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(54) Mechanical device for the self-recording of the end of stroke slider, when motorised shutters are being raised.

(57) The instant invention consists of a mechanical device, to be installed on motorised shutters, for the self-recording of the end of stroke slider, which stops the geared motor when the shutter reaches its top dead centre.

The device in question essentially comprises two limit microswitches working together with their respective sliders, screwed onto two threaded rods, one on the right and one on the left, made to rotate by the same geared motor which sets the shutter in motion.

Each threaded rod is made to rotate by its own drum, coupling of which with the corresponding gear-motor can take place automatically by the simple reverse of the geared motor, due to a special and ingenious mechanism.

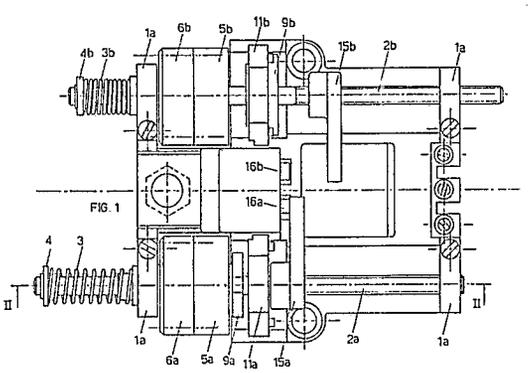

FIG. 1

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Description

This patent application for an industrial invention concerns a mechanical device for the self-recording of the end of stroke slider, when motorised shutters are being raised, with the result that it is no longer necessary to set said slider, which stops the geared motor at the end of the upward stroke of the shutter; currently the slider is set by means of various trial and error attempts on the part of the installer which is a considerable waste of time.

For a better understanding of the problem, which the invention intends to solve, we feel it is worthwhile to refer to the structural configuration of a shutter equipped with a geared motor to set it in motion. Said geared motors are normally installed at the centre of the horizontal shaft, rotation of which brings about the winding-up or vice-versa the winding-down of the shutter, hooked at the top to two or more spiral springs which, being loaded during the downward stroke of the shutter, then make the subsequent upward stroke easier, by reducing the effort required for raising either by the operator or the electric motor.

Installation of the geared motor takes place when the shutter is fully wound down and in any case, is made very easy for the operator, who encounters no obstacles in reaching and working on the shaft, which is left completely uncovered by the shutter.

In these conditions, it is also simple to establish the correct position for the regulation register, which has to intervene on a limit microswitch to stop the electric motor, when the shutter is down. On the other hand, it is currently impossible to immediately set the other regulation register, which stops the motor at the end of the upward stroke of the shutter, given the fact that the shutter blocks access to the register in that it is enclosed, together with the geared motor and the cylindrical spring housings, within the wound-up shutter .

These regulation registers are actually composed of two opposite limit microswitches, the position of which is adjustable and against which there beats a slider screwed along a threaded rod, made to rotate, first in one direction and then in the opposite direction, by the same geared motor which activates the shutter.

In other cases, the limit microswitches are fixed and they are struck by two adjustable screws which protrude from opposite sides of the aforementioned slider.

However, in both cases, it is impossible to gain access to the regulation registers when the shutter is wound up; therefore, currently it is necessary to set the end of stroke register which intervenes at the top dead centre, by trial and error; this register being positioned when the shutter is completely wound down, at a different point each time by the installer,until the exact position has been identified with subsequent adjustments.

The aim of the instant invention is to eliminate this setting phase by trial and error, having designed a mechanical device, thanks to which, it is possible to obtain self-recording of the end of stroke slider which stops the geared motor, when the shutter has reached its top dead centre.

The device, according to the invention, is based on the use, for each of the two end of stroke sliders, of a coupling joint, composed of a gear-motor, which can turn idle around the threaded rod, to which each slider is helically coupled and of a drum integral to the aforementioned threaded rod, which is constantly subjected to the returning action of a prestressed spring, which tends to push the drum against said gear,and coupling between them results in the transmission of motion from the first to the second following the coupling of their respective teeth.

A diaphragm positioned between the gear and the drum can stop the latter, integral to the threaded rod, from translating under the thrust of the returning spring, towards the gear-motor carrying out the coupling through which the transmission of motion is effected, from the gear to the drum and from here to the threaded rod, on which consequently the slider starts to traslate.

