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(54) **Tubular motor reducer for winding roller shutters and sunblinds integrated with anti-fall device**

(57) The present invention relates to a tubular motor reducer for winding roller shutters integrated with an anti-fall device, of inertial type, located between the adapter that drags the roller shutter winding shaft into

rotation and the sleeve which houses the epicyclic reduction gear of the tubular motor reducer.

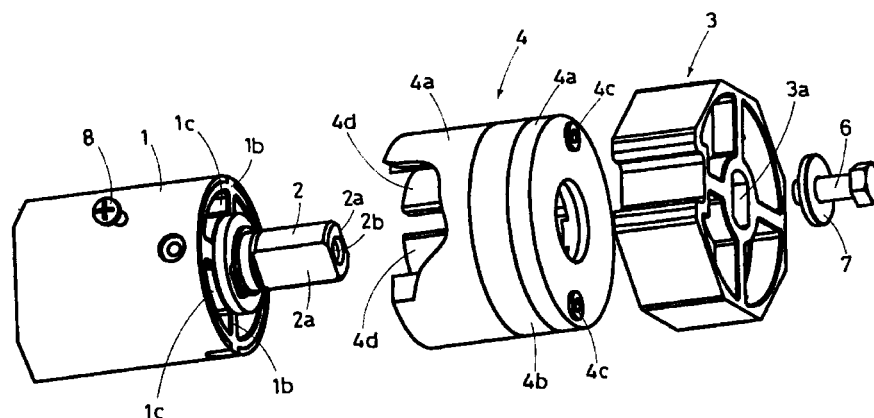


FIG. 1

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Description

[0001] The present patent application for utility model relates to a tubular motor reducer for winding roller shutters integrated with an anti-fall device, of inertial type.

[0002] Tubular motor reducers are currently used for the motor-driven winding of roller shutters in general. The tubular motor reducers are inserted inside one end of the tubular shaft used to wind the roller shutters.

[0003] In particular, the motor reducers usually include a multi-step epicyclic reduction gear housed inside a fixed sleeve, whose internal wall features a crown gear on which the crown wheels of the various steps of the epicyclic reduction gear engage. The epicyclic reduction gear is dragged into rotation by an electric motor fixed at one end of the sleeve, from whose other end the pin for the power takeoff projects.

[0004] The adapter designed to drag the winding shaft of the roller shutter into rotation is splined on the pin, with the adapter recessed and fixed inside the winding shaft.

[0005] A motor reducer of this type is illustrated in the Italian patent application no. AN 98 U 000012, registered by the applicant on 12.03.98.

[0006] Due to safety reasons and in compliance with the current regulations, the other end of the winding shaft features a safety device used to stop automatically and immediately the roller shutter in case of accidental fall, due to a fault of the reducer or the brake, which is always provided on the tubular motor reducer, since the motion transmission from the electric motor to the pin for power takeoff is not irreversible. This requires the presence of a safety braking system, designed to permanently maintain the roller shutter in raised position, thus avoiding the risk of accidentally starting the unwanted dangerous down travel of the roller shutter in an uncontrolled way because of its own weight.

[0007] The safety devices mentioned above are usually referred to as "parachute". Among the various models of "parachutes", the types which fully comply with the current safety regulations are defined as "cushioned parachutes", since their operation is basically based on a self-blocking system which, before stopping the winding shaft of the roller shutter, makes a short braking travel to dissipate through friction part of the kinetic energy acquired by the winding shaft because of the free fall of the roller shutter.

[0008] Before the final blocking of the winding shaft, the braking action reduces the strength of the stop impact, thus preventing the entire structure from suffering mechanical stress peaks, which can be high and harmful.

[0009] The European patent no. 0671543 registered by the applicant illustrates a particular model of "cushioned parachutes" belonging to the category of "inertial parachutes", based on the use of a special toothed wheel, splined on the winding shaft, which houses a series of cylindrical bodies in its perimetral compart-

ments and turns inside a friction ring located between a pair of lateral covers, which enclose the toothed wheel.

