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(54) **A motorized control for low-voltage switches**

Steuervorrichtung mit Motor für Niederspannungsschalter.

Dispositif de commande motorisé pour disjoncteurs à basse tension.

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Description

[0001] The present invention relates to a motorized control to be used preferably for the remote actuation of low-voltage electrical switches.

[0002] As is known, motorized controls are by now widely used for the remote control of devices designed in particular for circuit breaking or for handling of electrical networks, such as, for example, switches, disconnectors, or isolators. Devices of this sort, in fact, are often located in positions that are difficult to access for the operator who has the task of handling the electrical networks and call for the need on the part of the operator to carry out troublesome and sometimes dangerous manoeuvres and movements for guaranteeing actuation thereof. It appears therefore evident that the use of motorized controls which can be remotely controlled enables a considerable reduction in the dead times involved in the manoeuvres and movements of the operator, at the same time providing the possibility of performing, via a single control unit, actuation of a number of devices almost at the same time.

[0003] Current motorized controls used for actuation of low-voltage electrical switches envisage the use of an electric motor which, according to an external control signal, enables movement of the control lever of the switch from one position, corresponding to a circuit-opening condition, to another position, corresponding to a circuit-closing condition, and vice versa. In order to transfer motion from the motor to the control lever, there are currently used different solutions, which envisage, for example, the use of connecting rod-crank systems directly actuated by the motor or else the use of other kinematic chains, which are sometimes somewhat complex and difficult to put together.

[0004] The above and other motorized controls of the same kind present in any case various additional drawbacks, amongst which, for example, the ones due to use of mechanical end-of-travel mechanisms, which are extremely delicate elements in terms of operation and reliability; their use also leads, at the same time, to a considerable and disadvantageous increase in production costs.

[0005] Another drawback regards the kinematic mechanisms which are necessary for moving the control lever and which have already been referred to above. These, in fact, require a considerable precision both in the fabrication and in the assembly steps, and contribute, in this way, to a further increase in the overall costs.

[0006] An example of such widely used motorized controls is given in the patent application EP 0 872 867 A2. In this case, the motorized control is obtained through an electric motor governed by a control logic associated thereto. Following upon turning of the motor, corresponding kinematic mechanisms for transmission of the motion lead to the rotation of a control lever connected at one end to the actuation knob of an electrical switch. When the motorized control, through the control logic, is called

upon to set the switch in the circuit-closing condition, then the motor starts up and begins to rotate the control lever until the position is reached in which a first end-of-travel of the closing mechanism goes into action. At this point, the control logic issues a command for reversal of the direction of turning of the motor, which, by turning in the opposite direction, disengages the control lever until a second end-of-travel mechanism goes into action, which blocks the motor when the position of disengagement is reached. The reverse opening operation occurs substantially in the same way.

[0007] On the basis of these considerations, the main task of what forms the subject of the present invention is to overcome the drawbacks mentioned above and, in particular, to provide a motorized control which will enable a correct and effective actuation of switches commonly used in low-voltage electrical lines.

[0008] In the framework of the above task, a first purpose of the present invention is to provide a motorized control in which the movement of the switch will be based upon a simple and reliable control logic.

[0009] A further purpose of the present invention is to provide a motorized control, moving of which will be performed through a reduced number of components which may be easily coupled together in the assembly step.

[0010] Not the least important purpose of what forms the subject of the present invention is to provide a motorized control that will present high reliability, relative ease of production, and competitive costs.

The above task, as well as the above and other purposes which will appear more clearly in what follows, are achieved through a motorized control for low-voltage switch, according to claim 1, comprising:

- a servomechanism;
- a control unit for governing the servomechanism; and
- a coupling lever, which is associated to the said servomechanism and can be operatively associated to a switch.

The motorized control, according to the invention, is characterized in that the control unit generates at output a first impulse signal which constitutes a command for the servomechanism to perform a first rotation with pre-defined direction and amplitude and generates at output also a second impulse signal which constitutes a command for the servomechanism to perform a second pre-defined rotation. The first and second pre-defined rotations thus set in motion the coupling lever between a first pre-set position and a second pre-set position, and vice versa. Each of these two pre-defined positions represents, respectively, a circuit-opening condition and a circuit-closing condition of the switch.

[0011] The execution of pre-defined rotations of the servomechanism, by virtue of a control logic based upon impulse signals, represents one of the main advantages of the invention, in so far as it enables the coupling lever

to reach the pre-set positions without the use of end-of-travel mechanisms or similar transducers applied external to the motor.

[0012] Further characteristics and advantages of the invention will emerge more clearly from the description of preferred, but non-exclusive, embodiments of the motorized control according to the invention, illustrated purely by way of nonlimiting example in the annexed plate of drawings, in which:

- Figure 1 represents a block diagram of the motorized control according to the invention;
- Figure 2 represents an electric circuit diagram of an embodiment of the control unit of the motorized control according to the invention;
- Figure 3a is a first perspective view of a first embodiment of a control unit of a motorized control according to the invention;
- Figure 3b is a perspective view of constructional details corresponding to a first embodiment represented in Figure 3a;
- Figure 3c and 3d are a cross-sectional view and a second perspective view, respectively, of a first embodiment represented in Figure 3a;
- Figures 4a and 4b are perspective views, from different points of observation, of a second embodiment of the motorized control according to the invention;
- Figures 4c and 4d are a perspective view and a cross-sectional view, respectively, of an embodiment of Figures 4a and 4b.

[0013] With reference to the aforesaid figures, the motorized control 1 for low-voltage switches, according to the invention, basically comprises a servomechanism 10, a control unit 20, and a coupling lever 30, which is, at the same time, associated to the servomechanism 10 and to the switch to which the motorized control 1 is applied. In particular, the coupling lever 30 can be advantageously associated to the actuation knob of the switch to simulate in this way what occurs in a traditional manual actuation.

[0014] The motorized control, according to the invention, is characterized in that the control unit 20 generates a first impulse signal, which constitutes a command for the servomechanism 10 to perform a first rotation with pre-defined direction and amplitude, and generates a second impulse signal, which constitutes a command for the servomechanism 10 to perform a second rotation, which is also with pre-defined direction and amplitude. In particular, according to a preferred embodiment of the invention, the first and the second pre-defined rotations are performed so as to have a substantially coincident amplitude and opposite directions.

[0015] Through these two rotations, the servomechanism 10 in effect sets in motion the coupling lever 30 between a first pre-set position and a second pre-set position, and vice versa. Since these two positions are char-

acteristic, respectively, of a circuit-opening condition and of a circuit-closing condition, it may be noted how the traditional manual action will thus be perfectly simulated.

