,5.2) of the locking spring (5) will be positioned between an unlocking surface (2.1,2.2) of the coupling shaft (2) and a locking surface (3.1,3.2) of the winding drum (3).

[0043] This arrangement of the elements is specified by establishing the manner in which they interact with one another, as described below.

[0044] To prevent reversibility, when the winding drum (3) turns one of the locking surfaces (3.1,3.2) pushes the corresponding end (5.1,5.2) of the locking spring (5), expanding it and increasing the friction of the locking spring (5) against the spring housing (6), until the friction force is strong enough to prevent the rotation of the locking spring (5) and thus that of the winding drum (3).

[0045] To transmit the motion, when the coupling shaft (2) turns, one of the unlocking surfaces (2.1,2.2) reaches and pushes the corresponding end (5.1,5.2) of the locking spring (5), contracting it and reducing the force exerted by the body of the locking spring (5) against the spring housing (6), reducing the friction until it is low enough to allow the rotation of the locking spring (5), also allowing the rotation of the shaft until a first pushing surface of the shaft (2.3,2.4) contacts the corresponding second pushing surface (3.3,3.4) of the winding drum (3), pushing it and making it turn.

[0046] Specifically, as seen in figure 1 for reversibility, when the drum turns in an anticlockwise sense the locking surface (3.1) contacts the corresponding end (5.1) of the locking spring (5). After this contact the spring (5) expands, increasing the friction between the spring body and spring housing, locking the motion and providing the

irreversibility function as described.

[0047] Specifically, as shown in figure 1 for motion transmission, when the shaft (2) turns in an anticlockwise sense the unlocking surface of the shaft (2.1) contacts the corresponding end (5.1) of the locking spring (5), compressing it and reducing friction, so that the spring (5) is released as described above, allowing the rotation of the coupling shaft to continue. As the rotation of the coupling shaft continues, the first pushing surface of the shaft (2.3) contacts the corresponding second pushing surface of the drum (3.3) so that the latter will turn, transmitting the torque and motion of the shaft (2) to the drum (3), and from it to the cable and the rest of the window regulator mechanism.

[0048] In an option of the invention, as shown in figures 1, 2, 3, 8A, 8B, 9A and 9B, each one of the first pushing surfaces (2.3,2.4) of the shaft is near one end of the locking spring (5.1,5.2) and adjacent to the unlocking surface (2.1,2.2) corresponding to said end.

[0049] In a possible embodiment of this option, as shown in figures 1, 2, 3, 8A and 8B, one of the first pushing surfaces (2.3) of the shaft (2) is near one end (5) of the locking spring and adjacent to the unlocking surface (2.1) corresponding to said end (5), being displaced with respect to each other so that the separation between said unlocking surface of the shaft (2.1,2.2) and the locking surface of the drum (3.1,3.2) corresponding to this end of the spring is greater than that between the first pushing surfaces of the shaft (2.3,2.4) and the second ones of the drum (3.3,3.4) corresponding to said end (5).

[0050] In this embodiment, each locking surface of the drum (3.1,3.2) is in the same plane as the corresponding pushing surface of the drum (3.3,3.4).

[0051] In addition, in another possible embodiment of this option, as shown in figures 9A and 9B, according to which one of the second pushing surfaces (3.3) of the winding drum (3) is near one end (5) of the locking spring and adjacent to the locking surface (3.1) corresponding to said end (5), being displaced with respect to each other so that the separation between said locking surface of the drum (3.1,3.2) and the unlocking surface of the shaft (2.1,2.2) corresponding to this end (5) of the locking spring is greater than that between the first pushing surfaces of the shaft (2.3,2.4) and the second of the drum (3.3,3.4) corresponding to said end (5).

[0052] In this embodiment, each unlocking surface of the shaft (2.1,2.2) is in the same plane as the corresponding pushing surface of the shaft (2.3,2.4).

[0053] In another option of the invention, as shown in figures 7A and 7B, the second pushing surfaces (3.3,3.4) of the winding drum (3) and the corresponding ones of the coupling shaft (2) are not next to the ends of the locking spring (5), that is, they are in different planes and distant from those of the locking surfaces (3.1,3.2) of the winding drum (3) or those of the unlocking surfaces (2.1,2.2) of the coupling shaft (2).