[0010] The friction ring is characterised by the fact that its internal circumference features a loop where the cylindrical bodies that are normally housed in the peripheral compartments of the toothed wheel are fitted and engaged in case of free fall of the roller shutter. The bodies are automatically ejected from the peripheral compartments because of centrifugation when the rotation speed of the winding shaft becomes too high - and not because of the dragging power of the motor reducer.

[0011] As mentioned above, the "parachutes" are installed on the winding shaft on the opposite end compared to the tubular motor reducer. More exactly, the parachutes are installed in the place of the bearing which usually supports the winding shaft if the anti-fall devices are not present.

[0012] This means that two different operations are necessary to install the roller shutter: the assembling of the tubular motor reducer at one end of the winding shaft and the assembling of the "parachute" on the opposite end.

[0013] The purpose of the present invention is to create a tubular motor reducer for roller shutters integrated with an anti-fall device, of inertial type, in order to simplify and reduce the installation operations of the winding shaft.

[0014] Another purpose of the present invention is to create a tubular motor reducer for roller shutters integrated with an anti-fall device, of inertial type, whose cost is lower than the amount that is currently necessary to separately purchase the tubular motor reducer and the "cushioned parachute".

[0015] The tubular motor reducer according to the present invention features a traditional construction, since it comprises a fixed sleeve which houses the epicyclic reduction gear, from which the pin for power takeoff projects at one end, with the adapter for the dragging of the winding shaft of the roller shutter splined on the pin.

[0016] The peculiarity of the tubular motor reducer according to the present invention is the incorporation of a "parachute" of inertial type, located at one end of the sleeve, in intermediate position between the adapter and the sleeve.

[0017] More exactly, first the parachute and then the adapter are inserted into the power takeoff pin of the epicyclic reduction gear.

[0018] The "parachute" comprises an opposite pair of circular covers, between which a friction ring is located and tightened. A special toothed wheel freely turns inside the friction ring and is splined on the power takeoff pin of the epicyclic reduction gear. The pin length allows for going through and farther than the pair of covers, so that the adapter can be splined at the end of the pin.

[0019] In a different embodiment of the present invention, the power takeoff pin of the reduction gear does

not feature an extended length and is simply coupled with the special toothed wheel of the "parachute", which in turns features a pin on which the adapter used to drag the winding shaft of the roller shutter is fixed.

[0020] One cover is provided with means used to fix it to the end of the sleeve that houses the epicyclic reduction gear.

[0021] Finally, it must be noted that thanks to the appropriate design, the "parachute" integrated in the tubular motor reducer according to the present invention is capable of operating in the two rotation directions of the special toothed wheel, unlike the ordinary "parachutes" of known type, which usually operate in one direction only.

[0022] This particular design of the "parachute" according to the present invention derives from the fact that the tubular motor reducers must be capable of being indifferently assembled on the right or left end of the winding shaft, in order not to impose any restrictions on the installer who is free of deciding the most appropriate assembling position.

[0023] It appear obvious that the inversion of the end used to apply the tubular motor reducer causes the inversion of the rotation directions of the winding shaft, which correspond to the up and down travels of the roller shutter.

[0024] For clearer explication purposes, the description of the model according to the present invention continues with reference to the enclosed drawings whereby:

- Fig. 1 is an exploded axonometric view of the tubular motor reducer integrated with a "parachute" according to the present invention and according its first preferred embodiment;
- Fig. 2 is a cross-section with an axial plane of the "parachute" and the adapter, both assembled and fixed on one end of the motor reducer;
- Fig. 3 is the transversal cross-section of Fig. 2 with the plane III-III;
- Fig. 4 is an exploded axonometric view of the tubular motor reducer integrated with a "parachute" according to the present invention and a different constructive version;
- Fig. 5 is a cross-section with an axial plane of the "parachute" and the adapter, in the version shown in Figure 5, both assembled and fixed on one end of the motor reducer;
- Fig. 6 is the transversal cross-section of Fig. 5 with the plane VI-VI; Figs. 7 and 8 are a view of the same section of the special toothed wheel and the friction disk contained in the "parachute", but refer to a different operating moment of the "parachute": a passive moment in the rest phase and an active moment in the working phase.