[0016] The system for movement of the coupling lever 30, i.e., the production of pre-defined rotations such as the ones indicated, hence enables a considerable reliability and repeatability of the operations of circuit-opening and circuit-closing by the switch to be obtained.

[0017] With reference to Figure 1, the servomechanism 10 according to the invention principally comprises a control unit 12 that governs an electric motor 11, which is connected to the coupling lever 30 and is dedicated precisely to obtaining the first and the second pre-defined rotations.

[0018] In particular, the control unit 12, by encoding at input said first impulse signal or said second impulse signal sent by the control unit 20, sends, at output, a command to the electric motor 11 to perform the first rotation or the second rotation.

[0019] The servomechanism 10 further comprises transducer means 13 designed to supply to the control unit 12 a signal indicating the angular distance covered by the electric motor 11. These transducer means 13, constituted for example by a potentiometer connected to the shaft of the electric motor 11, enable the control unit 12 to perform a proportional control of the motor itself. The control unit 12 in fact supplies to the electric motor 11 a power proportional to the angular distance that must be covered thereby to complete said first rotation or said second rotation.

[0020] The use of the transducer means 13 also enables a proportional control of the speed of turning of the electric motor 11. The latter, in fact, can advantageously turn with a speed so much greater or so much smaller as greater or smaller is the angular distance that must be covered to complete the first rotation or the second rotation.

[0021] Once again with reference to the aforementioned Figure 1, the motorized control 1, according to the invention, further comprises disengagement means 40 designed to release the coupling lever 30 from the servomechanism 10. These disengagement means 40 are necessary to enable the coupling lever 30 to be free to move until completion of the first pre-defined rotation or the second pre-defined rotation is obtained. This condition is essential, for example, to enable a possible manual actuation of the switch or to enable the switch itself to trigger in order to carry out its function of protection in the case of poor operation of the network.

[0022] The disengagement means, according to a preferred embodiment of the motorized control 1, are associated to the servomechanism 10 and are activated through a third impulse signal sent to the servomechanism 10 itself by the control unit 20.

[0023] With reference to Figure 2, the control unit 20 comprises appropriate means 22 for generation of the impulse signals referred to above, as, for example, may be traditional generators of square waves. Via the use

of these electronic components, the control unit 20, according to the invention, generates impulse signals which have one and the same frequency but a different time duration of the impulses.

[0024] The control unit 12 of the servomechanism 10 decodes the signals at input sent by the control unit 20, recognizing precisely the different durations of the impulses and issuing accordingly a command to the electric motor 11 for performing the first rotation or the second rotation, or else issuing a command for activation of the disengagement means.

[0025] Handling of the activity of the control unit 20 by the user can advantageously be performed through the use of traditional remote-control devices, such as radio transmitters, or else via the use of simple pushbuttons 300, electrically connected to the unit itself, as represented schematically in Figure 1. Advantageously, the control unit 20 can operate via a power-supply unit 24, which supplies a supply voltage of 6 V. This voltage value enables limitation of the number and dimensions of the energy-accumulation means 23; the latter are necessary in order to provide the energy necessary for the completion of the rotations referred above in the case of sudden absence of the main power supply. Said task must be pursued ensuring normal modes of operation, i.e., guaranteeing, for example, the same speed of rotation of the coupling lever 30 that usually characterizes normal operation of the motorized control 1. This aspect appears particularly important for preventing onset of dangerous electric arcs between the contacts of the switch, for example in the case of low speeds of rotation of the coupling lever 30, i.e., of the actuation knob of the switch itself.

[0026] Figures 3a, 3b, 3c and 3d regard a first preferred embodiment of the motorized control 1 according to the invention, which envisages a movement of the coupling lever 30 through a rotation about an axis substantially parallel to the axis of rotation of the servomechanism 10.

[0027] With reference to Figures 3a and 3b, the motorized control 1 comprises a first supporting structure 50 for housing the servomechanism 10 and possibly the control unit 20. The supporting structure 50 comprises a resting base 51, a first surface 52, and a second surface 53. The first surface 52 develops in a direction substantially orthogonal to the resting base 51, whilst the second surface 53 develops in a direction orthogonal to the first surface, projecting in a raised and opposite position to the resting base 51.

[0028] Again with reference to the aforementioned Figures 3a and 3b, the resting base 51 and the second surface 53 comprise first means 55 for the anchorage of the servomechanism to said first supporting structure, as, for example, may be ordinary screw connections. The resting base 51 further comprises second anchoring means 56 designed to enable connection of the motorized control 1 to a possible outer containment casing 200.

[0029] Figure 3b shows the disengagement means 40 used in this first possible embodiment of the motorized control 1. In particular, they comprise a toothed flange

41 fixed to the shaft of the servomechanism 10 and positioned at one end part of its own.

[0030] With reference to Figure 3c, according to the invention, rotation of the coupling lever 30 is performed through the use of a first turning pair and of a second turning pair. In particular, said first turning pair comprises a first bushing 70, which is inserted in a first seat 72 obtained on said first surface 52; the bushing 70 is geometrically conjugated to a pin 73 obtained on a first end 75 of the coupling lever 30. The second turning pair comprises, instead, a second bushing 80, geometrically conjugated to a second seat 81 obtained on a second end 85 of the coupling lever 30. The second bushing 80 is fitted on the toothed flange 41. An alternative to the latter solution envisages a possible fitting of the second bushing 80 on the servomechanism 10.

[0031] The use of two turning pairs hence renders independent the movement of the coupling lever 30 with respect to that of the servomechanism 10. Furthermore, this constructional solution enables advantageous increase in the twisting resistance of the lever itself, thus enabling increase in the reliability of the motorized control 1.

[0032] With reference to Figure 3d, there is now described in greater detail the principle of movement of the coupling lever 30 of the motorized control 1. The control unit 20, by generating, for example, the first impulse signal, sends a command to the servomechanism 10 to perform a first pre-defined rotation, which is considered, purely by way of illustration, counterclockwise. The servomechanism 10 hence turns in a counterclockwise direction, thus leading to the rotation of the toothed flange 41 fixed thereto. Said toothed flange 41, through one of its projections 42, leads to the rotation of the coupling lever 30, which turns in a counterclockwise direction about the axis of rotation provided by the first turning pair and the second turning pair. Upon completion of the rotation, if the control unit 20 continues to generate the first impulse signal, then the toothed flange 41 maintains the position reached, preventing any movement of the coupling lever 30. This occurs in so far as upon persistence of the first impulse signal at input, the control unit 12 for driving the servomechanism 10 sends a command to the electric motor 11 for absorption of an amount of electric power such as to counter any external action exerted on the coupling lever 30, an action which, in effect, in these conditions would tend to modify the position of the shaft of the motor itself.

