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(71) Applicant: **GAPOSA S.r.l.**
I-63023 Fermo (AP) (IT)

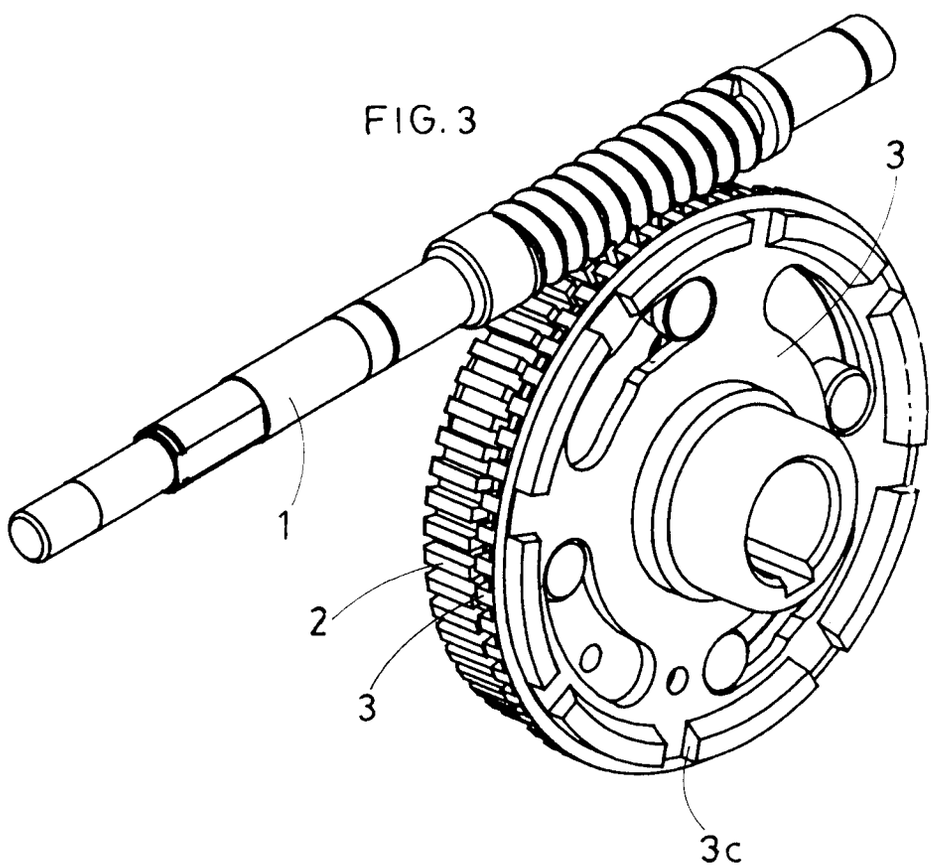
(72) Inventor: **Postacchini, Dante**
Fermo (AP) (IT)

(74) Representative: **Baldi, Claudio**
Piazza Ghislieri, 3
60035 Jesi (Ancona) (IT)

(54) Improved accident prevention device for stopping motorised roller shutters

(57) This invention concerns an accident prevention device for stopping motorised rolling shutters consisting of a gearmotor whose worm screw (1) engages simultaneously with two adjacent gear wheels (2,3), one (2) designed to drive the winding shaft and the other (3) to activate the stopping means of the shaft when the hold between the teeth of the first wheel (2) and the worm screw (1) accidentally fails.

FIG. 3



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Description

This patent application concerns an improved accident prevention device for stopping motorised rolling shutters. The device in question is designed to automatically stop the shutter if the coupling between the teeth of the worm screw and that of the wheel splined directly on the rolling shutter shaft in the gearmotor should fail for any unexpected, accidental reason or wear of the gears causing said shutter to fall.

The device in question is designed to improve similar devices of the type consisting of a single worm screw engaging with two adjacent gear wheels, one being the main wheel and the other the secondary wheel in that the first drives the movement while the second, which rotates with respect to the first, activates the stopping means in the case of an emergency.

These two wheels rotate together as a single wheel provided the same engage with a worm screw.

Should the main wheel and the worm screw accidentally disengage for any reason , the secondary wheel which remains engaged with the worm screw, will start turning with respect to the main wheel.

In this type of accident prevention device, the rotation between the two wheels is in fact used as a fault signal and simultaneously as a signal to activate the mechanical stopping means of the shutter winding shaft.