Said diaphragm has a large central opening which can only be axially crossed by the drum, when the two radial lobes protruding from the latter on diametrically opposite sides, have taken up an angular position, so as to arrive at two through notches, provided for the purpose along the contour of the central opening of the diaphragm; when this is the case, the two aforementioned lobes cross the notches while the drum moves beyond the opening of the diaphragm.

The radial lobes protruding from the drum can assume two different positions, with respect to the diaphragm :

a) a resting position, in which the two lobes are housed within two nests provided along the contour of the central opening of the diaphragm : in this position, while the teeth of the drum are inserted through the opening of the diaphragm, they are not coupled to the teeth of the gear-motor, positioned on the other side of the diaphragm;

b) a programming position, in which each of the two lobes is free to slide along a section of annular track provided along the contour of the diaphragm opening and ending in the notch which allows the lobe to pass from one part of the diaphragm to the other : in this position, the teeth of the drum have moved closer to the teeth of the gear-motor so that they are coupled together in such a way as to allow the transmission of motion in one direction of rotation only, thanks to the special shape of the teeth of the drum, which in this way, acts as a free-wheel.

The transmission of motion from the gear to the drum only takes place when the former turns in such a direction as to drive the radial lobes of the drum along the annular track of the diaphragm towards the

notch at the end of the track; once the notch has been reached, the drum is free to penetrate completely within the toothed nest in the gear-motor, making coupling with the gear-motor totally stable.

That being stated, the description now follows of the way in which the device according to the invention, allows automatic regulation of the end of stroke register which stops the geared motor when the shutter has reached its top dead centre.

When the shutter is fully wound down and the device is easily accessible to the operator, two operations should be carried out :

I) - Disengage from the resting position described above, the two lobes of the drum, which sets the threaded rod in rotation, on which rod there translates a slider which has to intervene on the limit microswitch, when the shutter has reached its bottom dead-centre; once the two lobes have been disengaged from their resting position, they are moved to the notches provided on the contour of the opening of the diaphragm, in between the gear-motor and the drum, so that the latter can immediately carry out the complete coupling of its own teeth with the teeth on the gear-motor and at the same time, intervene on a limit microswitch which stops the geared motor, when the shutter has reached its bottom dead centre.

II) - Disengage from their resting position, the two lobes of the other drum, which sets the threaded rod in rotation, on which rod there translates the slider, which has to intervene on the limit microswitch when the shutter has reached its top dead centre; once the two lobes have been disengaged from their resting position, they are moved to the programming position and namely; on the annular tracks provided on the contour of the abovementioned diaphragm.

When these two operations have been carried out, the operator only has to activate the geared motor, so as to raise the shutter; when the geared motor rotates it sets the two gears in rotation, which has the effect of making the slider on the first threaded rod, translate; the drum having been manually engaged by the operator by means of the gear-motor.

The second threaded rod is not set in rotation in as much as the drum, set in the programming position and working as a free-wheel cannot transmit motion in this direction of rotation.

When the shutter has reached its top dead centre, the operator reverses the direction of rotation of the geared motor and consequently also reverses the motion of the two gear-motors.

On the first threaded rod the slider also reverses its direction of movement and starts its return stroke which will end exactly when the shutter has reached its bottom dead centre, at the same time as said slider comes to a halt against the limit microswitch, which stops the geared motor.

On the second threaded rod, since the direction of rotation of the gear-motor has been reversed, the transmission of motion from this motor to its drum, set by the operator in its programming position, is effected. After a brief initial angle of rotation by the drum, its radial lobes go into the through notches on the diaphragm, in such a way that the drum can move beyond the diaphragm and be fully coupled with its gear-motor, by means of the thrusting action of the spring.

The threaded rod integral to the drum also translates and consequently the slider mounted onto it, comes to a halt against the limit microswitch which stops the motor when the shutter has reached its top dead centre.

As soon as contact has been made with said limit microswitch, the slider starts to distance itself from the microswitch, because the threaded rod has started to rotate together with the drum, which has moved from its programming position to a position of total coupling with the gear motor, following the reverse of the geared motor.