[0033] If, instead, upon completion of the first rotation, which is considered counterclockwise, the aforementioned third impulse signal is generated by the control unit 20, then the control unit 12 sends a command to the electric motor 11 for a rotation of the shaft in a clockwise direction, which is hence such as to disengage the toothed flange 41 from the coupling lever 30, bringing it, in effect, into a position which can be defined as neutral. In this way, the coupling lever is able to move freely since it is not being blocked in any way by the toothed flange 41.

[0034] Figures 4a, 4b, 4c and 4d correspond to a second preferred embodiment of the motorized control 1 according to the invention, which envisages, in this case, a movement of the coupling lever 30 via a rotation about an axis substantially orthogonal to the axis of rotation of the servomechanism 10.

[0035] In this second embodiment, the motorized control 1 comprises a second supporting structure 90 dedicated, also in this case, to housing the servomechanism 10 and possibly the control unit 20. This second containment structure comprises at least one third, bottom, surface 91, one fourth, side, surface 92, substantially orthogonal to said third surface 91, and one fifth, side, surface 93, substantially orthogonal to said third, bottom, surface 91 and opposite to said fourth, side, surface 92.

[0036] Advantageously, the supporting structure can be completed through a sixth, front, surface 94, a seventh, rear, surface 95 and an eighth, top, surface 96 so as to create a complete containment box of a substantially prismatic shape, as appears clearly from Figures 4a and 4b.

[0037] The bottom surface 91 may moreover advantageously comprise also third anchoring means 97 for fixing of the motorized control 1 in the proximity of the corresponding switch to be actuated.

[0038] In this second embodiment, the motorized control 1 comprises appropriate transmission means dedicated to transferring motion from the servomechanism 10 to the coupling lever 30. With reference to Figures 4c and 4d, these transmission means comprise basically a first gear 100 and a second gear 101, which are associated, respectively, to the shaft of the servomechanism 10 and to a second shaft 105 substantially orthogonal to the axis of rotation of said servomechanism 10. Advantageously, the second gear and the second rotation shaft 105 can be made in a single piece in order to decrease the number of components and thus favour the assembly operations.

[0039] Again with reference to Figure 4d, the motorized control 1 according to the invention comprises a third turning pair and a fourth turning pair, which are designed to enable rotation of the second gear 101 referred to above. In particular, said third turning pair advantageously comprises a third seat 110 obtained on said fourth, side, surface 92 and geometrically conjugated to a third end of said second shaft 105; likewise, the fourth turning pair, instead, comprises a fourth seat obtained on the aforesaid fifth, side, surface 93 and geometrically conjugated to a fourth end 113 of said second shaft 105.

[0040] From Figure 4d, it may moreover be noted how the rotation of the coupling lever 30 occurs advantageously about an axis of rotation which coincides precisely with the axis of rotation of the aforesaid second shaft 105. This solution enables a reduction in the number of components used and envisages the use of a fifth turning pair and a sixth turning pair. In particular, these latter turning pairs are obtained, respectively, through a fifth seat and a sixth seat, which are made, respectively, on

a fifth end 130 and a sixth end 135 of the coupling lever 30 and which can be geometrically coupled with said second shaft 105.

[0041] In order to favour mutual positioning of the ends of the coupling lever 30 with respect to the gear, the invention envisages the possibility of using spacer means 150 fitted on the second shaft 105, which advantageously increase also the flexural stiffness of said shaft.

[0042] In this second embodiment, the disengagement means may comprise the aforesaid toothed flange 41, which is advantageously fixedly connected to the second shaft 105 so as to perform its function according to modalities similar to the ones described previously.

[0043] This second embodiment proves particularly advantageous on account of the smaller spatial encumbrance which accompanies the solution. The servomechanism 10 has, in fact, a shaft 250 of the electric motor 11 that is substantially vertical and no longer horizontal as the one illustrated, for example, in Figure 3b and corresponding to the first embodiment referred to above.

[0044] It must moreover be emphasized how the pair of gears thus far described can effectively provide a reduction ratio for the purpose of obtaining a greater twisting moment on the coupling lever and hence enabling a greater force of movement of the lever.

[0045] The technical solutions adopted for the motorized control enable the pre-set tasks and purposes to be fully achieved. In particular, the system of movement of the coupling lever proves reliable and is obtained with a reduced number of components such as to enable a reduction in the final costs and such as to facilitate the assembly operations.

[0046] The motorized control thus conceived may undergo numerous modifications and variations, all of which fall within the scope of the claims.

[0047] In practice, the materials used, as well as the dimensions and the corresponding shapes, may be any whatsoever according to the requirements and the state of the art.

Claims

1. A motorized control (1) for a low-voltage switch, comprising:

- a servomechanism (10);
- a control unit (20) for governing said servomechanism (10); and
- a coupling lever (30) associated to said servomechanism (10) and designed to be operatively connected to said switch for determining a position of circuit-closing and/or circuit-opening thereof,

characterized in that said control unit (20) generates at output a first impulse signal, which constitutes a command for said servomechanism (10) to perform

a first rotation with pre-defined direction and amplitude, and a second impulse signal, which constitutes a command for said servomechanism (10) to perform a second rotation with pre-defined direction and amplitude, said first and said second pre-defined rotations moving said coupling lever (30) between a first pre-set position and a second pre-set position, and vice versa.

2. The motorized control (1) according to claim 1, **characterized in that** said second pre-defined rotation substantially coincides in amplitude and is opposite in direction to said first rotation.
3. The motorized control (1) according to one or more of the preceding claims, **characterized in that** said servomechanism (10) comprises an electric motor (11), a control unit (12) for governing said electric motor (11), transducer means (13) of the angular distance covered by said electric motor (11), said electric motor (11) being connected to said coupling lever (30) and performing said first and said second pre-defined rotations.
4. The motorized control (1) according to claim 3, **characterized in that** said control unit (12), following upon encoding at input of said first signal, sends a command at output to said electric motor (11) to perform said first pre-defined rotation and, following upon encoding at input of said second signal, sends a command at output to said electric motor to perform said second rotation.
5. The motorized control (1) according to claim 3 or claim 4, **characterized in that** said control unit (12) applies to said electric motor (11) a power proportional to the angular distance that must be covered thereby to complete said first or said second pre-defined rotation.
6. The motorized control (1) according to one or more of claims 3 to 5, **characterized in that** said electric motor (11) turns with a speed proportional to the angular distance that must be covered thereby to complete said first or said second pre-defined rotation.
7. The motorized control (1) according to one or more of the preceding claims, **characterized in that** it comprises disengagement means (40) designed to release said coupling lever (30) from said servomechanism (10), said disengagement means being actuated via said servomechanism (10).
8. The motorized control (1) according to one or more of the preceding claims, **characterized in that** said control unit (20) generates a third impulse signal which constitutes a command for said servomechanism (10) for activation of said disengagement

means (40).

