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(54) **Adapter module with compensation springs for tubular motors suitable for the moving of protection devices**

Adaptermodul mit Ausgleichsfedern für Rohrmotoren zur Bewegung von Schutzvorrichtungen

Module adaptateur doté de ressorts de compensation pour moteurs tubulaires appropriés pour déplacer des dispositifs de protection

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Description

[0001] The present invention concerns an adapter module for tubular motors equipped with electronic limit switches, used for the automation of environmental protection devices, especially awnings, rolling shutters or similar.

[0002] In household automation, the use of motors is becoming increasingly more frequent for the moving of environmental protection devices, especially awnings and rolling shutters. Normally these motors have a tubular shape and dimensions which allow them to be inserted in the roller tube to which the environmental protection device is attached. By means of an appropriate adapter, the drive shaft of the motor is splined to the roller tube so that to each rotational movement of the drive shaft corresponds an equal rotational movement of the roller tube and thus of the awning or roller shutter to which it is attached.

[0003] A fundamental part of any type of tubular motor for the moving of an awning or roller shutter is that known as the "limit switch unit". The function of the limit switch unit is to automatically stop the motor when the position of the awning or the roller shutter has reached one of the two points defined as end-of-travel limits. For example, in the case of a roller shutter, the upper end-of-travel limit (upper limit switch) corresponds to the situation in which the roller shutter is totally rolled around the roller tube, the lower end-of-travel limit (lower limit switch) corresponds to the situation in which the roller shutter totally closes the opening to which it has been applied.

[0004] Depending on the characteristics of the limit switch unit, the tubular motors may be divided into two categories: tubular motors with "mechanical limit switches" and those with "electronic limit switches".

[0005] In the tubular motors with the "mechanical limit switches", the limit switch unit comprises a mechanism that operates the microswitches. As soon as the motor reaches one of the limit switch positions, the relative microswitch comes into operation, thus stopping the motor. Tubular motors with "mechanical limit switches" embody the simplest type of motor, the only function they are able to perform being that of moving the environmental protection device in a certain direction, without any kind of control other than that of the reaching the limit switch positions.

[0006] In tubular motors with "electronic limit switches", the limit switch unit generally comprises an electronic card containing a relay and microprocessor, an angular position detector and a sensor. The angular position detector is normally housed near the gear ring or next to a gear internal to the motor belonging to the reduction unit, in a fixed position, and its purpose is to create an alternation of physical characteristics (e.g. presence/absence of magnetic material or presence/absence of conductive material or presence/absence of light or other elements) that are angularly variable. The purpose of the sensor is to transform the alternation of physical characteristics into an electrical signal. Through the microprocessor, the purpose of the electronic card is to analyse the electrical signal, obtaining information from it on the operating status of the motor. The microprocessor processes the data acquired from the sensor and as soon as the motor has reached one of the two limit switch positions, the relative relay is opened, with consequent stopping of the motor. Tubular motors with "electronic limit switches" not only enable the management of limit switch positions but also the constant monitoring of the operation of the motor during the movement of the environmental protection device. For example, it is possible to monitor and change the speed of the motor, identify anomalous operating conditions or blocking of the motor due to the tripping of the thermal cutout etc.

[0007] An extremely important requirement for the household automation market is that of being able to operate awnings and rolling shutters with motors that have the capacity to detect the presence of obstacles which pose resistance to the movement of the motor, automatically stopping the manoeuvre in course. On the basis of the information provided above, only motors with "electronic limit switches" are able to provide a solution to this type of problem. Even in this case, however, the detection of an obstacle during the movement of the motor is not always easy. In fact, while the detection of an obstacle that poses resistance to the raising manoeuvre may be easily effected, it is not so easy to effect the detection of an obstacle that poses resistance to the lowering manoeuvre. With a view to clarifying the problem in question, figure 1 represents the typical time sequence of the electrical signals supplied by the sensor in the case of a roller shutter moving without encountering any obstacles (11), in the case of it encountering an obstacle during the raising phase (12) and in the case of it encountering an obstacle during the lowering phase (13).