A device of this kind is described in patent DE-A-34 27 505, where both the gear wheels are splined on the shutter winding shaft where the secondary wheel is provided with an annular series of holes through which a corresponding series of pins positioned between the pair of wheels and subject to the thrust of relevant expelling springs, pass in the case of an emergency stop.

Obviously the perfect alignment between said pins and the holes of the secondary wheel occurs only when the secondary wheel rotates with respect to the main wheel; when said pins are pushed through the corresponding holes of the secondary wheel, the tips of the same touches and wedges into corresponding hollows on the internal face of the gearmotor casing so that the secondary wheel is stopped abruptly together with the shutter winding shaft, since, as mentioned previously, the secondary wheel is splined on the shaft.

The main problem encountered on this type of stopping devices is that the secondary wheel remains engaged with the worm screw even after the stopping means have been activated so that although the worm screw continues to be subject to a drive moment, it is also stopped abruptly together with the secondary wheel with which the same engages.

This is not only a critical operating condition for the gearmotor's electric motor but also causes another problem in that the stopping means which stop the secondary wheel not only have to support the violent impact due to stoppage of the falling shutter but also the strain transmitted to the same by the worm screw via the secondary wheel, on which the drive moment supplied by the worm screw is discharged.

The scope of this invention is to perfect said stopping devices so that the secondary wheel is automatically disengaged from the worm screw when the means which stop the secondary wheel and consequently the shutter winding shaft, are activated.

The device according to the invention has been designed in this prospective, where the worm screw of the gearmotor engages simultaneously with a pair of adjacent gear wheels which are not however splined to the shutter winding shaft since the drive from the gearmotor to the above shaft occurs by means of a flange fixed on the internal face of the main wheel provided with a hub splined on the shutter winding shaft.

The secondary wheel is in fact centred on said hub and can rotate and translate.

The secondary wheel is moreover provided with one or more curved slots characterised by a centre groove, in which the enlarged head of the same number of stopping pins projecting from the face of said flange, attaches.

More precisely the longitudinal axis of these curved slots consists of an arch whose centre coincides with that of the two adjacent wheels.

A series of annular springs being provided between the flange and secondary wheel which exercise on the latter an axial thrust that tends to detach the secondary wheel from the main wheel.

This detachment can however only occur if the enlarged head of the stopping pins disengages from the centre groove of the slot with which the same is coupled.

This release is possible thanks to the fact that the width of the curved slots on the secondary wheel is greater than the diameter of the enlarged head of the stopping pins, which is however greater than the space of the middle groove of each slot.

Consequently, if the main wheel accidentally becomes disengaged from the worm screw, the secondary wheel which is still engaged with the worm screw is rotated with respect to the main wheel and consequently also with respect to the flange fixed on the internal face of the main wheel.

It is only then that the enlarged head of the stopping pins can detach and disengage from the centre groove of the slots of the secondary wheel which springs axially forward sliding along the hub of the flange until it disengages from the worm screw. The secondary wheel is stopped thanks to front teeth on the external face which wedge into teeth on the internal face of the gearmotor casing, against which said secondary wheel is pushed by the above springs.

It is evident that stoppage of the secondary wheel will correspond to stoppage of the flange whose free rotation will be impeded by the enlarged head of the stopping pins engaged in the slots of the secondary wheel.

It is also evident that stoppage of the flange will correspond to stoppage of the shutter winding shaft in that the hub of the flange is splined on the shaft.

For major clarity the description of the invention continues with reference to the enclosed drawings intended purely for purposes of illustration and not in a limiting sense where:

- fig. 1 is an exploded axonometric view of all the different components of the stopping device according to the invention.
- fig. 2 is an axonometric view of the stopping device according to the invention assembled in normal operating position.
- fig. 3 is an axonometric view of the stopping device according to the invention, assembled and in the emergency stop position.
- fig. 4 is a cross-section - with an orthogonal plane to the worm screw and passing through the centre of the pair of adjacent gear wheels - of the device in question in normal operating position.
- fig. 5 is a cross-section - on an orthogonal plane to the worm crew and passing through the centre of the adjacent pair of gear wheels - of the device in question in its emergency stop position.