[0025] With reference to the above mentioned figures the tubular motor reducer according to the present

invention comprises a fixed cylindrical sleeve (1) which houses an epicyclic reduction gear and from which the power takeoff pin (2) projects at one end, on which the adapter (3) which drags the winding shaft of the roller shutter is splined (not shown in the enclosed figures).

[0026] The peculiarity of the tubular motor reducer according to the present invention is the incorporation of a "parachute" of inertial type (4) fixed at one end of the sleeve (1) in intermediate position between the adapter (3) and the sleeve.

[0027] The "parachute" (4) comprises an opposite pair of circular covers (4a), between which a friction ring (4b) is located and tightened. A special toothed wheel (5) freely turns inside the friction ring and is splined on the power takeoff pin (2) of the epicyclic reduction gear. The length of the pin (2) allows for going through and farther than the pair of covers (4a), so that the adapter (3) can be splined at the end of the pin (2). The adapter is provided with a hub (3a) with two faceted sections, which exactly houses the pin (2) provided with two opposite plane faces (2a).

[0028] The adapter (3) is permanently fixed at the end of the pin (2) by means of a screw (6) with washer (7) that is screwed into a threaded hole (2b) located in the centre of the ending section of the pin (2).

[0029] The fixing of the adapter (3) with the screw (6) indirectly determines the permanent stop of the "parachute" (4) which remains blocked between the adapter (3) and the sleeve (1).

[0030] The two covers (4a) are tightened from opposite parts against the intermediate friction disk (4b) by means of peripheral screws (4c). One of the covers (4a) is provided with means used to fix it at the end of the sleeve (1) which houses the epicyclic reduction gear.

[0031] In particular, the cover (4a) features a tubular configuration with suitable diameter in order to be externally inserted on the sleeve (1) for a short section, which ends with a grid bottom (1b) from which the power take-off pin (2) centrally projects.

[0032] The centring of the cover (4a) on the sleeve (1) is favoured by an annular series of front teeth (4d) located inside the cover (4a) and designed to match with the corresponding slots (1c) of the grid bottom (1b).

[0033] The free extraction of the cover (4a) from the sleeve (1) is prevented by some radial screws (8).

[0034] With particular reference to Figures 7 and 8, it must be noted that the toothed wheel (5) is exactly centred and freely slides inside the friction disk (4b). The perimeter of the toothed wheel (5) features a regularly spaced series of identical compartments (9) with each compartment housing a cylindrical body (10), whose diameter is the same as the maximum depth of each compartment (9), in which each body is exactly housed.

[0035] More exactly, each cylindrical body (10) is housed inside a semicircular housing (9a) located in the centre of each compartment (9), which is preceded and followed by two identical symmetrical arched chamfers (9b), inclined towards the centre of the semicircular

housing (9a).

[0036] The internal edge of the friction disk (4b) features a loop (11) with symmetrical profile, which extends for a double length with respect to each compartment (9) of the wheel (5) and has a constant depth, lower than the diameter of the cylindrical bodies (10). In case of centrifugation, the cylindrical bodies (10) fit against the loop (11) and engage between one end of the loop (11) and one chamfer (9b) of the compartments (9) - as shown in Figure 8. This determines the origin of a braking action exercised by the friction disk (4b) against the wheel (5) and thus indirectly on the winding shaft, on which the wheel (5) is splined.

[0037] Number (4c) indicates the slots located on the friction disk (4b) for the passage of the screws (4c) which tighten the covers (4a) against the disk (4b).

[0038] The constructive version of the model according to the present invention shown in Figures 4, 5 and 6 differs from the model illustrated above only because it adopts a special "parachute" (40), especially designed for this specific application.