9. The motorized control (1) according to claim 7 or claim 8, **characterized in that** said disengagement means (40) comprise a toothed flange (41) positioned at an end part of the shaft of said servomechanism (10).
10. The motorized control (1) according to one or more of the preceding claims, **characterized in that** said control unit (20) comprises means for generating impulse signals (22) configured for generating said first, second and third impulse signals in order to present one and the same frequency and different time durations of the impulses.
11. The motorized control (1) according to one or more of the preceding claims, **characterized in that** said coupling lever (30) turns about an axis substantially parallel to the axis of rotation of said servomechanism (10).
12. The motorized control (1) according to one or more of the preceding claims, **characterized in that** it comprises a first and a second turning pair designed to enable rotation of said coupling lever.
13. The motorized control (1) according to one or more of the preceding claims, **characterized in that** it comprises a first supporting structure (50) for housing said servomechanism (10) and said control unit (20), said supporting structure (50) comprising a resting base (51), a first surface (52) substantially orthogonal to said base (51), and a second surface (53) substantially orthogonal to said first surface (52) and projecting in a raised position with respect to said base (51).
14. The motorized control (1) according to claim 13, **characterized in that** said base (51) and said second surface (53) comprise first means (55) for the anchorage of said servomechanism (10) to said support (50).
15. The motorized control (1) according to claim 14, **characterized in that** said first turning pair comprises a first bushing (70), inserted in a first seat (72) of said first surface (52) and geometrically conjugated to a pin (73) obtained at a first end (75) of said coupling lever (30), said second turning pair comprising a second bushing (80) geometrically conjugated to a second seat (81) obtained on a second end (85) of said coupling lever (30), said second bushing (80) being fitted on said servomechanism (10) or on said disengagement means (40).
16. The motorized control (1) according to one or more of claims 13 to 15, **characterized in that** said base

(51) comprises second means (56) for the anchorage of said motorized control (1) on a possible outer containment casing (200).

17. The motorized control (1) according to one or more of claims 1 to 10, **characterized in that** said coupling lever (30) turns about an axis substantially orthogonal to the axis of rotation of said servomechanism (10). 5
18. The motorized control (1) according to claim 17, **characterized in that** it comprises a second supporting structure (90) for housing said servomechanism (10) and said control unit (20), said second supporting structure (90) comprising at least: one third, bottom, surface (91); one fourth, side, surface (92) substantially orthogonal to said third bottom surface (91); and one fifth, side, surface (93) substantially orthogonal to said third bottom surface (91) and opposite to said fourth, side, surface (92). 10
19. The motorized control (1) according to claim 17 or claim 18, **characterized in that** it comprises transmission means designed to transfer the motion from said electric motor (11) to said coupling lever (30), said transmission means comprising a first gear (100) which meshes with a second gear (101), said first gear (100) being associated to the shaft of said servomechanism (10), said second gear (101) being associated to a second shaft (105) substantially orthogonal to the axis of said first gear (100). 15
20. The motorized control (1) according to claim 19, **characterized in that** it comprises a third turning pair and a fourth turning pair to enable rotation of said second gear, said third and fourth turning pairs comprising respectively a third seat (110) and a fourth seat obtained on said fourth, side, surface and on said fifth, side, surface and geometrically conjugated to a third end (112) and to a fourth end (113) of said second shaft (105). 20
21. The motorized control (1) according to one or more of claims 17 to 20, **characterized in that** said disengagement means (40) are positioned on said shaft (105). 25
22. The motorized control (1) according to one or more of claims 17 to 21, **characterized in that** it comprises a fifth turning pair and a sixth turning pair designed to enable rotation of said coupling lever (30), said fifth and sixth turning pairs being made through a fifth seat and a sixth seat, which are obtained, respectively, on a fifth end (130) and a sixth end (135) of said coupling lever (30) and which can be geometrically coupled with said second shaft (105). 30

Patentansprüche

1. Motorisierte Steuerung (1) für einen Niederspannungs-Schalter, aufweisend:
 - einen Servomechanismus (10);
 - eine Steuereinheit (20) zur Steuerung des Servomechanismus (10); und
 - einen Kupplungshebel (30), der dem Servomechanismus (10) angegliedert ist und der für eine betriebsmäßige Verbindung mit dem Schalter ausgelegt ist, um zu bestimmen, ob dieser eine offene oder geschlossen Schaltstellung einnimmt,**dadurch gekennzeichnet, dass** die Steuereinheit (20) als Ausgabe ein erstes Impulssignal, das einen Befehl an den Servomechanismus (10) zur Durchführung einer ersten Drehung mit einer vorab definierten Richtung und einem vorab definierten Umfang darstellt, und ein zweites Impulssignal erzeugt, das einen Befehl an den Servomechanismus (10) zur Durchführung einer zweiten Drehung mit einer vorab definierten Richtung und einem vorab definierten Umfang darstellt, wobei die ersten und zweiten vorab definierten Drehungen den Kupplungshebel (30) zwischen einer ersten vorab eingestellten Position und einer zweiten vorab eingestellten Position hin und her bewegen. 35
2. Motorisierte Steuerung (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die zweite vorab definierte Drehung ihrem Umfang nach im Wesentlichen mit der ersten Drehung übereinstimmt, und ihrer Richtung nach entgegengesetzt dazu ist. 40
3. Motorisierte Steuerung (1) nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Servomechanismus (10) einen Elektromotor (11), eine Steuereinheit (12) zur Steuerung des Elektromotors (11) und einen Signalgeber (13) für den Winkelabstand, der vom Elektromotor (11) zurückgelegt wird, aufweist, wobei der Elektromotor (11) mit dem Kupplungshebel (30) verbunden ist und die ersten und zweiten vorab definierten Drehungen durchführt. 45
4. Motorisierte Steuerung (1) nach Anspruch 3, **dadurch gekennzeichnet, dass** die Steuereinheit (12) im Anschluss an eine Kodierung des ersten Signals einen Befehl zur Durchführung der ersten vorab definierten Drehung an den Elektromotor (11) ausgibt und im Anschluss an eine Kodierung des zweiten Signals einen Befehl zur Durchführung der zweiten Drehung an den Elektromotor ausgibt. 50
5. Motorisierte Steuerung (1) nach Anspruch 3 oder Anspruch 4, **dadurch gekennzeichnet, dass** die Steu-