[0008] As long as the roller shutter does not encounter obstacles, the roller tube rotates more or less at a constant rate; the electrical signal (11) generated by the sensor is therefore made up of an alternation of logical states and its period is just about constant.

[0009] When the roller shutter strikes an obstacle during the raising manoeuvre, the roller tube slows down until it stops, blocking the drive shaft of the motor; the electrical signal (12) supplied by the sensor will no longer consist of an alternation of logical states but of a stable logical state, since the magnet is no longer able to rotate and hence to generate the alternation of presence/absence of magnetism. This situation is easily detectable by the microprocessor which then takes appropriate action.

[0010] During the lowering manoeuvre, as long as the roller shutter does not encounter an obstacle, the roller tube in addition to being subjected to the downward force of the motor is further encumbered by the downward force of the roller shutter. When the roller shutter strikes an obstacle, its weight comes to rest on the obstacle and no longer on the roller tube; as a result, the roller tube is

subjected to a slight deceleration for a short time, proportional, among other things, to the weight of the roller shutter and to the play that always exists between the roller tube, the adapter and the drive shaft of the motor. The deceleration of the roller tube will be transmitted through the drive elements to the magnet, which will be subjected to a slight deceleration for a short time; the electrical signal (3) generated by the sensor will differ only slightly compared to the electrical signal (11) generated in the absence of an obstacle.

[0011] The latter situation is therefore difficult for the microprocessor to manage, given the negligible difference between the signal (11) generated by the sensor during movement in absence of obstacles and the signal (13) generated by the sensor when, during the lowering manoeuvre, an obstacle is encountered.

[0012] The solution currently adopted is that of increasing the play between the roller tube and the drive shaft by using a "loose adaptor". This type of adaptor is splined to the drive shaft of the motor, but the outer part of the adaptor is constructed in such a way that the adapter has a few angular degrees of free movement before impacting the roller tube when a manoeuvre is initiated. When the roller shutter encounters an obstacle, the greater the play between the roller tube and the drive shaft of the motor, the greater the deceleration effect transferred to the magnet. This type of approach is however unable to provide satisfying results inasmuch as the play artificially generated between the roller tube and the adapter is sometimes progressively cancelled out by the inevitable friction generated by the sliding of the roller shutter on the guides, by the friction between the roller shutter and the roller tube, by the settling movements of the motor fixing bracket.

[0013] An angular position detector that is suitable to detect end of stacking of slats of a rolling shutter is described in document FR 2 790 787 A1. Document DE 296 18 538 U1 discloses a compensation clutch suitable to compensate changes of fabric length of an awning at the end of its retraction in the containment box.

[0014] It is an object of the innovation to eliminate such problems by realizing a tubular motor adapter equipped with compensation springs capable of amplifying the effect of the loss of the weight that bore down on the roller tube in order to allow the electronic card to unmistakably detect the presence of an obstacle during the motor's lowering manoeuvre.

[0015] This object and others that shall be observed from the description that follows have been achieved according to the invention with an adapter module with compensation springs for tubular motors that has the features set forth in claim 1.

[0016] The present invention is further clarified below in its preferred embodiment of practical realization shown purely by way of non-limiting example with reference to the annexed figures:

figure 2 represents a form of practical realization of the adapter module with compensation springs;
figure 3 shows a cross-section of the adapter module with compensation springs during the lowering manoeuvre in absence of obstacles and a representation of the electrical signal generated by the sensor;
figure 4 shows a cross-section of the adapter module with compensation springs at the moment in which the roller shutter encounters the obstacle during the lowering phase and a representation of the electrical signal generated by the sensor;
figure 5 shows a cross-section of the adapter module with compensation springs at the end of the spring's thrust action and a representation of the electrical signal generated by the sensor.