[0054] In a variant of the embodiment shown, the support (1) also comprises a drum housing (7), which together

with the spring housing (6) are joined to the support (1).

[0055] The drum housing (7) is a cover that surrounds the drum (3) at least on its lateral surface, so that it protects the cable that is wound in said lateral surface, and also provides a containment wall for said cable to ensure that it remains correctly wound.

[0056] One option of this variant shown in figure 1 is that in which the drum housing (7) and the spring housing (6) are joined to and integrated in the support (1), adjacent to each other and on the same side with respect to the drum (3).

[0057] Another option shown in figure 2 is that in which the drum housing (7) is joined and integrated in the support (1), and the spring housing (6) is joined to and integrated concentrically in the drum housing (7), said spring housing (6) also being disposed inside the space (3.5) that the winding drum (3) has in this case, concentrically with it.

[0058] In another variant shown in figure 3, the spring housing (6) is joined to and integrated in the support (1), said spring housing (6) projecting from the surface of the support (1) towards a space (3.5) that the drum (3.5) has in one of its faces, while the drum housing (7) consists in an additional piece attached to the support (1) from the face of the drum (3) opposite to that comprising the space (3.5), the drum (3) being positioned between the drum housing (7) and the support (1).

Claims

1. Driver assembly for a powered window regulator wherein said assembly comprises a support (1), a coupling shaft (2), a winding drum (3), and a reduction gearbox motor (4) connected to the coupling shaft (2), **characterised in that** the winding drum (3) is connected with an angular clearance to the coupling shaft (2), the driver assembly also comprises a locking spring (5) and a cylindrical spring housing (6), the locking spring (5) comprises two ends(5.1,5.2) and an expandable central section (5.3), said ends (5.1,5.2) bend towards the inside of the spring housing (6), this spring housing (6) is rigidly joined to the support (1) and houses the locking spring (5) compressed such that the outer surface of the expandable central section (5.3) contacts the inner surface of the spring housing (6) and (5), the coupling shaft (2) includes two unlocking surfaces (2.1,2.2) and two first pushing surfaces (2.3,2.4), the winding drum (3) includes two locking surfaces (3.1,3.2) and two second pushing surfaces (3.3,3.4), such that each end (5.1,5.2) of the locking spring (5) is located between an unlocking surface (2.1,2.2) of the coupling spring (2) and a locking surface (3.1,3.2) of the winding drum (3).
2. Driver assembly according to claim 1, wherein at least one of the first pushing surfaces (2.3,2.4) of the

shaft and the corresponding second pushing surface (3.3,3.4) of the drum are located next to one of the ends (5.1,5.2) of the locking spring and the corresponding locking surfaces (3.1,3.2) of the drum and unlocking surfaces (2.1,2.2) of the shaft, the unlocking surface (2.1,2.2) of the shaft corresponding to said end and said first pushing surface (2.3, 2.4) of the shaft being displaced with respect to each other, so that the separation between each unlocking surface (2.1,2.2) of the shaft and locking surface (3.1, 3.2) of the drum is greater than that between the first pushing surface (2.3,2.4) of the shaft and the second pushing surface (3.3,3.4) of the drum.

3. Driver assembly according to claim 1, wherein the unlocking surfaces (2.1, 2.2) of the coupling shaft (2) at least one of the second pushing surfaces (3.3,3.4) of the drum and the corresponding first pushing surface (2.3,2.4) of the shaft are located next to one of the ends (5.1,5.2) of the locking spring and the corresponding unlocking surfaces (2.1,2.2) of the shaft and locking surfaces (3.1,3.2) of the drum, the locking surface (3.1,3.2) of the drum corresponding to said end and said second pushing surface (3.3, 3.4) of the drum being displaced with respect to each other, so that the separation between each locking surface (3.1,3.2) of the drum and unlocking surface (2.1, 2.2) of the shaft is greater than that between the first pushing surface (2.3,2.4) of the shaft and the second pushing surface (3.4,3.4) of the drum.
4. Driver assembly according to claim 1, wherein the locking surface (3.1,3.2) and the corresponding second pushing surface (3.3,3.4) of the winding drum (3) are in the same plane.
5. Driver assembly according to claim 1, wherein the unlocking surface (2.1,2.2) and the corresponding first pushing surface (2.3,2.4) of the coupling shaft (2) are in the same plane.
6. Driver assembly according to claim 1, wherein the second pushing surfaces (3.3,3.4) of the winding drum (3) and the corresponding ones of the coupling shaft (2) are not next to the ends of the locking spring (5), so that they are in different planes and distant from those of the locking surfaces (3.1,3.2) of the winding drum (3) or those of the unlocking surfaces (2.1,2.2) of the coupling shaft (2).
7. Driver assembly according to any of claims 1 to 6 wherein the support (1) also comprises a drum housing (7), said housing (7) and the spring housing (6) being joined at the support (1).
8. Driver assembly according to claim 7 wherein the drum housing (7) and the spring housing (6) are integrated in the support (1), adjacent to each other