[0039] The adoption of the special "parachute" (40) does not impose a longer length of the power takeoff pin (2) of the reduction gear. In this way it is not necessary to design two different models of reducer, that is a - as it currently occurs - and another model capable of simultaneously dragging the wheel (5) of the "parachute" and the adapter (3), as provided in the present invention.

[0040] The "parachute" (40) is housed inside a sleeve (12) whose diameter allows for externally inserting it on the sleeve for a short section.

[0041] The centring of the sleeve (12) on the sleeve (1) is favoured by an annular series of front teeth (12a) located inside one end of the sleeve (12) and designed to match with the corresponding slots (1c) of the grid bottom (1b) of the sleeve (1).

[0042] The free extraction of the sleeve (12) from the sleeve (1) is prevented by some radial screws (8).

[0043] The "parachute" (4) comprises an opposite pair of circular covers (40a), between which a friction ring (40b) is located and tightened. A special toothed wheel (50) freely turns inside the friction ring and is splined on the power takeoff pin (2) of the epicyclic reduction gear. The tightening pressure of the covers (40a) against the friction disk (40b) is provided by means of a spring (13) positioned between the parachute (40) and the cover plug (14) of the sleeve (12). The plug (14) is inserted and blocked on the opening of the sleeve (12) by means of an elastic ring (15) which is housed inside an annular groove located on the internal edge of the opening.

[0044] The wheel (5) only differs from the wheel (5) because it features a hub on which a second pin (20) is fitted and aligned with the pin (2), projecting from the central hole (14a) of the plug (14) in order to be inserted into the hub (3a) of the adapter (3).

[0045] The adapter (3) is permanently fixed to the end

of the pin (20) by means of a screw (6) with washer (7), screwed into a threaded hole (20b) provided in the centre of the ending section of the pin (20).

Claims

1. Tubular motor reducer for winding roller shutters integrated with an anti-fall device of inertial type, characterised in that it comprises:

- a tubular motor reduced of the type made up of a cylindrical sleeve (1) which houses an epicyclic reduction gear and from which the power takeoff pin (2) projects;
- an adapter (3) to be inserted and fitted inside the winding shaft of the roller shutter;
- a "cushioned parachute" (4 or 40) of inertial type, located between the adapter (3) and the tubular motor reducer, fixed to the sleeve (1) on the end from which the pin (2) projects, on which the turning wheel (5 or 50) of the "parachute" is splined.

2. Tubular motor reducer for winding roller shutters integrated with an anti-fall device of inertial type, according to the previous claim, characterised in that one (4a) of the fixed covers of the "parachute" (4) features a tubular configuration with suitable diameter in order to be externally inserted for a short section on the sleeve (1), which ends with a grid bottom (1b) from which the power takeoff pin (2) centrally projects; it being provided that an annular series of front teeth (12a) is located inside the cover (4a), capable of matching to the corresponding slots (1c) of the grid bottom (1b).

3. Tubular motor reducer for winding roller shutters integrated with an anti-fall device of inertial type, according to the previous claims, characterised in that the cover (4a) of the "parachute" (4) is fixed to the sleeve (1) with radial screws (8).

4. Tubular motor reducer for winding roller shutters integrated with an anti-fall device of inertial type, according to claim 1, characterised in that the "parachute" (4) comprises:

- an opposite pair of circular covers (4a), between which a friction ring (4b) is located and tightened;
- a special wheel (5) which freely turns inside the friction disk (4b) and features a regularly spaced series of identical compartments (9) with each compartment housing a cylindrical body (10), whose diameter is the same as the maximum depth of each compartment (9), which is exactly housed in a semicircular housing (9a) located in the centre of each compart-

ment (9), which is preceded and followed by two identical symmetrical arched chamfers (9b), inclined towards the centre of the semicircular housing (9a);

- a friction disk (4b) whose internal edge features a loop (11) with symmetrical profile, which extends for a double length with respect to each compartment (9) of the wheel (5) and has a constant depth, lower than the diameter of the cylindrical bodies (10).