[0017] Figure 2 represents a form of practical realization of the adapter module with compensation springs. It consists of an internal adapter module (1) splined to the drive shaft (2) of the tubular motor, an external adapter module (4) splined to the roller tube (6), a plate (3) and a spring (5). The internal adapter module (1) is lodged in the external adapter module (4); the internal (1) and external (4) adapter modules are constructed in such a way as to produce a play of 20 angular degrees; this play enables the internal adapter module (1) and the external adapter module (4) to rotate, one with respect to the other, for a maximum of 20 angular degrees.

[0018] The internal adapter module (1) is coupled to the external adapter module (4) by means of a spring (5) in such a way that the application of a weight force on the roller tube compresses the spring (5). The plate (3) is attached to the internal adapter module (1) for the sole purpose of preventing the internal adapter module (1) from sliding out of the external adapter module (4).

[0019] Figure 3 shows a cross-section of the adapter module with compensation springs during a lowering manoeuvre before the roller shutter encounters an obstacle. The weight force (38) of the roller shutter applied to the roller tube and hence to the external adapter module (34) is such that it compresses the spring (35); up to the point in which the roller shutter encounters the obstacle (36) the drive shaft of the tubular motor, the internal adapter module (31), the external adapter module (34) and the roller tube move in an integral manner. The electrical signal (37) generated by the sensor consists of an alternation of logical states and the period of the signal is just about constant.

[0020] Figure 4 shows a cross-section of the adapter module with compensation spring when, during the lowering manoeuvre, the obstacle is encountered (46). When the roller shutter encounters the obstacle (46) the weight force (48) of the roller shutter comes to rest on the obstacle (46) and no longer on the roller tube, the spring (45) tends to return to its rest condition applying to the external adapter module (44) and hence to the roller tube a thrust in the opposite direction to that in which the motor drive shaft is rotating, thereby reducing the angular velocity of the roller tube. Through the gear ring

which moves integrally with the roller tube, the deceleration of the roller tube is transmitted to the reduction unit and hence to the position detector. The electrical signal (47) generated by the sensor indicates the deceleration with a substantial increase in the period of the signal.

[0021] Figure 5 shows a cross-section of the adapter module with compensation spring at the end of the spring's thrust action (55). When the spring (55) has completed its thrust action on the external adapter module (54) cancelling out the play of 20 angular degrees between the external adapter module (54) and the internal adapter module (51), the drive shaft, the internal adapter module (51), the external adapter module (54) and the roller tube start moving again in an integral manner. The electrical signal (57) generated by the sensor returns to being an alternation of logical states and with a period that is just about constant.

[0022] From the above, it may be clearly observed that the adapter with compensation springs presents numerous advantages, among which:

- in the event of the presence of an obstacle during the lowering phase, it enables the sensor to supply to the microprocessor an electrical signal that differs substantially from that generated in the absence of obstacles, thereby placing the microprocessor in the condition to intercept in a safe and timely manner the presence of the obstacle during the lowering phase.
- It cancels out the negative effects on the system's performance of the inevitable, if minor, structural friction that may be created during the movement of the awning or roller shutter or similar.
- It can be easily adapted to make it compatible with roller tubes of any shape and tubular motors of any kind equipped with electronic limit switches with position sensors applied near to the gear ring or to the parts of the reduction unit.