With reference to the above figures, the stopping device in question is of the type consisting of a gearmotor whose worm screw (1) engages simultaneously with two adjacent gear wheels, namely a main (2) and a secondary (3) wheel; the first (2) rotates the winding shaft of the shutter and the second (3) stops said shaft if the first wheel (2) accidentally disengages from the worm screw (1).

Neither of these wheels are splined on the shaft (not illustrated in the enclosed drawings) in that the transmission of the wheel (2) movement of the shaft occurs by means of a flange (4) provided with a hub (4a) splined on the shaft.

This flange (4) is fixed, and in the case in question screwed, on the internal face (2a) of the main wheel (2), while the secondary wheel is centred on the hub (4a) and can rotate and translate axially with respect to the hub.

The secondary wheel (3) is provided with a pair of diametrically opposing identical slots (3a) having a curved profile and provided with a centre groove (3b) of reduced width, into which the enlarged head (5a) of the stopping pins (5) fixed on the flange (4) and projecting from the latter on the part interfaced to the internal side of the secondary wheel (3) which is provided with front teeth (3c) on its external face, namely that facing the opposing wall of the casing (6) of the gearmotor, engage.

A series of annular compressed springs (7) being provided between the flange (4) and the secondary wheel (3) which constantly exercise an axial thrust on the wheel (3) tending to detach the latter from the main wheel (2).

As previously mentioned above, this detachment between the main wheel (2) and the secondary wheel (3) may occur only if the stopping pins (5) slide in the slots (3a) and project from the centre groove (3b) so that the enlarged heads (5a) may house in the slots (3a).

This occurs automatically whenever the worm screw (1) disengages accidentally from the main wheel (2) but not from the secondary wheel (3), which continues to be rotated and starts a relevant motion with respect to the wheel (2) and consequently with respect to flange (4), integral to the wheel (2).

When the secondary wheel (3) detaches from the main wheel (2) due to the thrust of the springs (7), the front teeth (3c) of the wheel (3) strike and are wedged against the internal wall of the casing (6) provided with teeth (6a) designed to engage with the front teeth (3c) of the wheel (3) whose free rotation is thrust prevented.

The stoppage of the wheel (3) corresponds to the stoppage of the flange (4) and consequently that of the shutter winding shaft on which the flange (4) hub (4a) is splined.

In particular the rotation of the flange (4) is stopped by the stopping pins (5) whose enlarged head (5a) is engaged and stopped in the slots (3a) of the wheel (3).

In the preferred embodiment of the invention illustrated in the above drawings, the secondary wheel (3) is provided with a second pair of curved slots (8) identical to the slots (3a) but without centre groove (3b).

It being provided that corresponding pins (9) identical to the stop pins (5) but without enlarged head are fitted and slide within this pair of slots (8).

These pins (9) in fact do not perform a hooking action with respect to the secondary wheel (3) but simply assist the pins (5) during the emergency stopping phase in the sense that said pins (9) support, together with the pins (5), the stress due to the abrupt stopping of the wheel (3) when the pins (5 and 9) slide in the corresponding slots (3a and 8) and abut simultaneously against the bottom of the corresponding housing slot.

In the preferred embodiment of the invention illustrated in the enclosed drawings, the flange (4) is fixed to the main wheel (2) by means of the screws (10) which fix the pins (5 and 9) to the flange (4).

For this purpose, the pins (5 and 9) are provided with an axial threaded hole in which the screws (10) which pass through holes (11) on the wheel (2) and on the flange (4), engage. Finally mention is made that in an alternative embodiment of the invention, the main wheel (2) may be splined directly on the shutter winding shaft, so that the flange (4) is no longer required, provided the springs (7) and the stopping pins (5) with enlarged head (5a) are used.

In fact, in the preferred embodiment of the invention illustrated in the drawings, the flange (4) is used only for cost related reasons, since the main wheel (2) is generally made of expensive brass, while the worm screw is made of steel. The realisation of the wheel (2) in brass complete with hub, would be too expensive so that use of the steel hub (4a), which is an integral part of the steel flange (4), which is fixed to the wheel (2) made of ex-

pensive brass, has been preferred. Even if this description refers to rolling shutters, it is evident that the accident prevention device in question may also be used in the same way and with the same efficiency, as an emergency stop, for any rotating winding shaft, whether or not the element to wind is a shutter rather than a blind, a wire, chain or cable etc.