5. Tubular motor reducer for winding roller shutters integrated with an anti-fall device of inertial type, according to claim 1, characterised in that the "parachute" (40) comprises:

- an opposite pair of circular covers (40a), between which a friction ring (40b) is located and tightened;
- a special wheel (50) which freely turns inside the friction disk (40b) and features a regularly spaced series of identical compartments (9) with each compartment housing a cylindrical body (10), whose diameter is the same as the maximum depth of each compartment (9), which is exactly housed in a semicircular housing (9a) located in the centre of each compartment (9), which is preceded and followed by two identical symmetrical arched chamfers (9b), inclined towards the centre of the semicircular housing (9a);
- a friction disk (40b) whose internal edge features a loop (11) with symmetrical profile, which extends for a double length with respect to each compartment (9) of the wheel (5) and has a constant depth, lower than the diameter of the cylindrical bodies (10);
- a sleeve (12) which houses the parachute (40), whose diameter allows for externally inserting it on the sleeve (1), featuring an annular series of front teeth (12a) located inside one end and designed to match with the corresponding slots (1c) of the grid bottom (1b) of the sleeve (1), to which the sleeve (12) is fixed with radial screws (8);
- a spring (13) which is positioned between the parachute (40) and the cover plug (14) of the sleeve (12), with the plug (14) inserted and blocked on the opening of the sleeve (12) by means of an elastic ring (15) which is housed inside an annular groove located on the internal edge of the opening;
- a wheel (50) featuring a hub on which a second pin (20) is fitted and aligned with the pin (2), projecting from the central hole (14a) of the plug (14) in order to be inserted into the hub (3a) of the adapter (3).