For further clarity of explanation, the description continues with reference to the attached drawings, reproduced for illustrative and not restrictive purposes, in which :

Fig.1 is a top view of the device according to the invention, in which one of the two drums is represented in its resting position, while the other is represented in its working position, with its relative slider in contact with the limit microswitch concerned ;

Fig.2 is the section of Fig.1 with the II-II plane indicated in Fig.1;

Fig.3 is a view of the diaphragm positioned in between the drum and the gear-motor;

Figs. 4-5-6-7 are sections of Fig.3 with the IV,V,VI and VII planes indicated in Fig .3,

Fig.8 is a view of the gear-motor;

Fig.9 is the section with the IX plane indicated in Fig.8;

Fig. 10 is a view of the drum with its threaded rod;

Figs 11 and 12 are two orthogonal projections of Fig. 10 according to the views XI and XII , indicated in Fig. 10.

It is understood that the device according to the invention, comprises two drums with their threaded rods, two diaphragms, two sliders, two limit microswitches, there being specular inverted profiles for the end sections of the teeth of the drums, for the sections of annular track provided on the edges of the diaphragm openings, for the sliders and for the thread of the threaded rods, of which as previously mentioned, one is on the right and the other on the left.

With reference to the abovementioned figures, the device according to the invention consists of a base (1), on which two parallel threaded rods are mounted (2a and 2b), one on the right and the other on the left, inserted through holes made for the purpose on the sides at the end (1a) of the base (1), said threaded rods (2a and 2b) protruding from the end for a certain length, out of one of the two ends (1a) of the base (1).

Along these ends two prestressed springs (3a and 3b) are inserted which constantly discharge their lifting force onto two spring caps (4a and 4b)

fixed to the end of the two threaded rods.

On the two threaded rods (2a and 2b), two gears (5a and 5b) are inserted the teeth (6a and 6b) of which simultaneously mesh with a crown gear, not shown in the drawing, which is set in rotation by the geared motor which moves the shutter.

On one side of said gears (5a and 5b) is a central housing (7), on the circular surface of which there are a series of grooves (7a), diametrically opposite each other in pairs, within which two ribs (8) are precisely lodged, these ribs running along the external surface of two drums (9a and 9b), inserted on a median knurled section of the threaded rods (2a and 2b).

As shown in Figs 10, 11 and 12, said drums have a circular flange (10), at one end, from which two lobes (11) in a position directly opposite each other protrude, their width being equal to the longitudinal ribs (8) on the same plane as the lobes, said ribs ending at the front in an oblique section. (8a)

In between the gear motors (5a and 5b) and the drums (9a and 9b), two diaphragms are positioned (11a and 11b), each of which, as shown in Figures 3,4,5,6, and 7, has a large central opening (12) which can only be crossed by the drums if the lobes (11) are positioned at the corresponding notches (13) provided for the purpose along the contour of the aforementioned opening (12).

On the side of the diaphragms (11a and 11b) which faces the drums (9a and 9b), on the edges of the opening (12), there are two sections of annular track (13a and 13b) which respectively terminate in the aforementioned notches (13).

On this same side of the diaphragms there are two recesses (14) diametrically opposite each other, where the lobes (11) of the drums, can be firmly installed in their resting position, namely, when the ribs (8) of the drums are not engaged within the grooves (7a) of the central housing (7) of the gear motors (5a and 5b).

If, on the other hand, said lobes (11) are positioned on the tracks (13a and 13b), provided on the diaphragms (11a and 11b), the ribs (8) of the drums are inserted within the grooves (7a) for a very brief section at the front and consequently coupling of the parts takes place at the oblique end section (8a) of the longitudinal ribs (8); this means that if the gear-motor turns in such a direction that the pulling force it exercises is discharged against the aforementioned end section (8a), the axial component of said force, at each contrast, repeatedly causes the drum to move backwards, winning out over the resisting force of the spring inserted on the threaded rod; while, if the direction of rotation is the opposite of the one just described, the drum is made to rotate and consequently, as soon as the lobes (11) reach the notches (13) by sliding along the tracks (13a and 13b), the drum can cross the opening (12) of the diaphragm and be firmly engaged within the housing (7) of its gear-motor, by which it is set in rotation together with its integral threaded rod, thereby starting translation of the slider (15a or 15b) along the rod.

In the light of the above description, with reference to the attached drawings, it is now clear how recording of the two sliders which stop the geared motor each time the shutter reaches one of its two dead centres, takes place.

It is worth noting that the device according to the invention will be supplied by the manufacturer so that both the sliders are already set to beat against the limit microswitches.