Claims

1. An improved accident prevention device for stopping motorised rolling shutters of the type consisting of a gearmotor whose worm screw (1) engages simultaneously with a main (2) and a secondary (3) wheel, adjacent to the first and positioned at a short distance from one of the internal walls of the casing (6) of the gearmotor, characterised by a flange (4) provided with a hub (4a) splined to the shutter winding shaft and fixed to the internal face (2a) of the main wheel (2), while the secondary wheel (3) is centred on the hub (4a) and can rotate and translate; it being provided that the secondary wheel (3) has one or more slots (3a) with curved profile and a middle groove (3b) having reduced width, in which the enlarged head (5a) of the same number of stopping pins (5) is hooked, the same being fixed to the flange (4) and projecting from the latter on the side interfaced to the internal side of the secondary wheel (3), which on its external face is provided with front teeth (3c) designed to engage with the teeth (6a) on the casing (6) on the wall facing the wheel (3); it also being provided that between the flange (4) and the secondary wheel (3) there are a series of annular compressed springs (7) which constantly exercise an axial thrust on the wheel (3) thereby tending to draw the latter away from the main wheel (2).

2. An improved accident prevention device for stopping motorised rolling shutters according to the previous claim characterised in that the secondary wheel (3) is provided with one or more curved slots (8) - identical to slots (3a) but without centre groove (3b) - in which the pins (9) identical to the stop pins (5) but without enlarged head, are fitted and slide.

3. An improved accident prevention device for stopping motorised rolling shutters according to the previous claims characterised in that the flange (4) is fixed to the main wheel (2) by means of the screws (10) which fix the pins (5 and 9) to the flange (4); it being provided that said pins (5 and 9) have an axial threaded hole in which the screws (10) that pass through the holes (11) on the wheel (2) and on the flange (4), engage.

4. An improved accident prevention device for stopping motorised rolling shutters according to the previous claims characterised in that in an alternative embodiment, the flange (4) provided with hub (4a) is realised in a single piece with the main wheel (2).