Claims

1. Adapter module with compensation springs for tubular motors suitable for moving awnings or roller shutters or similar, comprising at least one internal adapter module (1, 31, 41, 51) splined to the drive shaft (2) of the motor, at least one external adapter module (4, 34, 44, 54) splined to the roller tube (6) and coupled to the internal adapter module (1, 31, 41, 51) by at least one spring (5, 35, 45, 55), the external adapter module (4, 34, 44, 54) and the internal adapter module (1, 31, 41, 51) being constructed in such a way that some play is left between the two so as to permit, in operation, reciprocal rotation for at least five angular degrees, **characterized by** the fact that the spring (5, 35, 45, 55) is arranged in such a way as to compress or to extend upon application of a shutter- or awning-weight force on the roller tube (6), with the drive shaft (2) and the internal (31) and external (34) adapter modules being movable in an integral manner, and as to return to its rest condition by applying to the external adapter module (4, 44, 54) and hence to the roller tube (6) a thrust in the opposite direction to that in which the drive shaft (2) is rotating thereby to generate a temporary difference between the angular velocity of the internal adapter module (1, 31, 41, 51) and the angular velocity of the external adapter module (4, 34, 44, 54) at the moment in which the weight force applied to the roller tube (6) is cancelled out, completion of said thrust of the spring (5) corresponding to a cancelling out of the play between the internal adapter module (1,31,41,51) and the external adapter module (4, 34, 44, 54), the drive shaft (2) and the internal (31) and external (34) adapter modules being again movable in an integral manner

2. Adapter module with compensation springs for tubular motors suitable for moving awnings or roller shutters or similar as claimed in Claim 1, **characterized by** the fact than the spring or at least one of the springs (5) is a torsion spring.

3. Adapter module with compensation springs for tubular motors suitable for moving awnings or roller shutters or similar as claimed in Claim 1, **characterized by** the fact the spring or at least one of the springs (5) is a compression spring.

4. Adapter module with compensation springs for tubular motors suitable for moving awnings or roller shutters or similar as claimed in Claim 1, **characterized by** the fact that the spring or at least one of the springs (5) is an extension spring.

Patentansprüche

1. Adaptermodul mit Ausgleichsfedern für Rohrmotoren, geeignet zum Bewegen von Markisen oder Rollläden oder Ähnlichem, das Folgendes umfasst: mindestens ein internes Adaptermodul (1, 31, 41, 51), verkeilt mit der Antriebswelle (2) des Motors, mindestens ein externes Adaptermodul (4, 34, 44, 54), das mit dem Rollenmantel (6) verkeilt und über mindestens eine Feder (5, 35, 45, 55) mit dem internen Adaptermodul (1, 31, 41, 51) gekoppelt ist, wobei das externe Adaptermodul (4, 34, 44, 54) und das interne Adaptermodul (1, 31, 41, 51) so konstruiert sind, dass ein gewisses Spiel zwischen den beiden gelassen wird, um während des Betriebs eine gegenseitige Drehung um mindestens fünf Winkelgrad zu ermöglichen, **dadurch gekennzeichnet, dass** die Feder (5, 35, 45, 55) so angeordnet ist, dass sie sich bei Einwirkung einer Rollladen- oder Markisen-Gewichtskraft auf den Rollenmantel (6) zusammen-

drückt oder verlängert, wobei die Antriebswelle (2) und die internen (31) und externen (34) Adaptermodule integral beweglich sind, und so, dass sie in ihren Ruhezustand zurückkehren durch Ausübung, auf das externe Adaptermodul (4, 44, 54) und somit auf den Rollenmantel (6), eines Schubs in die Richtung, die derjenigen entgegengesetzt ist, in die sich die Antriebswelle (2) dreht, wodurch eine vorübergehende Differenz zwischen der Winkelgeschwindigkeit des internen Adaptermoduls (1, 31, 41, 51) und der Winkelgeschwindigkeit des externen Adaptermoduls (4, 34, 44, 54) in dem Moment erzeugt wird, in dem die auf den Rollenmantel (6) ausgeübte Gewichtskraft aufgehoben wird, wobei der Abschluss des Schubs der Feder (5) einem Aufheben des Spiels zwischen dem internen Adaptermodul (1, 31, 41, 51) und dem externen Adaptermodul (4, 34, 44, 54) entspricht, wobei die Antriebswelle (2) und die internen (31) und externen (34) Adaptermodule erneut integral beweglich sind.

2. Adaptermodul mit Ausgleichsfedern für Rohrmotoren, geeignet zum Bewegen von Markisen oder Rollläden oder Ähnlichem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Feder oder mindestens eine der Federn (5) eine Torsionsfeder ist.