and on the same side with respect to the drum (3).

9. Driver assembly according to claim 7 wherein the drum housing (7) and the spring housing (6) are integrated in the support (1), and the spring housing (6) is disposed inside the drum housing (7) and concentric with it.
10. Driver assembly according to any of claims 1 to 6, wherein the spring housing (6) is joined to and integrated in the support (1), said spring housing (6) projecting from the surface of the support (1) towards a space (3.5) that the drum has in one of its faces, while the drum housing (7) consists in an additional piece attached to the support (1) from the face of the drum (3) opposite to that comprising the space (3.5), the drum (3) being positioned between the drum housing (7) and the support (1).

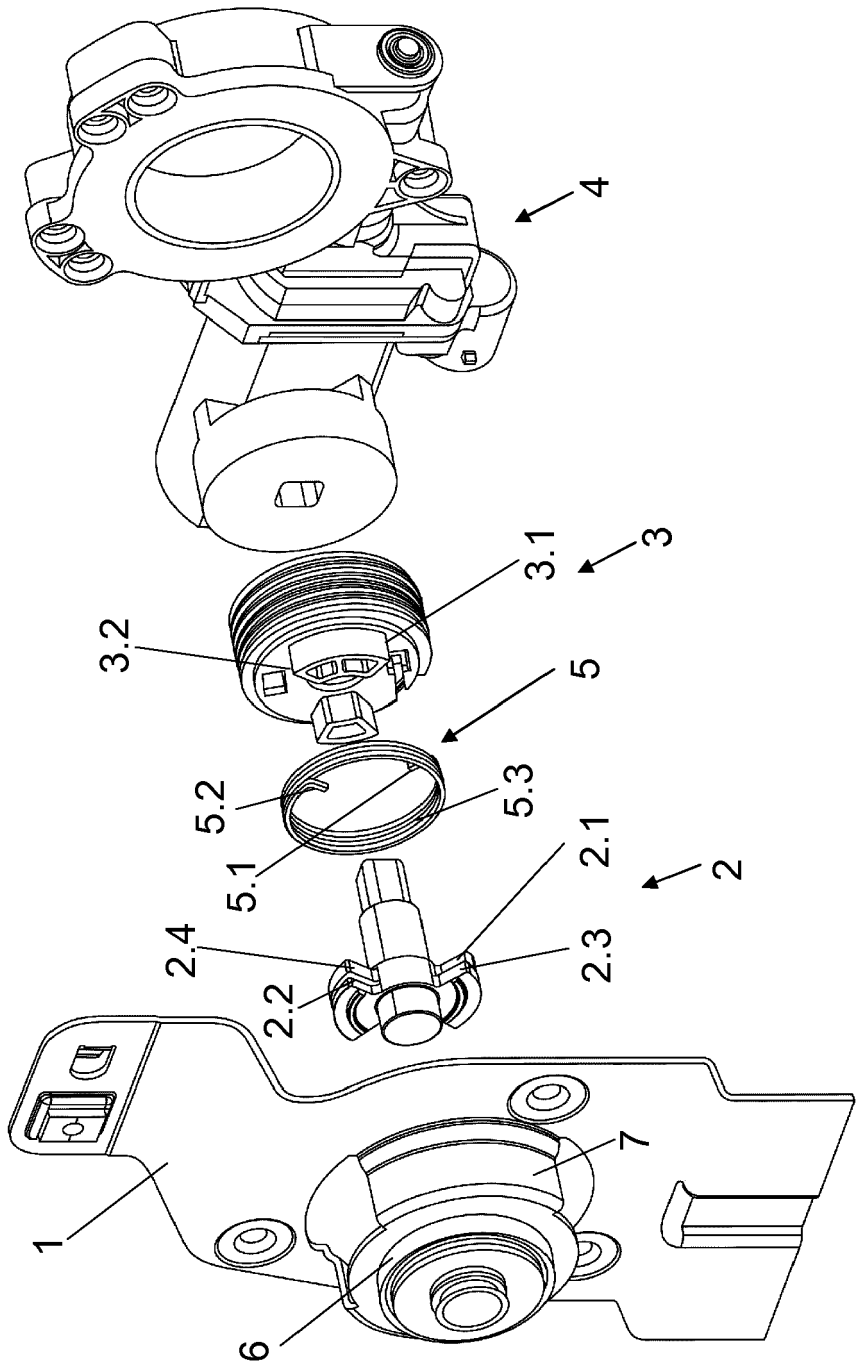


Fig.1

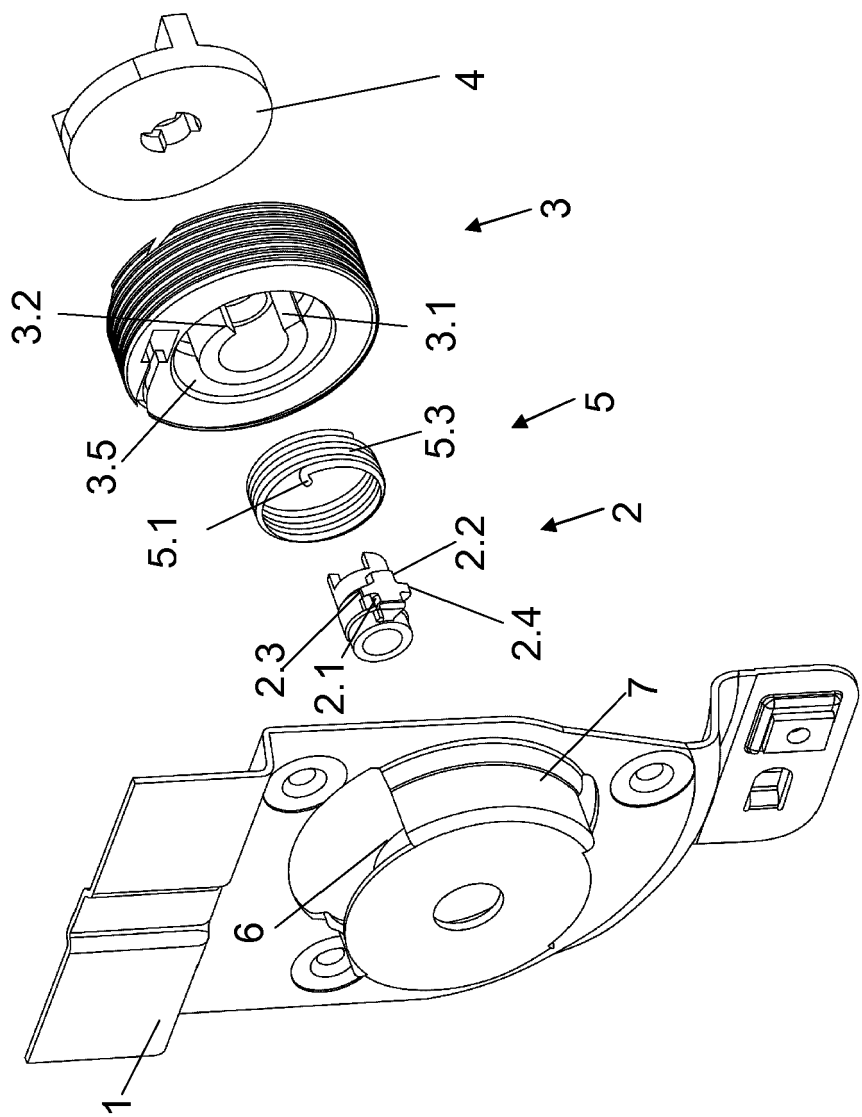