- ereinheit (12) eine Leistung an den Elektromotor (11) anlegt, die proportional zum Winkelabstand ist, der von diesem zurückgelegt werden muss, um die erste oder die zweite vorab definierte Drehung zurückzulegen.
6. Motorisierte Steuerung (1) nach einem oder mehreren der Ansprüche 3 bis 5, **dadurch gekennzeichnet, dass** der Elektromotor (11) sich mit einer Geschwindigkeit dreht, die proportional zum Winkelabstand ist, der von diesem zurückgelegt werden muss, um die erste oder die zweite vorab definierte Drehung zurückzulegen.
7. Motorisierte Steuerung (1) nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie ein Ausrückungsmittel (40) aufweist, um den Kupplungshebel (30) vom Servomechanismus (10) zu lösen, wobei das Ausrückungsmittel über den Servomechanismus (10) betätigt wird.
8. Motorisierte Steuerung (1) nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Steuereinheit (20) ein drittes Impulssignal erzeugt, das einen Befehl zur Aktivierung des Ausrückungsmittels (40) für den Servomechanismus (10) darstellt.
9. Motorisierte Steuerung (1) nach Anspruch 7 oder Anspruch 8, **dadurch gekennzeichnet, dass** das Ausrückungsmittel (40) einen Zahnflansch (41) aufweist, der an einem Endabschnitt der Welle des Servomechanismus (10) angeordnet ist.
10. Motorisierte Steuerung (1) nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Steuereinheit (20) Mittel zur Erzeugung von Impulssignalen (22) aufweist, die so ausgelegt sind, dass sie nacheinander erste, zweite und dritte Impulssignale erzeugen, um ein und dieselbe Frequenz und unterschiedliche zeitliche Längen der Impulse zu liefern.
11. Motorisierte Steuerung (1) nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Kupplungshebel (30) sich um eine Achse dreht, die im Wesentlichen parallel ist zur Drehachse des Servomechanismus (10).
12. Motorisierte Steuerung (1) nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie ein erstes und ein zweites Drehkörperpaar aufweist, die dafür ausgelegt sind, eine Drehung des Kupplungshebels zu ermöglichen.
13. Motorisierte Steuerung (1) nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine erste Trägerkonstruktion (50) zur Unterbringung des Servomechanismus (10) und der Steuereinheit (20) aufweist, wobei die Trägerkonstruktion (50) eine aufliegende Basis (51), eine erste Oberfläche (52), die im Wesentlichen orthogonal ist zu der Basis (51), und eine zweite Oberfläche (53) aufweist, die im Wesentlichen orthogonal ist zur ersten Oberfläche (52) und in einer in Bezug auf die Basis (51) bevorstehenden Position vorsteht.
14. Motorisierte Steuerung (1) nach Anspruch 13, **dadurch gekennzeichnet, dass** die Basis (51) und die zweite Oberfläche (5) erste Mittel (55) für Verankerung des Servomechanismus (10) am Träger (50) aufweisen.
15. Motorisierte Steuerung (1) nach Anspruch 14, **dadurch gekennzeichnet, dass** das erste Drehkörperpaar eine erste Buchse (70) aufweist, die in eine erste Aufnahme (72) der ersten Oberfläche (52) eingeführt ist und formschlüssig mit einem Zapfen (73) verbunden ist, der an einem ersten Ende (75) des Kupplungshebels (30) ausgebildet ist, wobei das zweite Drehkörperpaar eine zweite Buchse (80) aufweist, die formschlüssig mit einer zweiten Aufnahme (81) verbunden ist, die an einem zweiten Ende (85) des Kupplungshebels (30) vorgesehen ist, wobei die zweite Buchse (80) auf den Servomechanismus (10) oder das Ausrückungsmittel (40) aufgesetzt ist.
16. Motorisierte Steuerung (1) nach einem oder mehreren der Ansprüche 13 bis 15, **dadurch gekennzeichnet, dass** die Basis (51) zweite Mittel (56) für die Verankerung der motorisierten Steuerung (1) an einem möglicherweise vorhandenen äußeren Behältergehäuse (200) aufweist.
17. Motorisierte Steuerung (1) nach einem oder mehreren der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** der Kupplungshebel (30) sich um eine Achse dreht, die im Wesentlichen orthogonal ist zur Drehachse des Servomechanismus (10).
18. Motorisierte Steuerung (1) nach Anspruch 17, **dadurch gekennzeichnet, dass** sie eine zweite Trägerkonstruktion (90) zur Unterbringung des Servomechanismus (10) und der Steuereinheit (20) aufweist, wobei die zweite Trägerkonstruktion (90) zumindest aufweist: eine dritte, untere Oberfläche (91); eine vierte, seitliche Oberfläche (92), die im Wesentlichen orthogonal ist zur dritten, unteren Oberfläche (91); und eine fünfte, seitliche Oberfläche (93), die im Wesentlichen orthogonal ist zur dritten, unteren Oberfläche (91) und die der vierten, seitlichen Oberfläche (92) gegenüber liegt.
19. Motorisierte Steuerung (1) nach Anspruch 17, **dadurch gekennzeichnet, dass** sie Übertragungsmittel

tel aufweist, die dafür ausgelegt sind, die Bewegung vom Elektromotor (11) auf den Kupplungshebel (30) zu übertragen, wobei das Getriebemittel ein erstes Zahnrad (100) aufweist, das mit einem zweiten Zahnrad (101) in Eingriff steht, wobei das erste Zahnrad (100) zur Welle des Servomechanismus (10) gehört, und wobei das zweite Zahnrad (101) zu einer zweiten Welle (105) gehört, die im Wesentlichen orthogonal ist zur Achse des ersten Zahnrads (100).

20. Motorisierte Steuerung (1) nach Anspruch 19, **dadurch gekennzeichnet, dass** sie ein drittes Drehkörperpaar und ein viertes Drehkörperpaar aufweist, um eine Drehung des zweiten Zahnrads zu ermöglichen, wobei die dritten und vierten Drehkörperpaare jeweils eine dritte Aufnahme (110) und eine vierte Aufnahme aufweisen, die an der vierten, seitlichen Oberfläche und an der fünften, seitlichen Oberfläche ausgebildet sind und formschlüssig mit einem dritten Ende (112) und einem vierten Ende (113) der zweiten Welle (105) verbunden sind.
21. Motorisierte Steuerung nach einem oder mehreren der Ansprüche 17 bis 20, **dadurch gekennzeichnet, dass** die Ausrückungsmittel (40) an der Welle (105) angeordnet sind.
22. Motorisierte Steuerung (1) nach einem oder mehreren der Ansprüche 17 bis 21, **dadurch gekennzeichnet, dass** sie ein fünftes Drehkörperpaar und ein sechstes Drehkörperpaar aufweist, die dafür ausgelegt sind, eine Drehung des Kupplungshebels (30) zu ermöglichen, wobei die fünften und sechsten Drehkörperpaare durch eine fünfte Ausnahme und eine sechste Aufnahme, die jeweils an einem fünften Ende (130) und einem sechsten Ende (135) des Kupplungshebels (30) ausgebildet sind, und die formschlüssig mit der zweiten Welle (105) verbunden werden können, gebildet sind.