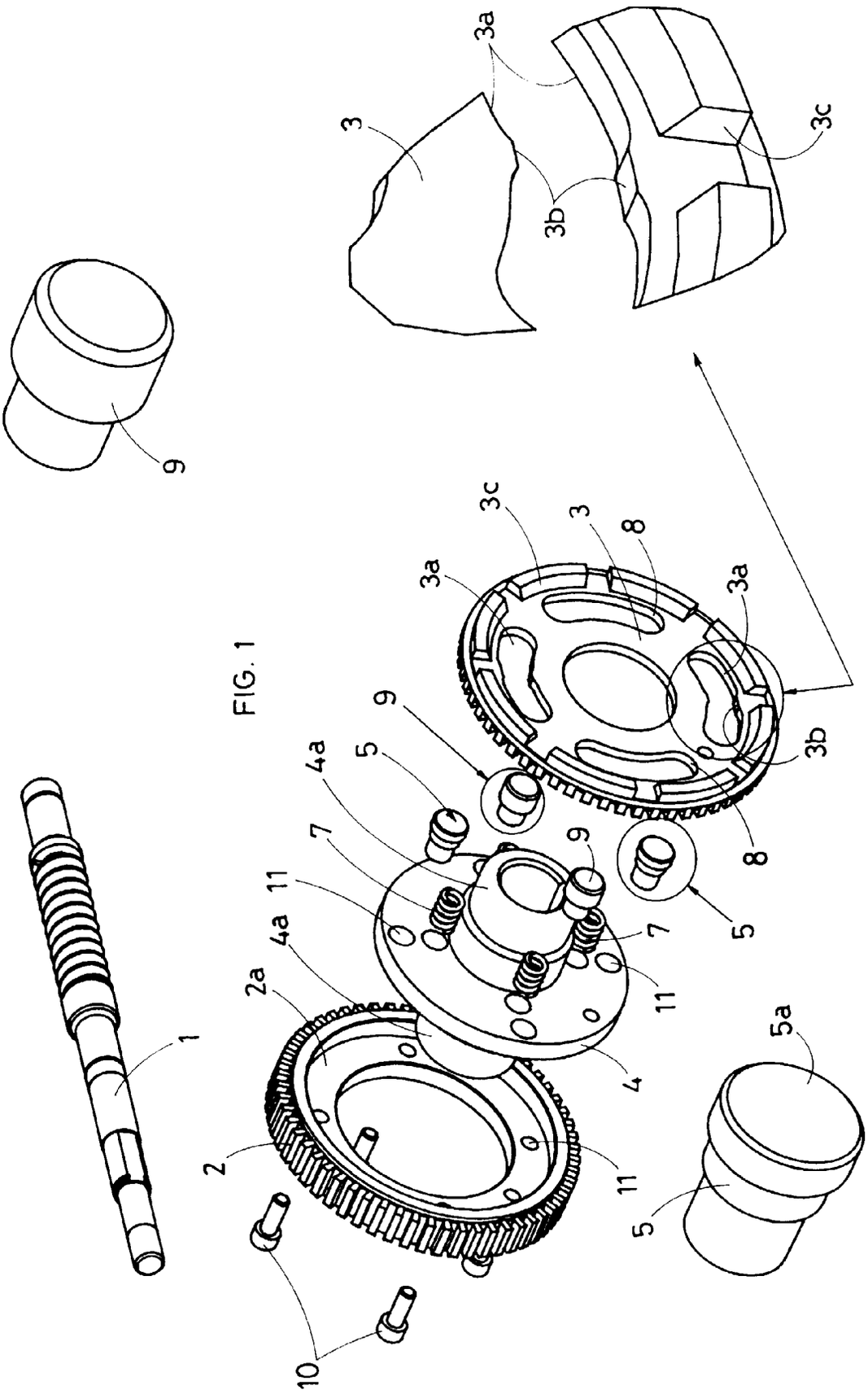

FIG. 1

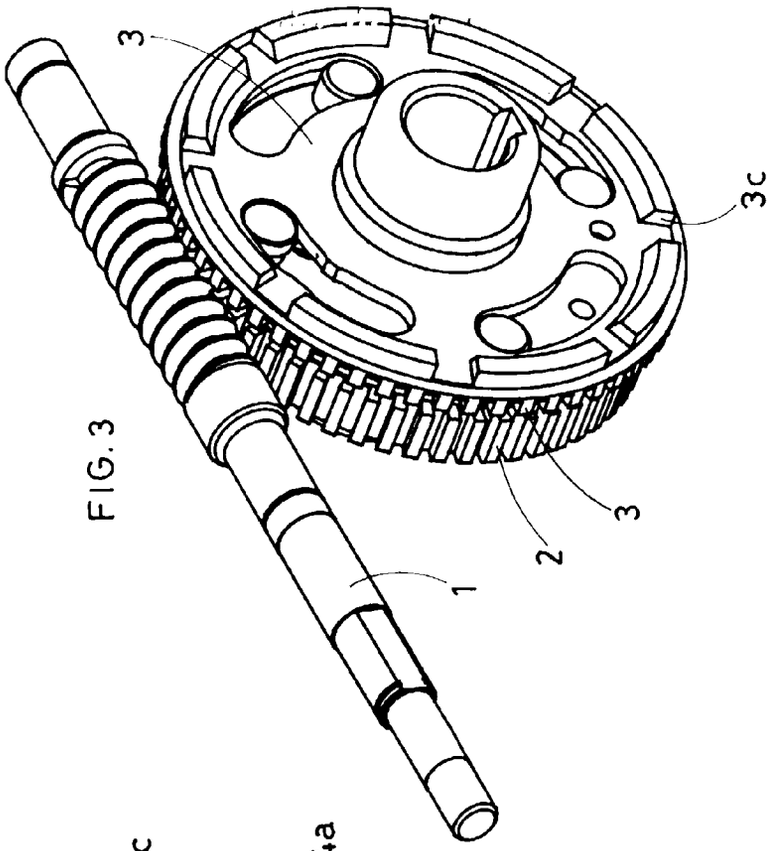