Fig.2

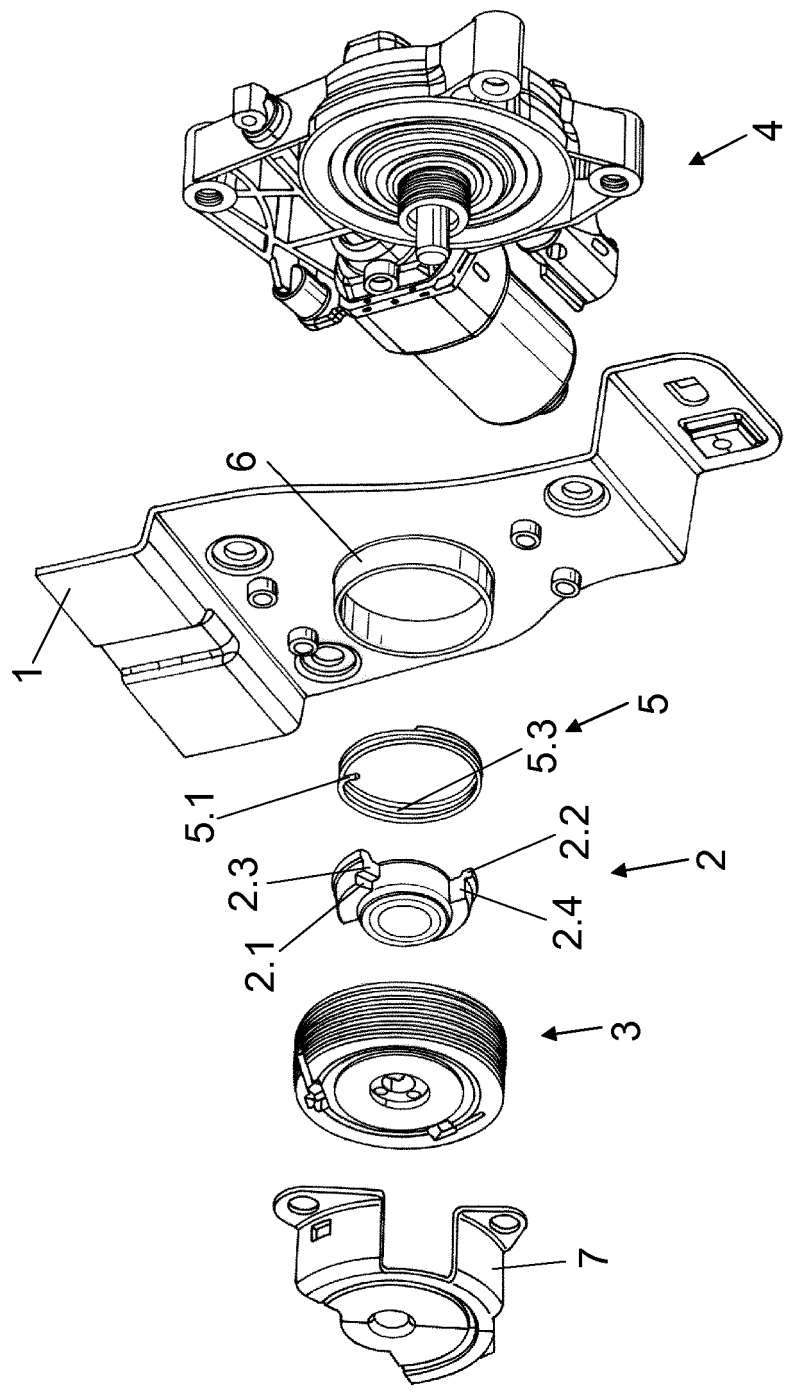


Fig.3

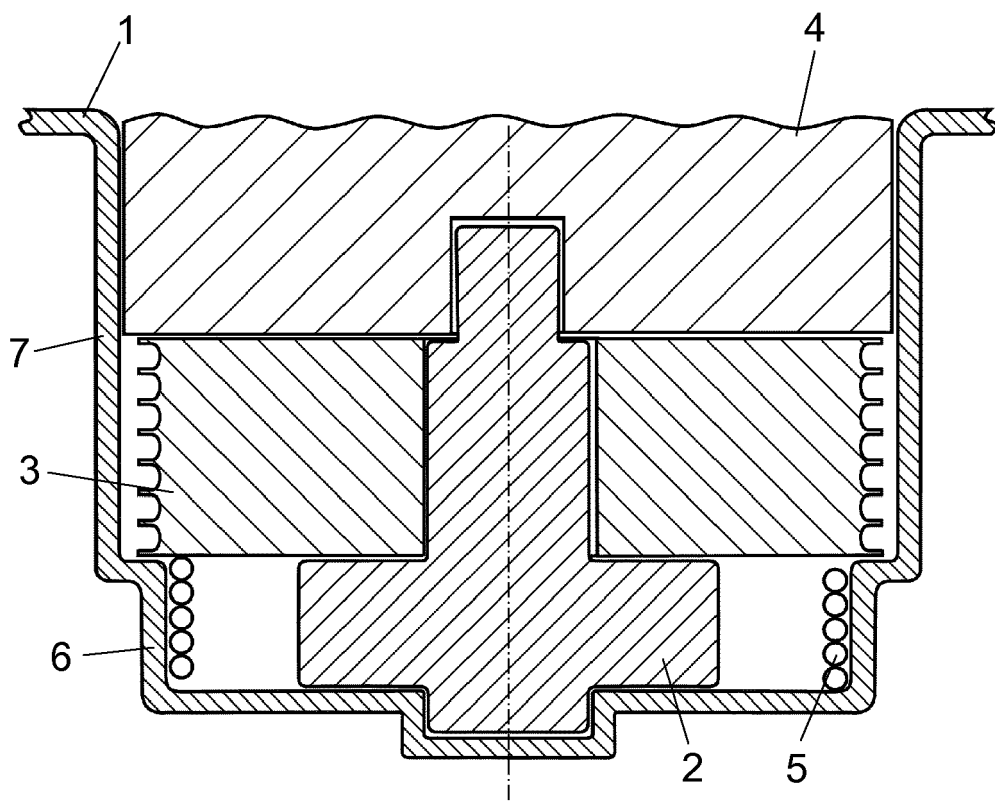


Fig.4

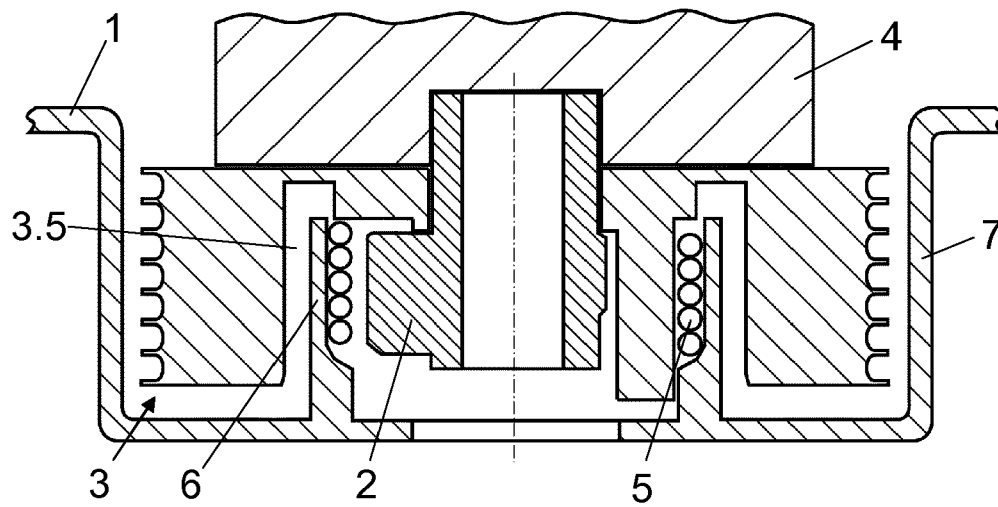


Fig.5

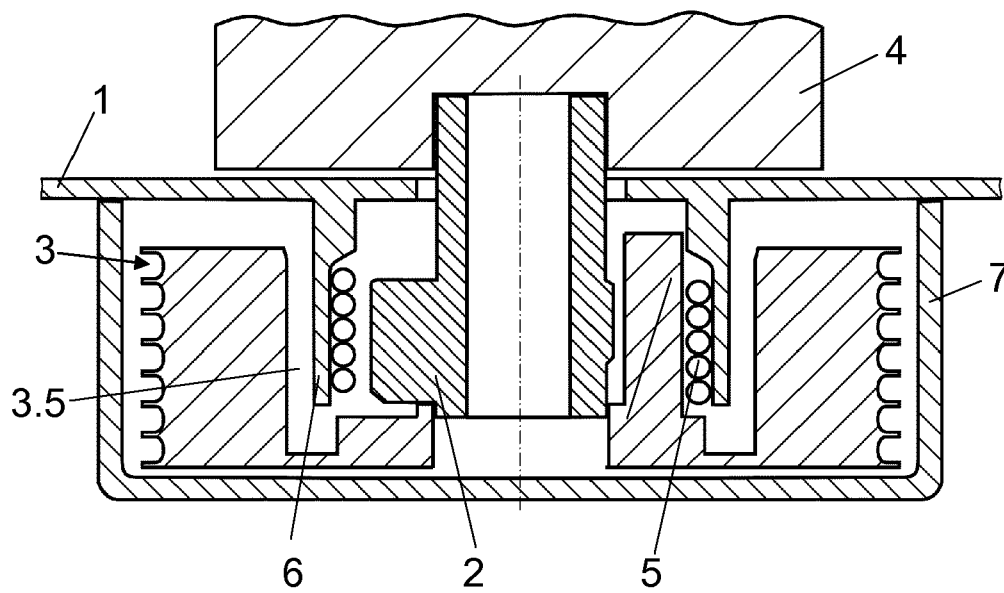


Fig.6

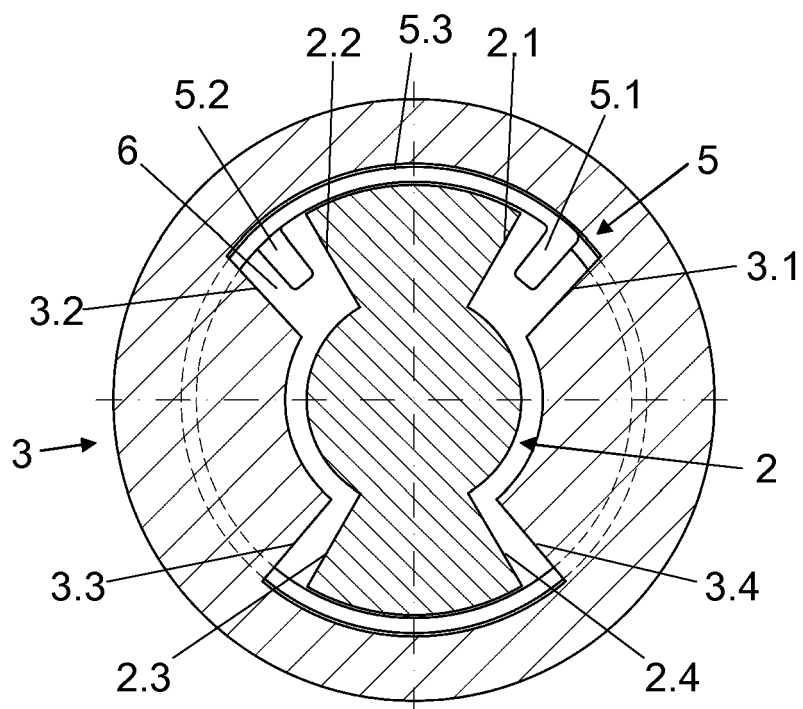


Fig.7A