Revendications

1. Dispositif de commande (1) motorisé, pour un disjoncteur à basse tension, comprenant :
- un servomécanisme (10) ;
 - une unité de commande (20), pour gouverner ledit servomécanisme (10) ; et
 - un levier d'accouplement (30), associé audit servomécanisme (10) et conçu pour être couplé fonctionnellement audit disjoncteur, de manière à déterminer une position d'une fermeture de circuit et/ou d'une ouverture de circuit de celui-ci,

caractérisé en ce que ladite unité de commande

(20) génère à la sortie un premier signal impulsif, constituant une commande pour ledit servomécanisme (10), de manière à effectuer une première rotation, avec un sens et une amplitude prédéfinis, et un deuxième signal impulsif, constituant une commande pour ledit servomécanisme (10), de manière à effectuer une deuxième rotation, avec un sens et une amplitude prédéfinis, ladite première et ladite deuxième rotations prédéfinies déplaçant ledit levier d'accouplement (30) entre une première position préétablie et une deuxième position préétablie, et vice versa.

2. Dispositif de commande (1) motorisé selon la revendication 1, **caractérisé en ce que** ladite deuxième rotation prédéfinie coïncide sensiblement en amplitude et est de sens opposé à ladite première rotation.
3. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit servomécanisme (10) comprend un moteur électrique (11), une unité de commande (12) pour gouverner ledit moteur électrique (11), des moyens transducteurs (13) de la distance angulaire parcourue par ledit moteur électrique (11), ledit moteur électrique (11) étant connecté audit levier d'accouplement (30) et accomplissant ladite première et ladite deuxième rotations prédéfinies.
4. Dispositif de commande (1) motorisé selon la revendication 3, **caractérisé en ce que** ladite unité de commande (12), à la suite du codage à une entrée dudit premier signal, envoie une commande à une sortie dudit moteur électrique (11), pour accomplir ladite rotation prédéfinie et, à la suite du codage à une entrée dudit deuxième signal, envoie une commande à une sortie audit moteur électrique, pour accomplir ladite deuxième rotation.
5. Dispositif de commande (1) motorisé selon la revendication 3 ou la revendication 4, **caractérisé en ce que** ladite unité de commande (12) applique audit moteur électrique (11) une énergie proportionnelle à la distance angulaire devant être parcourue, de manière à accomplir ladite première ou ladite deuxième rotation prédéfinie.
6. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications 3 à 5, **caractérisé en ce que** ledit moteur électrique (11) tourne à une vitesse proportionnelle à la distance angulaire devant être parcourue, de manière à accomplir ladite première ou ladite deuxième rotation prédéfinie.
7. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce qu'il** comprend des moyens de désengagement (40), conçus pour dégager ledit levier

d'accouplement (30) vis-à-vis dudit servomécanisme (10), lesdits moyens de désengagement étant actionnés via ledit servomécanisme (10).

8. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite unité de commande (20) génère un troisième signal impulsif, constituant une commande pour ledit servomécanisme (10), pour l'activation desdits moyens de désengagement (40). 5
9. Dispositif de commande (1) motorisé selon la revendication 7 ou la revendication 8, **caractérisé en ce que** lesdits moyens de désengagement (40) comprennent une bride dentée (41), positionnée à une partie d'extrémité de l'arbre dudit servomécanisme (10). 10
10. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite unité de commande (20) comprend des moyens pour générer des signaux impulsifs (22), configurés pour générer lesdits premiers, deuxièmes et troisièmes signaux impulsifs, de manière à présenter une seule et même fréquence et des durées d'impulsions différentes. 20
11. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit levier d'accouplement (30) tourne autour d'un axe sensiblement parallèle à l'axe de rotation dudit servomécanisme (10). 25
12. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce qu'il** comprend une première et une deuxième paire rotative, conçues pour permettre la rotation dudit levier d'accouplement. 30
13. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce qu'il** comprend une première structure support (50), pour loger ledit servomécanisme (10) et ladite unité de commande (20), ladite structure support (50) comprenant une base formant socle (51), une première surface (52), sensiblement orthogonale à ladite base (51), et une deuxième surface (53), sensiblement orthogonale à ladite première surface (52) et faisant saillie, en une position levée, par rapport à ladite base (51). 35
14. Dispositif de commande (1) motorisé selon la revendication 13, **caractérisé en ce que** ladite base (51) et ladite deuxième surface (53) comprennent des premiers moyens (55) pour l'ancrage dudit servomécanisme (10) sur ledit support (50). 40

15. Dispositif de commande (1) motorisé selon la revendication 14, **caractérisé en ce que** ladite première paire rotative comprend une première douille (70), insérée dans un premier siège (72) de ladite première surface (52) et conjuguée géométriquement à une tige (73), obtenue à une première extrémité (75) dudit levier d'accouplement (30), ladite deuxième paire rotative comprenant une deuxième douille (80), conjuguée géométriquement à un deuxième siège (81) obtenu sur une deuxième extrémité (85) dudit levier d'accouplement (30), ladite deuxième douille (80) étant montée sur ledit servomécanisme (10) ou sur lesdits moyens de désengagement (40). 45
16. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications 13 à 15, **caractérisé en ce que** ladite base (51) comprend des deuxièmes moyens (56) pour l'ancrage dudit dispositif de commande (1) motorisé, sur une éventuel boîtier de confinement extérieur (200). 50
17. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications 1 à 10, **caractérisé en ce que** ledit levier d'accouplement (30) tourne autour d'un axe sensiblement orthogonal à l'axe de rotation dudit servomécanisme (10). 55
18. Dispositif de commande (1) motorisé selon la revendication 17, **caractérisé en ce qu'il** comprend une deuxième structure support (90), pour loger ledit servomécanisme (10) et ladite unité de commande (20), ladite deuxième structure support (90) comprenant au moins : une troisième surface inférieure (91), une quatrième surface latérale (92), sensiblement orthogonale à ladite troisième surface inférieure (91) ; et une cinquième surface latérale (93), sensiblement orthogonale à ladite troisième surface inférieure (91) et opposée à ladite quatrième surface latérale (92). 60
19. Dispositif de commande (1) motorisé selon la revendication 17 ou la revendication 18, **caractérisé en ce qu'il** comprend des moyens de transmission, conçus pour transférer le mouvement, dudit moteur électrique (11) audit levier d'accouplement (30), lesdits moyens de transmission comprenant une première roue dentée (100), s'engrenant avec une deuxième roue dentée (101), ladite première roue dentée (100) étant associée à l'arbre dudit servomécanisme (10), ladite deuxième roue dentée (101) étant associée à un deuxième arbre (105) sensiblement orthogonal à l'axe de ladite première roue dentée (100). 65
20. Dispositif de commande (1) motorisé selon la revendication 19, **caractérisé en ce qu'il** comprend une troisième paire rotative et une quatrième paire rotative, pour permettre la rotation de ladite deuxième roue dentée, lesdites troisième et quatrième paires rotatives comprenant respectivement un troisième 70

siège (110) et un quatrième siège, obtenus sur ladite quatrième surface latérale et sur ladite cinquième surface latérale, et conjugués géométriquement à une troisième extrémité (112) et à une quatrième extrémité (113) dudit deuxième arbre (105).