3. Adaptermodul mit Ausgleichsfedern für Rohrmotoren, geeignet zum Bewegen von Markisen oder Rollläden oder Ähnlichem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Feder oder mindestens eine der Federn (5) eine Druckfeder ist.

4. Adaptermodul mit Ausgleichsfedern für Rohrmotoren, geeignet zum Bewegen von Markisen oder Rollläden oder Ähnlichem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Feder oder mindestens eine der Federn (5) eine Zugfeder ist.

Revendications

1. Module d'adaptateur avec ressorts de compensation pour moteurs tubulaires approprié pour déplacer des stores ou des volets à rouleaux, ou similaires, comprenant au moins un module d'adaptateur intérieur (1, 31, 41, 51) adapté par cannelures à l'arbre d'entraînement (2) du moteur, au moins un module d'adaptateur extérieur (4, 34, 44, 54) adapté par cannelures au tube de rouleau (6) et couplé au module d'adaptateur intérieur (1, 31, 41, 51) par au moins un ressort (5, 35, 45, 55), le module d'adaptateur extérieur (4, 34, 44, 54) et le module d'adaptateur intérieur (1, 31, 41, 51) étant construits de telle sorte qu'un certain jeu demeure entre les deux, de façon à permettre, lors du fonctionnement, une rotation réciproque d'au moins cinq degrés angulaires, **caractérisé en ce que** le ressort (5, 35, 45, 55) est agencé de façon à être comprimé ou à être étendu lors de l'application d'une force de poids de volet ou de store au tube de rouleau (6), l'arbre d'entraînement (2) et les modules d'adaptateur intérieur (31) et extérieur (34) étant mobiles d'une façon intégrée, et de façon à revenir à sa condition de repos par l'application au module d'adaptateur extérieur (4, 44, 54), et, par conséquent, au tube de rouleau (6), d'une poussée dans la direction opposée à celle dans laquelle tourne l'arbre d'entraînement (2), de façon à générer ainsi une différence temporaire entre la vitesse angulaire du module d'adaptateur intérieur (1, 31, 41, 51) et la vitesse angulaire du module d'adaptateur extérieur (4, 34, 44, 54) au moment où la force de poids appliquée au tube de rouleau (6) est annulée, l'achèvement de ladite poussée du ressort (5) correspondant à l'élimination du jeu entre le module d'adaptateur intérieur (1, 31, 41, 51) et le module d'adaptateur extérieur (4, 34, 44, 54), l'arbre d'entraînement (2) et les modules d'adaptateur intérieur (31) et extérieur (34) étant à nouveau mobiles d'une façon intégrée,

2. Module d'adaptateur avec ressorts de compensation pour moteurs tubulaires approprié pour déplacer des stores ou des volets à rouleaux, ou similaires, selon la revendication 1, **caractérisé en ce que** le ressort ou au moins l'un des ressorts (5) est un ressort de torsion.

3. Module d'adaptateur avec ressorts de compensation pour moteurs tubulaires approprié pour déplacer des stores ou des volets à rouleaux, ou similaires, selon la revendication 1, **caractérisé en ce que** le ressort ou au moins l'un des ressorts (5) est un ressort de compression.

4. Module d'adaptateur avec ressorts de compensation pour moteurs tubulaires approprié pour déplacer des stores ou des volets à rouleaux, ou similaires, selon la revendication 1, **caractérisé en ce que** le ressort ou au moins l'un des ressorts (5) est un ressort d'extension.