Once the shutter is completely wound down, the installer engages one of the two drums, say, the one indicated by number 9a, with its gear-motor (5a) and sets the other drum (9b) in its programming position, with its lobes (11) on the tracks (13a and 13b) of the diaphragm (11b). Should the teeth of the drum (9a) and the teeth of the gear-motor (5a) not meet at the corresponding position, the installer only has to extract the diaphragm (12a) for a short while, so that the drum can rotate until it gets freely inserted within the housing (7) of its gear motor, so that the diaphragm cannot obstruct this manual coupling operation.

At this point, the installer can activate the geared motor which starts to raise the shutter.

During this upward stroke the drum (9a), coupled with its gear-motor, (5a), sets the threaded rod (2a) in rotation, as a consequence of which the slider (15a) translates along the rod and is therefore detached from the limit microswitch (16a), which it beat against following coupling between the gear (5a) and the drum (9a).

On the other hand, during this upward stroke, the gear-motor (5b), set in rotation by the geared motor, together with the other gear motor (5a), is unable to set its own drum (9b), set by the installer in its programming position, in rotation, since the contrast between the grooves (7a) of the gear (5b) and the ribs (8) of the drum (9b), occurs at the end oblique section of said ribs (8), and therefore, instead of being set in rotation by the gear (5b), the drum (9b) is repeatedly pushed back together with the threaded rod (2b), the spring (3b) of which sends both the rod and the drum forwards as soon as the aforementioned contrasting action is concluded.

Therefore, during the entire upward stroke of the shutter, the slider (15b) stays at a standstill compared to its supporting rod (2b), while the slider (15a) translates along its threaded rod (2a).

When the shutter has reached its top dead centre, the installer, of course has to reverse the geared motor and as a consequence, the slider also inverts its stroke along the threaded rod (2a).

When rotation of the geared motor is reversed, the gear-motor (5b) starts to rotate its drum (9b) and after a small angle of rotation, it moves from its programming position to a position of firm coupling with its gear, crossing the separating diaphragm (11b).

During this forward movement of the drum (9b) and the rod (2b), pushed by the spring (3b), the slider (15b) beats against the limit microswitch (16b), from which it is immediately detached by the threaded rod (2b), which starts to rotate by means of the drum (9b) firmly coupled with its gear (5b).

It is clear that from now on, the slider (15b) will beat against the limit microswitch (16b), each time the shutter reaches its top dead centre and in the

same way, the slider (15a) will beat against the limit microswitch (16a), each time the shutter reaches its bottom dead centre.

Claims

1) Mechanical device for the self-recording of the end of stroke slider, when motorised shutters are being raised, comprising :
- a base (1), on which there are two parallel threaded rods (2a) and (2b), one on the right and the other on the left, inserted through two holes, provided for the purpose on the end sides (1a) of the base (1);
-two drums (9a and 9b) inserted on a median knurled section of the threaded rods, there being on each of said drums a circular flange (10) at the base, from which there protrude two lobes (11) diametrically opposite each other and on the same plane as two longitudinal ribs (8), which run along the external surface of each drum;
- two gear motors (5a and 5b) inserted idle on said threaded rods (2a and 2b), the teeth of which (6a and 6b) are designed to mesh simultaneously with a crown gear, set in rotation by the geared motor which moves the shutter; on the side which faces each drum, each gear motor has a central hollow housing (7), on the circular surface of which a series of grooves (7a) is provided, within which the aforementioned longitudinal ribs (8) of the drums, are precisely housed ;
- two sliders (15a and 15b) helically coupled to the threaded rods (2a)and (2b);
- two limit microswitches (16a and 16b) which intervene on said sliders (15a and 15b) and cause the geared motor to stop at the two dead centres of the shutter stroke ;
-device characterised by the fact that in between the gear-motors (5a and 5b) and the drums (9a and 9b), two diaphragms (11a and 11b) are positioned, each diaphragm having a large central opening (12), which which can only be crossed by by the drums if their lobes reach the notches (13) provided for the purpose along the contour of the opening (12), since on the side of the diaphragms (11a and 11b), which faces the drums (9a and 9b), on the edges of the opening (12), there are two sections of annular track (13a and 13b), which end at the aforementioned notches; moreover, on this same side of the diaphragms, there are two recesses (14) diametrically opposite each other, within which the lobes (11) of the drums can be firmly housed in their resting position;

2) Mechanical device for the self-recording of the end of stroke slider, when motorised shutters are being raised, according to claim 1), characterised by the fact that said threaded rods (2a and 2b) are constantly subjected to the ection of two prestressed springs (3a and 3b) inserted along the end protruding sections of said rods, which protrude for a cetain length out of one of the two edges (1a) of the base (1);

3) Mechanical device for the self-recording of the end of stroke slider, when motorised shutters are being raised, according to the previous claims, characterised by the fact that the longitudinal ribs (8) of the drums, have an oblique end section (8a);

4) Mechanical device for the self-recording of the end of stroke slider, when motorised shutters are being raised, according to the previous claims, characterised by the fact that when the lobes (11) come to rest against the annular tracks (13a and 13b), the ribs (8) of the drums are inserted within the grooves (7a) of the gear-motors, for a very brief section in such a way that coupling occurs at the oblique end section (8a) of the longitudinal ribs (8).