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21. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications 17 à 20, **caractérisé en ce que** lesdits moyens de désengagement (40) sont positionnés sur ledit arbre (105).

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22. Dispositif de commande (1) motorisé selon l'une ou plusieurs des revendications 17 à 21, **caractérisé en ce qu'il** comprend une cinquième paire rotative et une sixième paire rotative, conçues pour permettre la rotation dudit levier d'accouplement (30), lesdites cinquième et sixième paires rotatives étant passées par un cinquième siège et un sixième siège, obtenus, respectivement, sur une cinquième extrémité (130) et une sixième extrémité (135) dudit levier d'accouplement (30) et pouvant être couplées géométriquement audit deuxième arbre (105).

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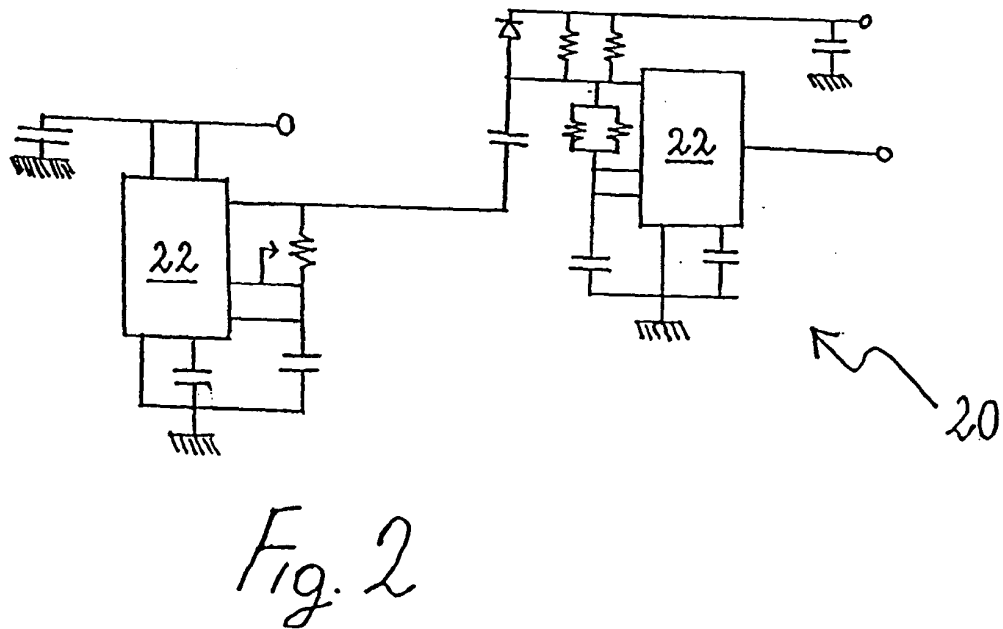
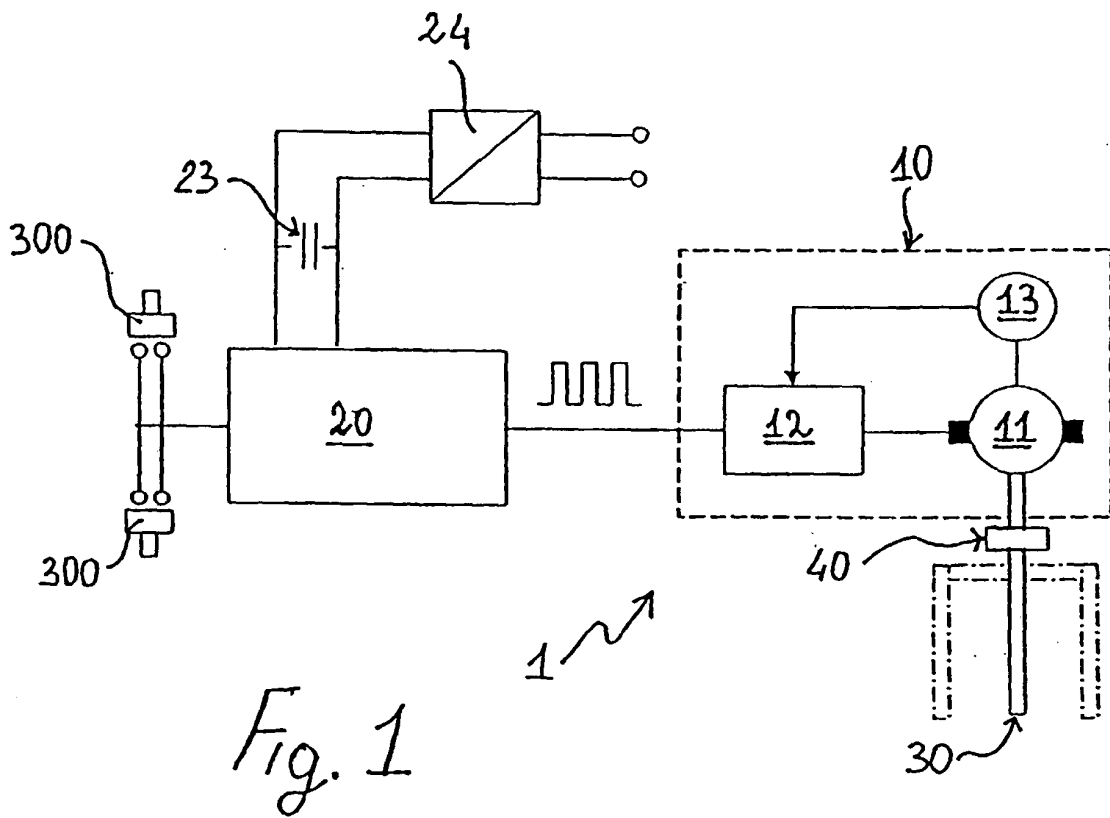
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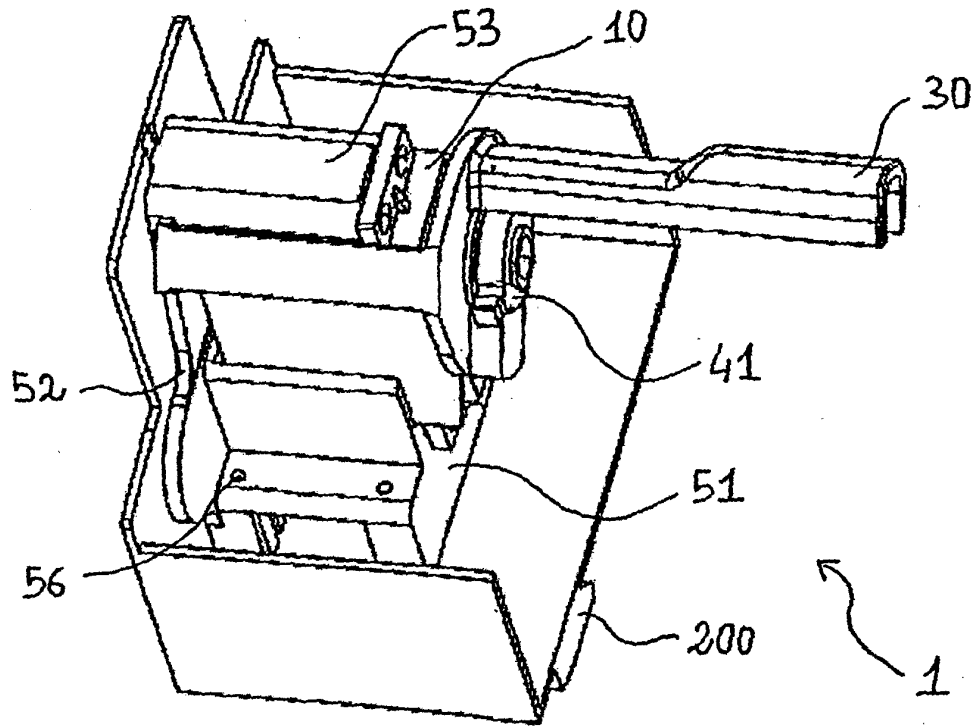