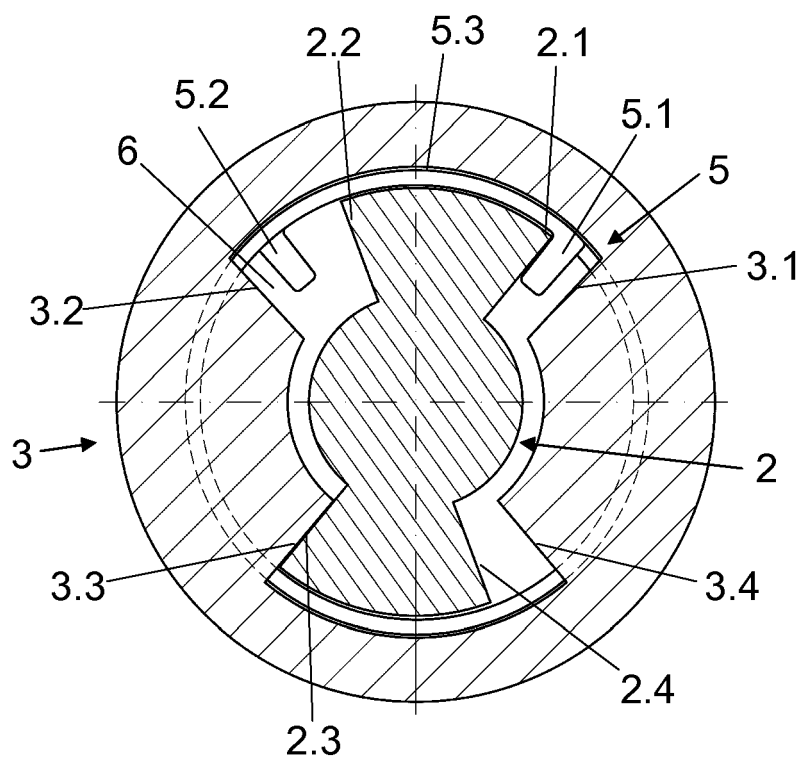


Fig.7B

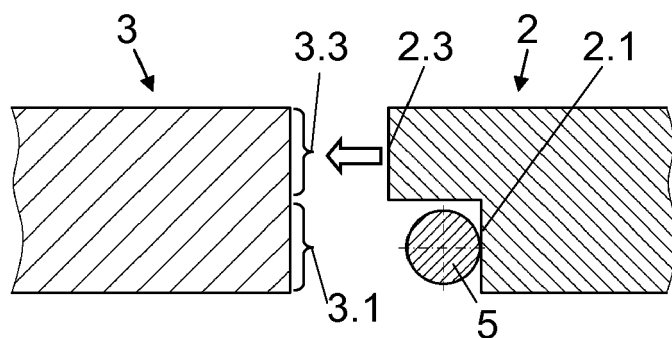


Fig. 8A

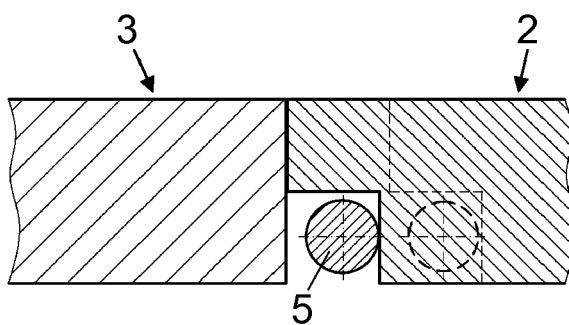


Fig. 8B

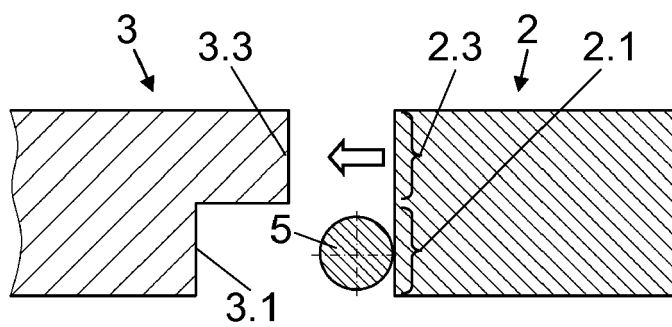


Fig. 9A

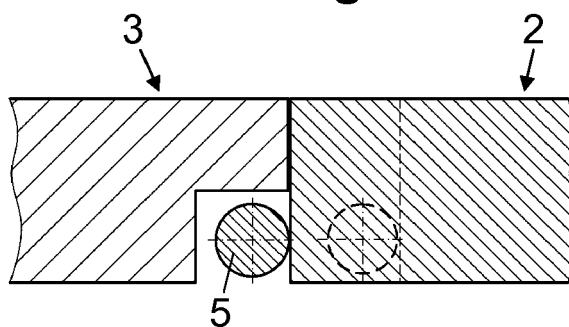


Fig. 9B



EUROPEAN SEARCH REPORT

Application Number
EP 12 38 2426

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 102 36 372 A1 (BROSE FAHRZEUGTEILE [DE]) 19 February 2004 (2004-02-19)	1,2,4,5	INV. E05F11/50 E05F15/16
Y	* paragraph [0080] - paragraph [0083] * * figures 13a-13f *	10	
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