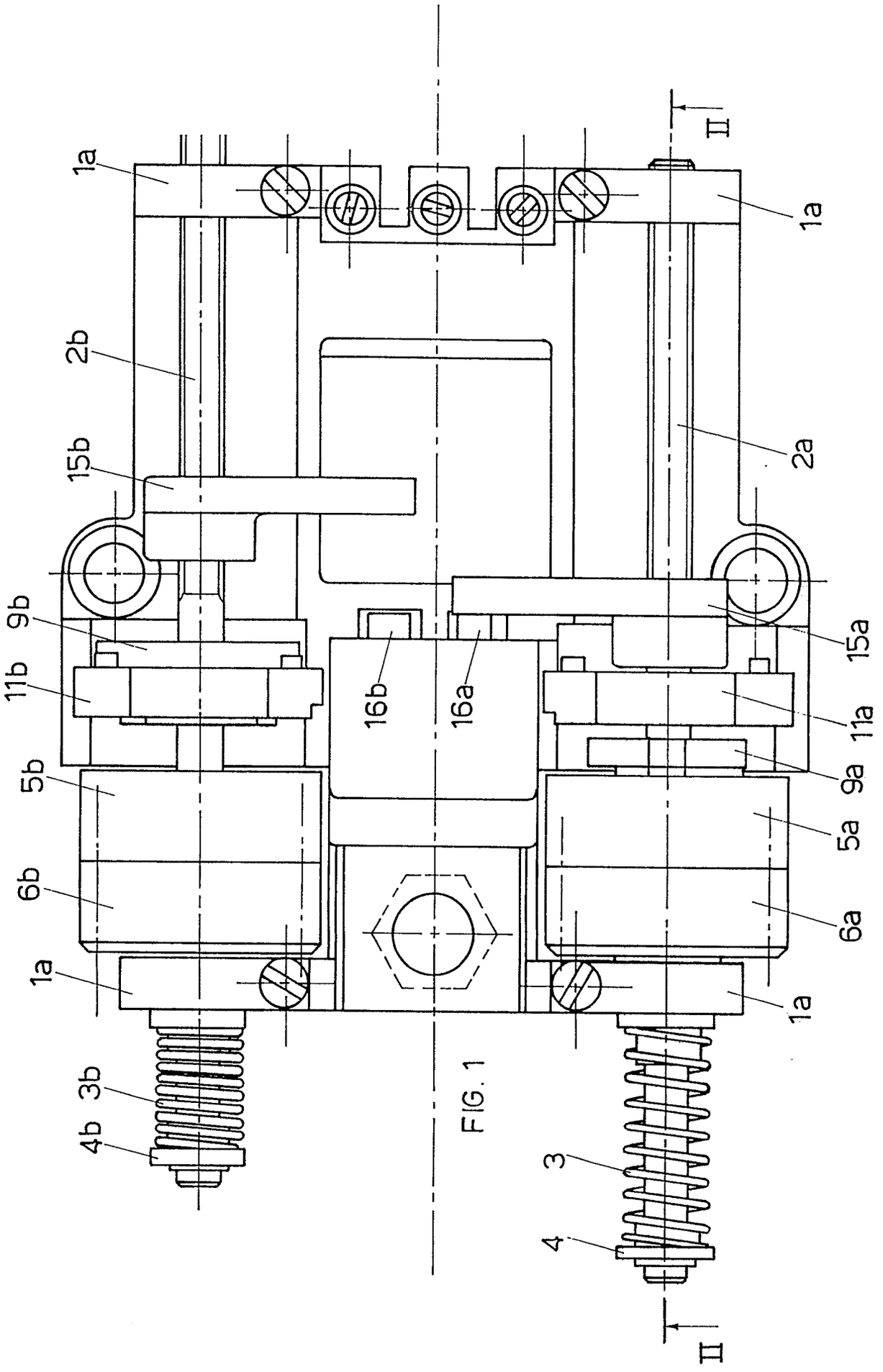
II
1a
1a
2b
2a
15b
15a
9b
11b
16b
16a
11a
9a
5b
5a
6b
6a
1a
1a
3b
4b
3
4
II