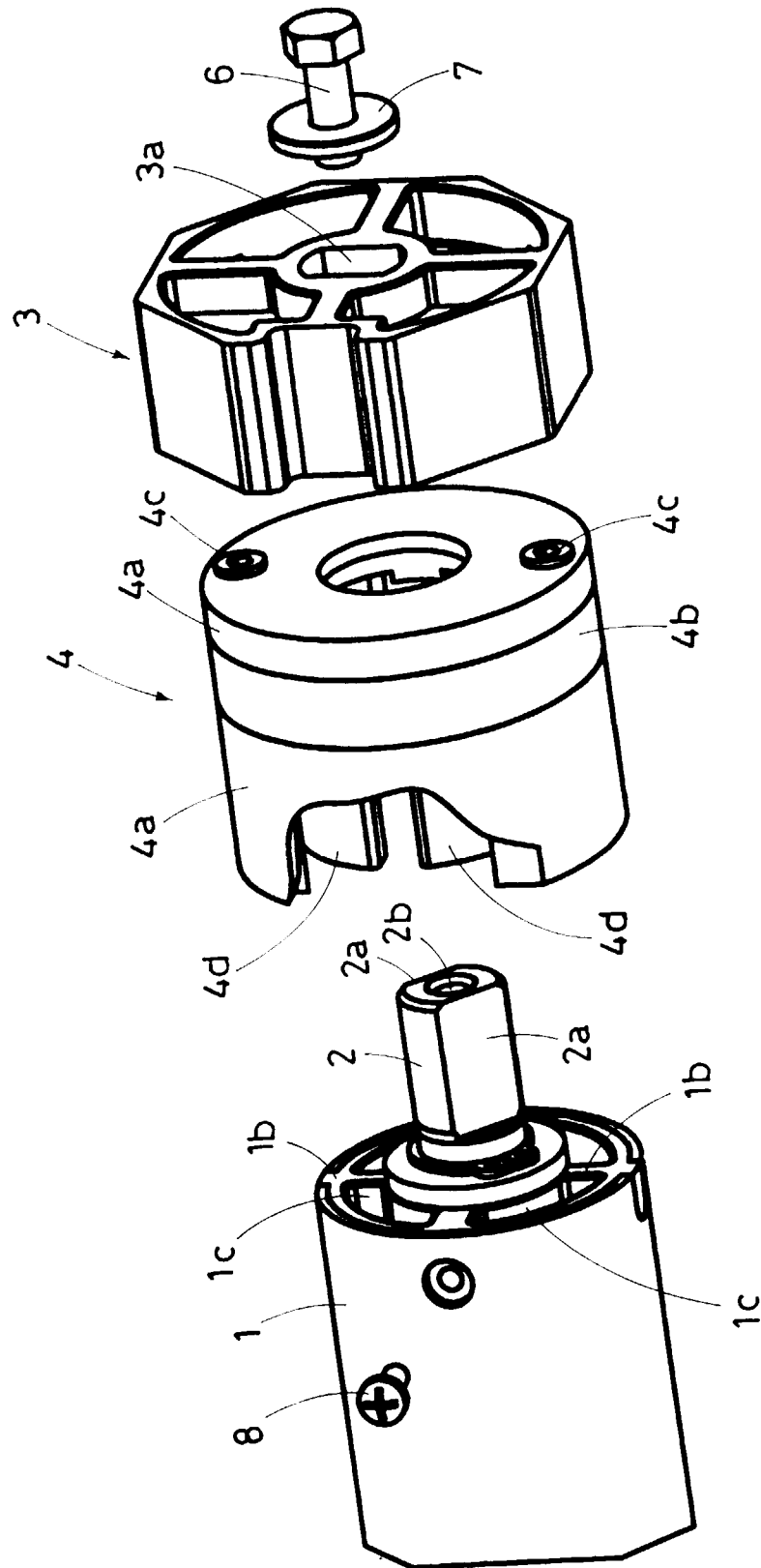


FIG. 1

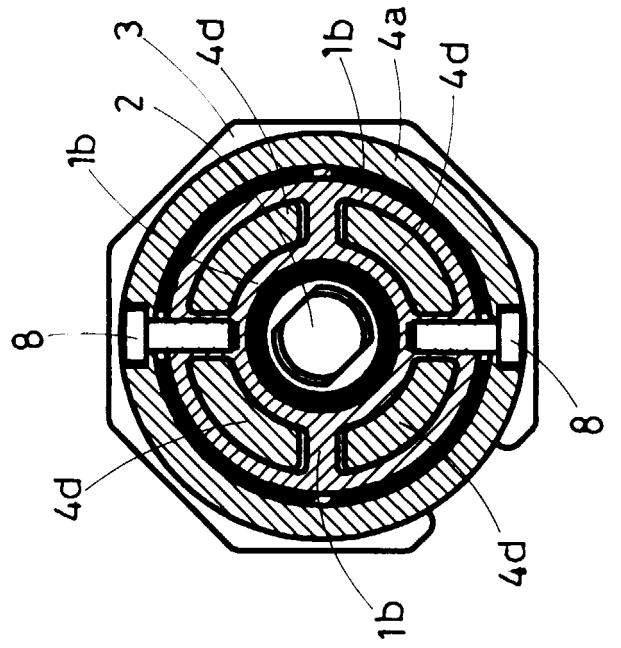


FIG. 3