FIG. 3

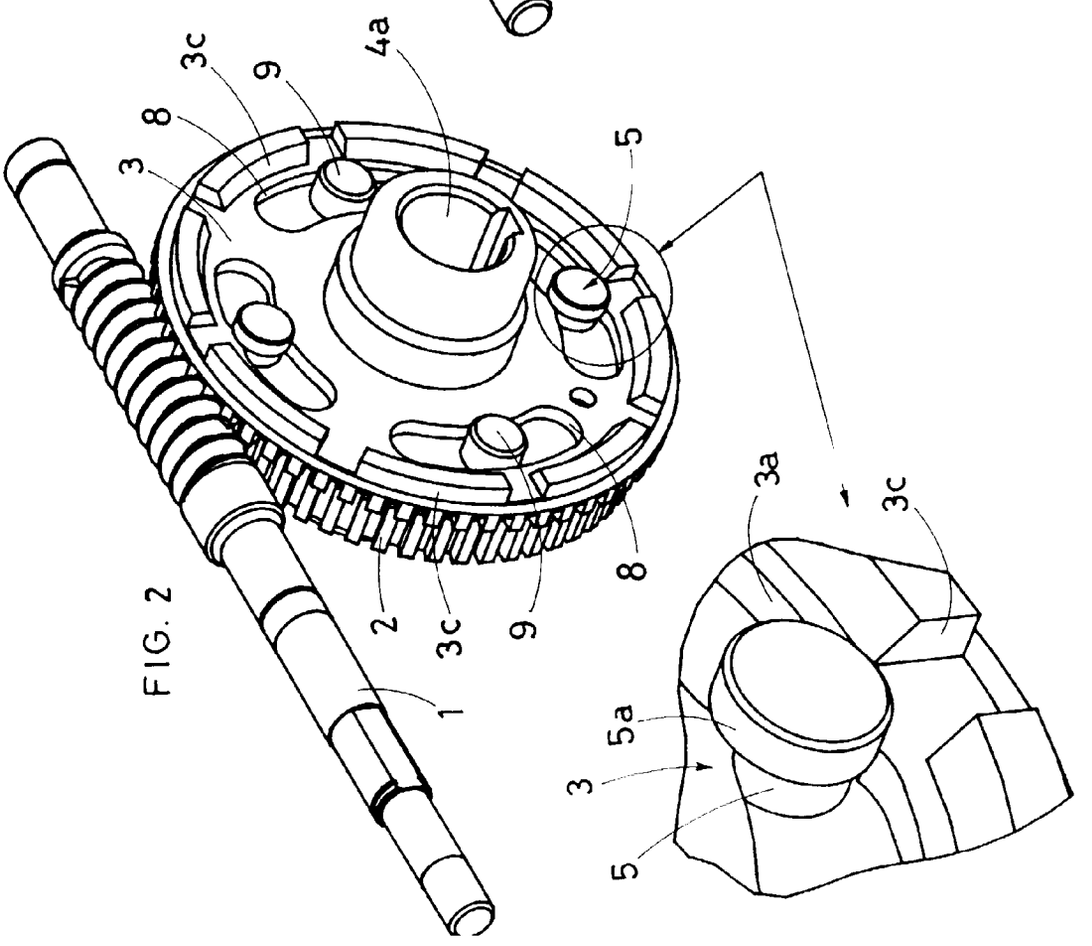

FIG. 2