FIG. 1

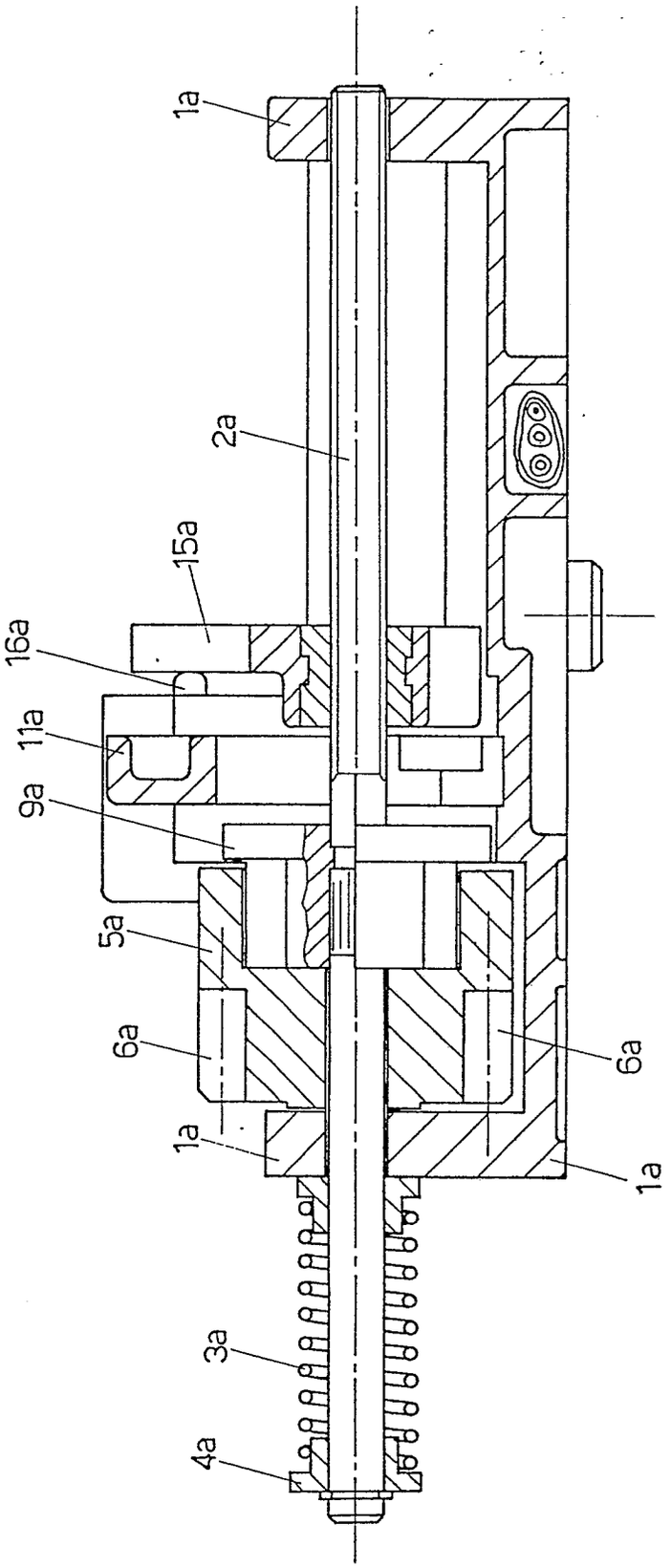

FIG. 2

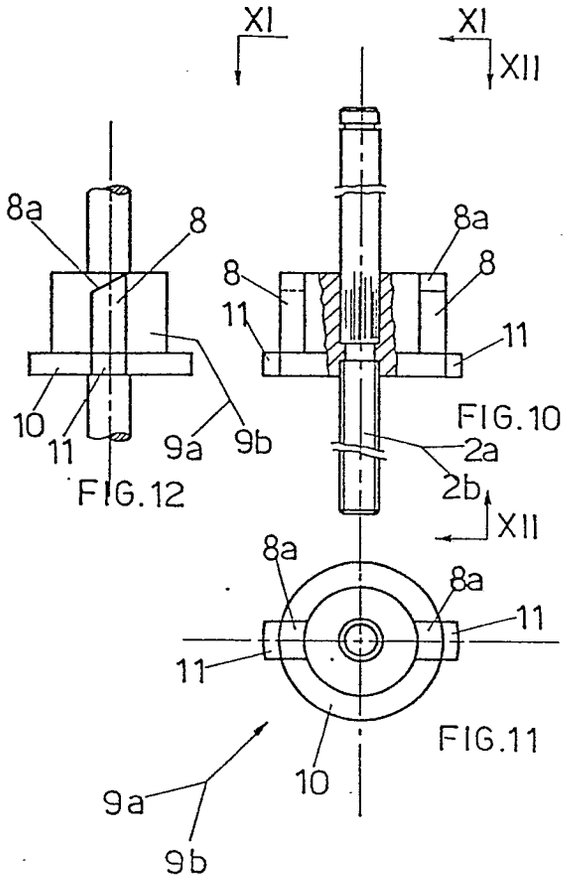

FIG.10

FIG.12

FIG.11