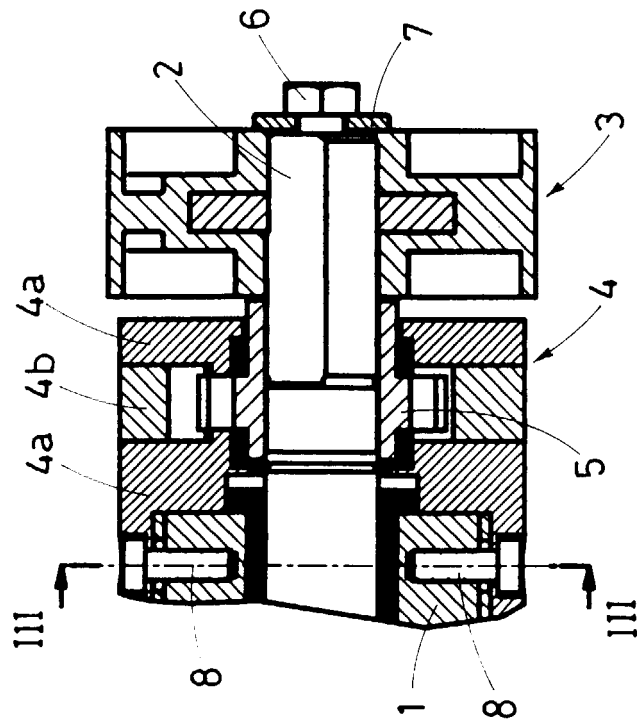


FIG. 2

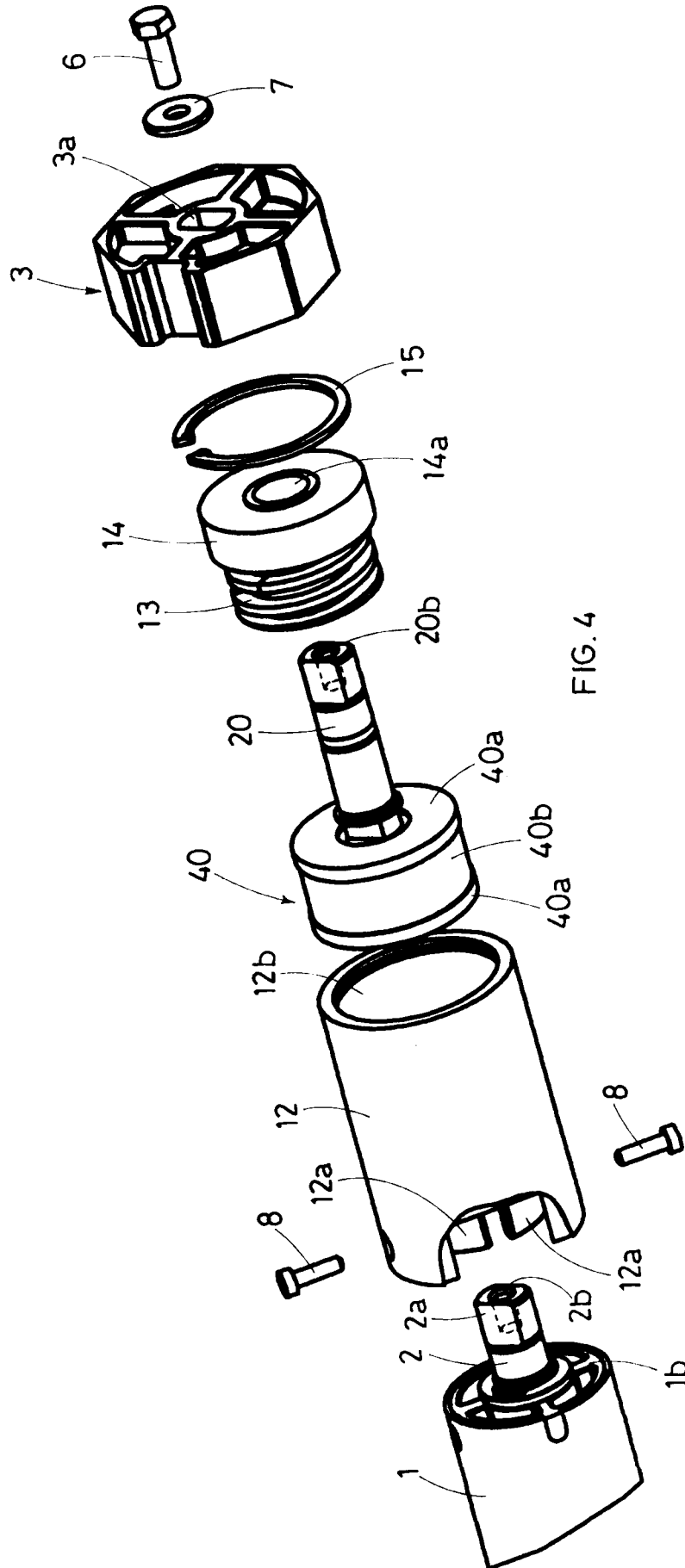


FIG. 4