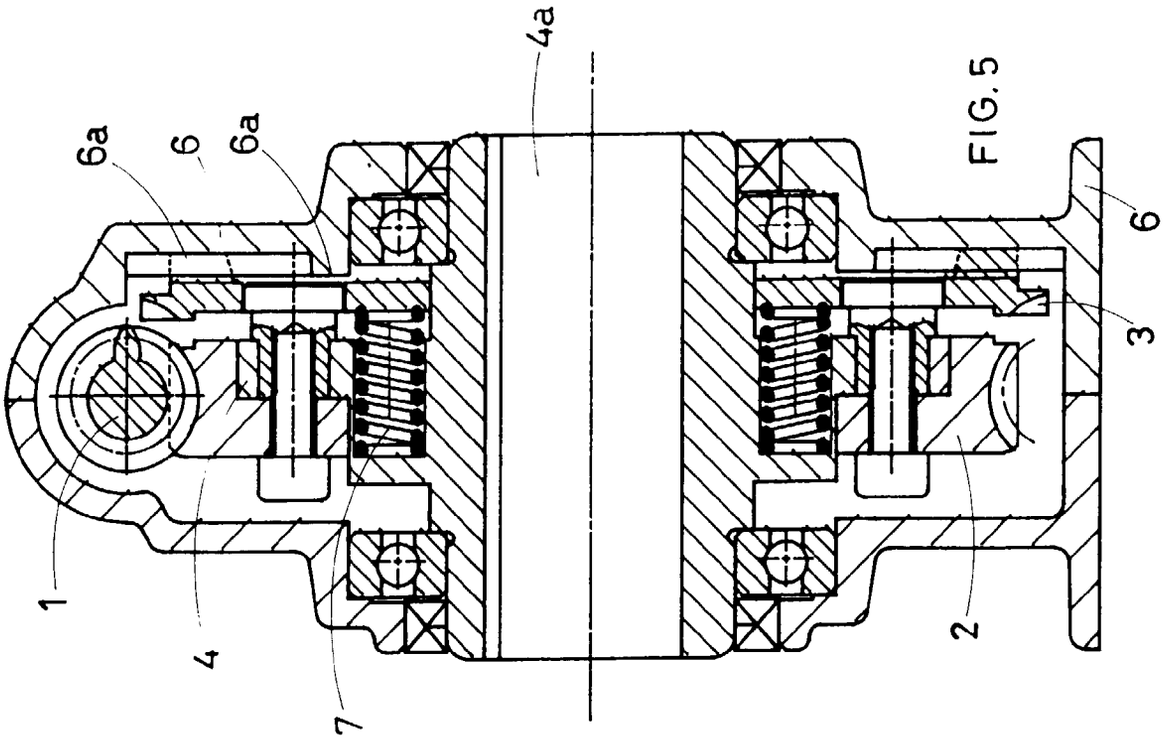

FIG. 5

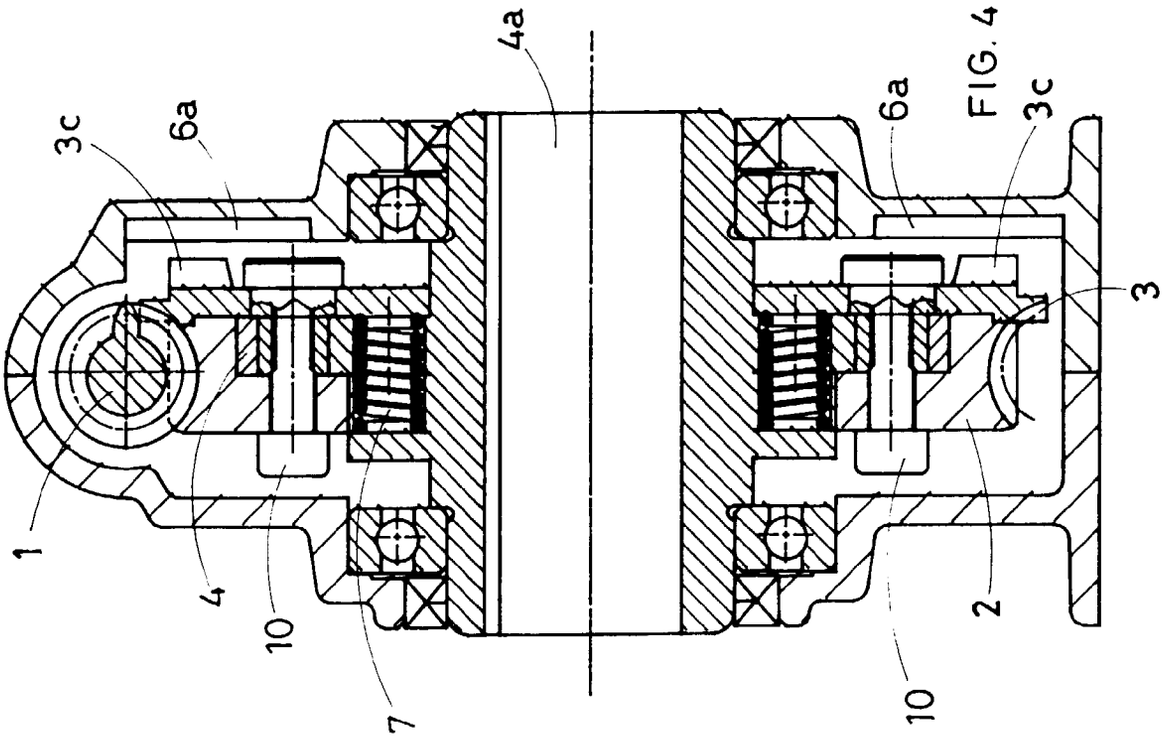

FIG. 4