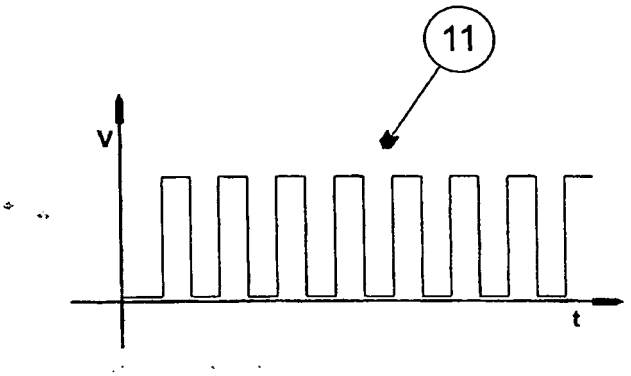
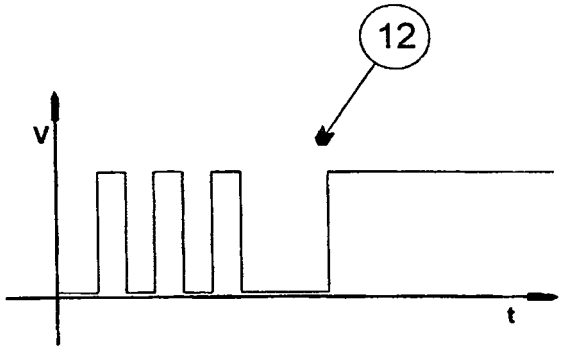
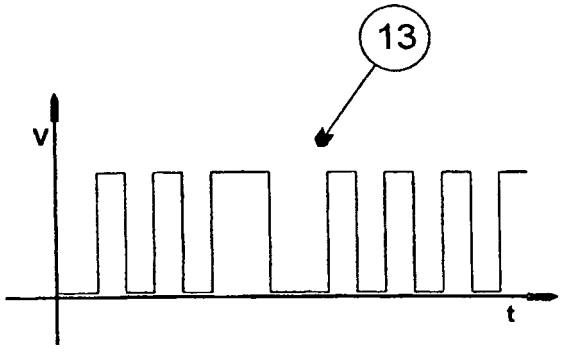