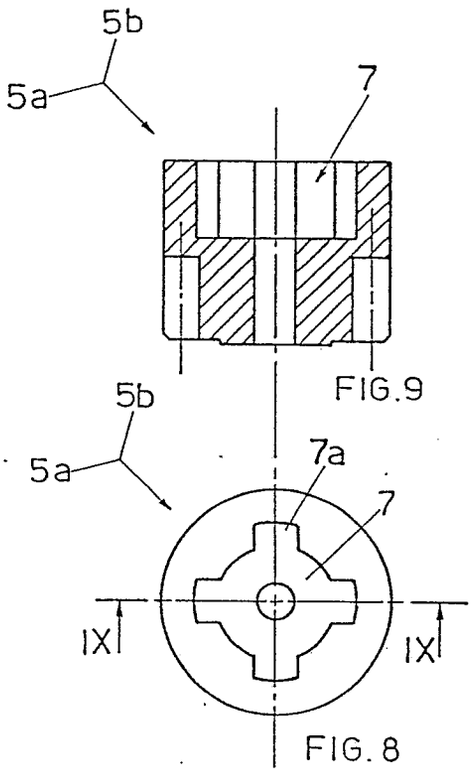

FIG.9

FIG.8

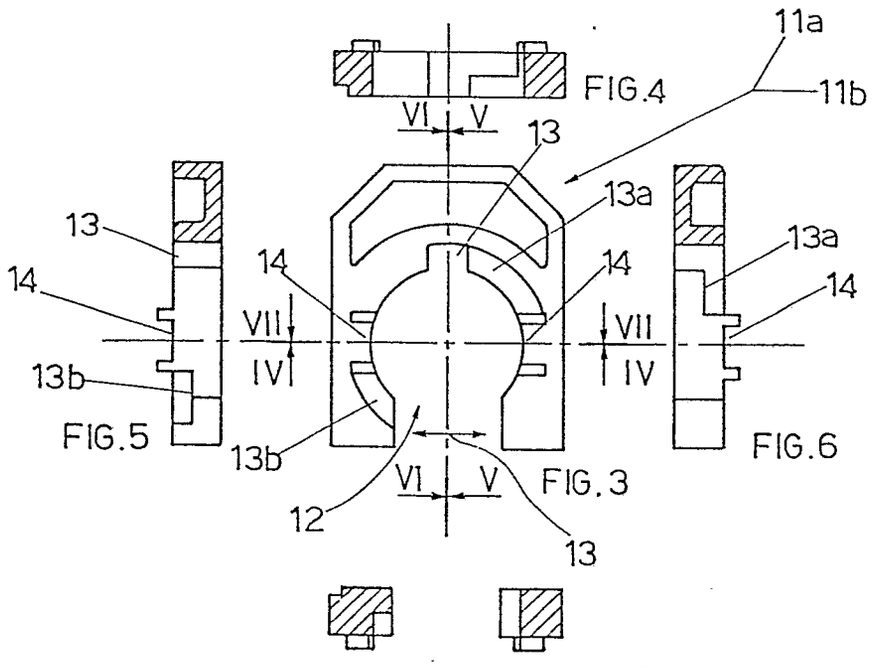

FIG.4

FIG.5

FIG.6

FIG.3

FIG.7