Fig. 1





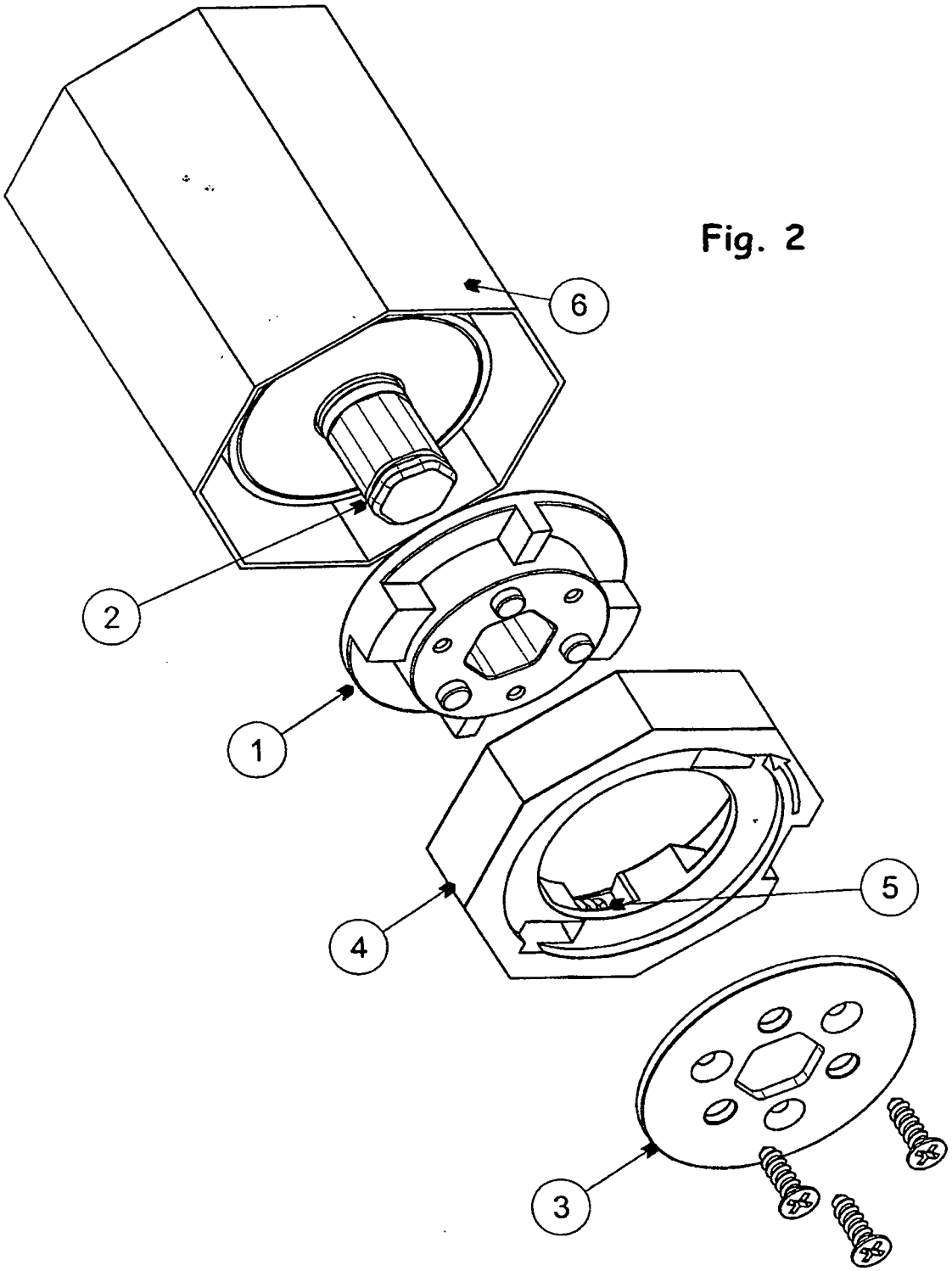


Fig. 2

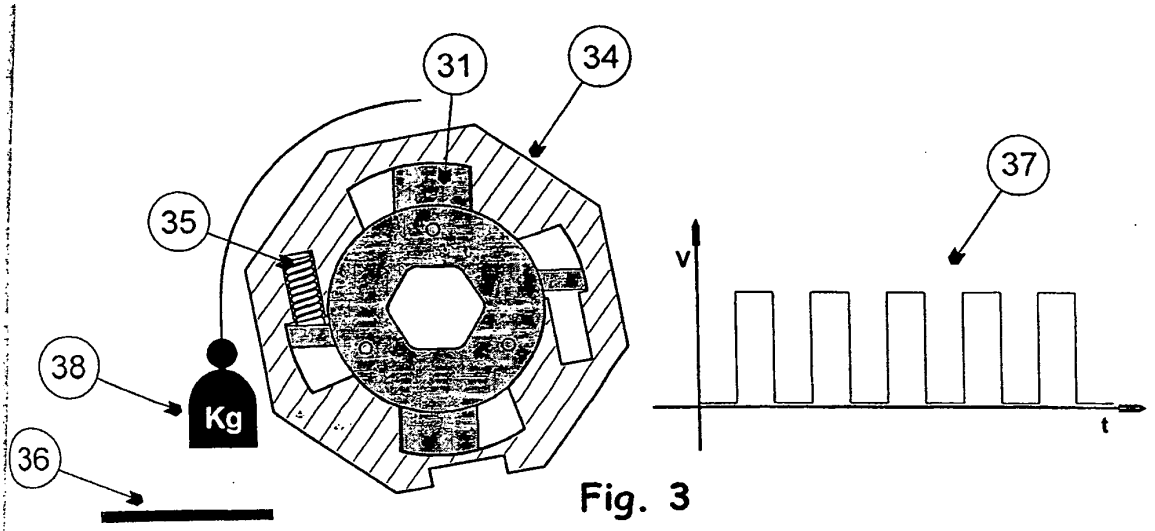


Fig. 3

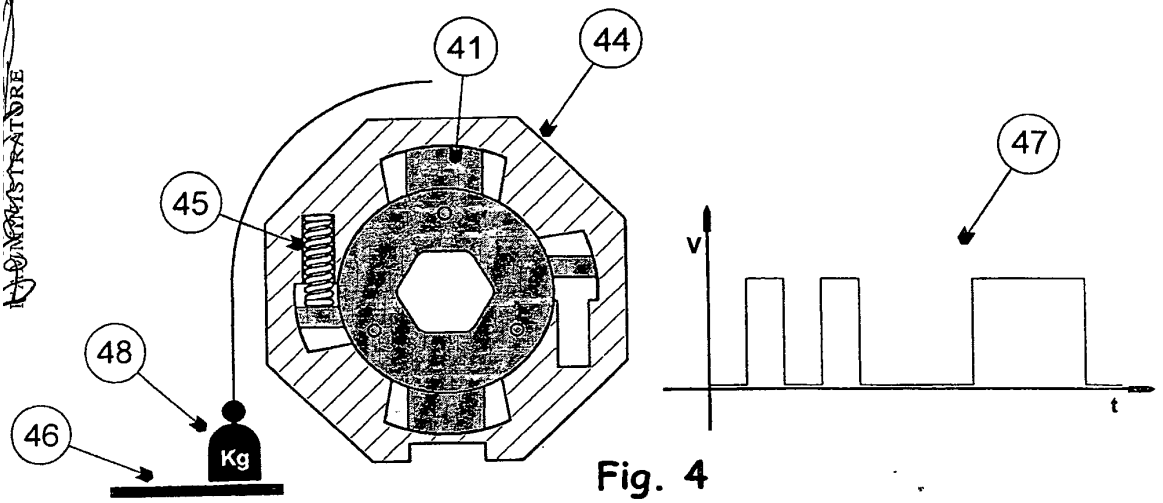


Fig. 4

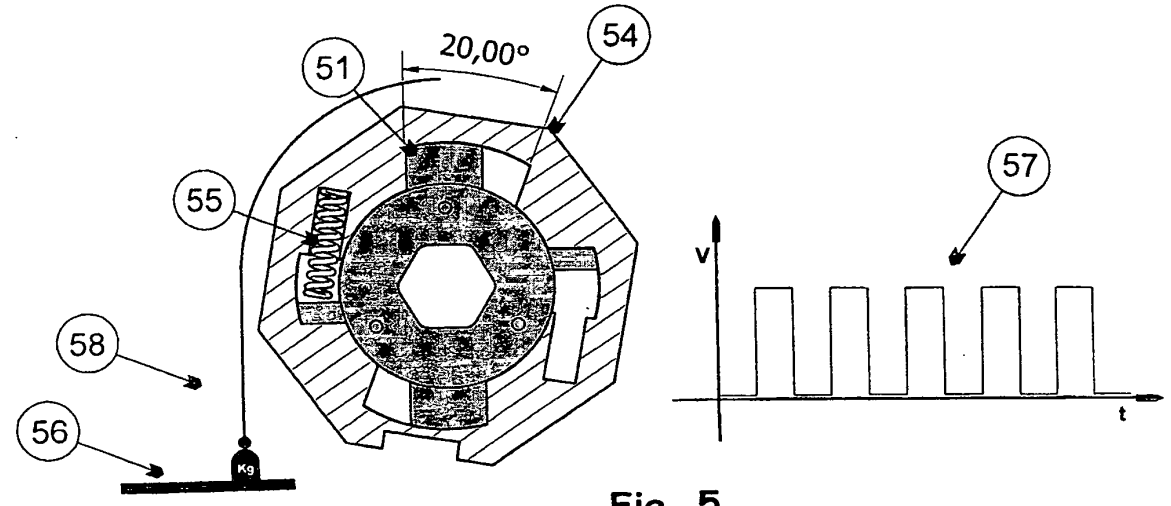


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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- DE 29618538 U1 **[0013]**