Fig. 3a

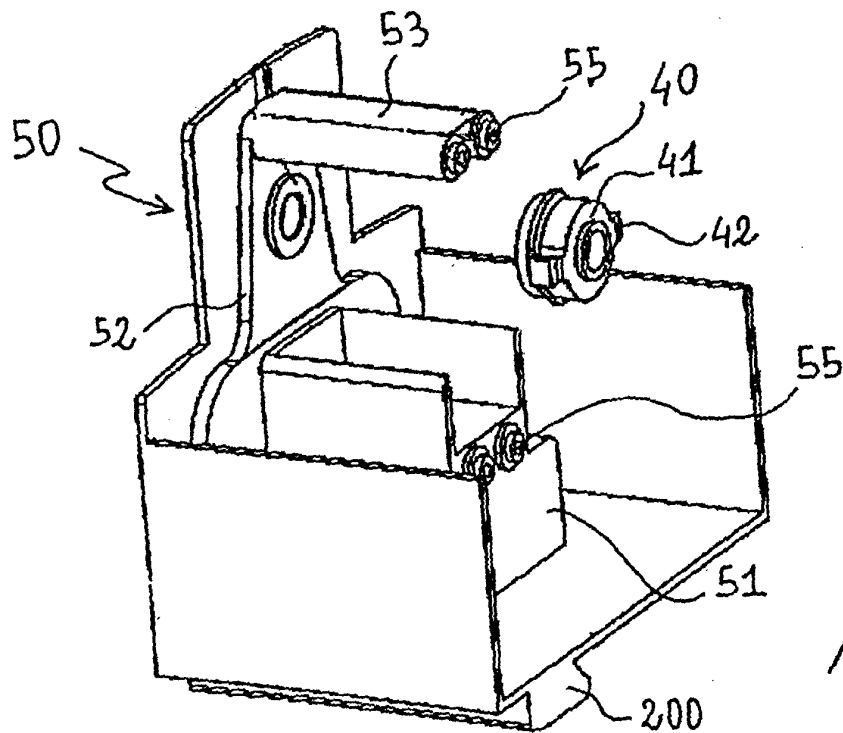


Fig. 3b

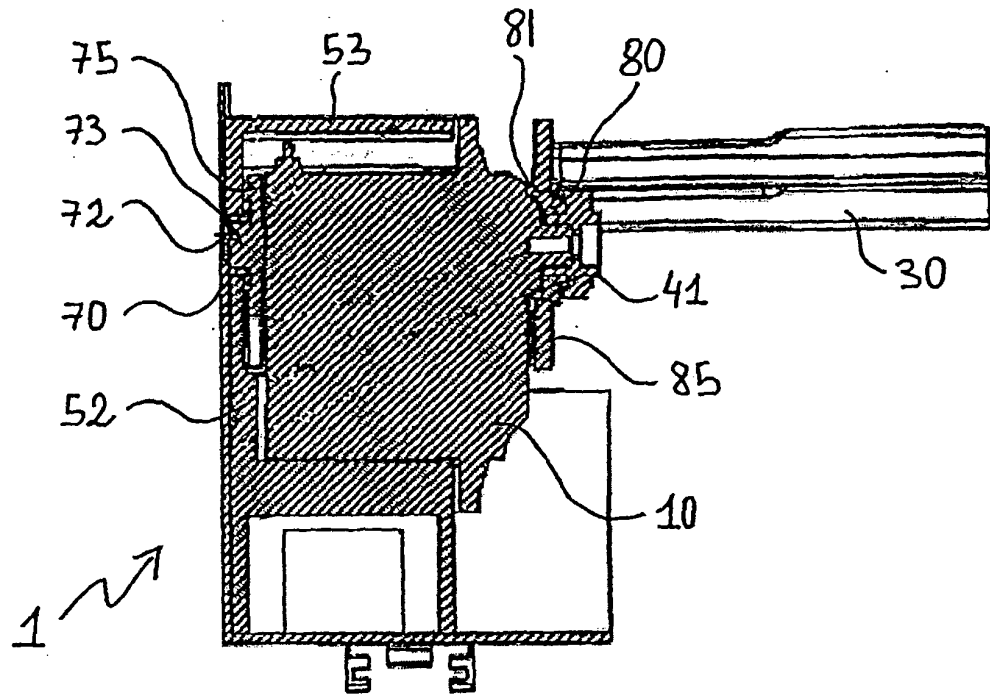


Fig. 3c

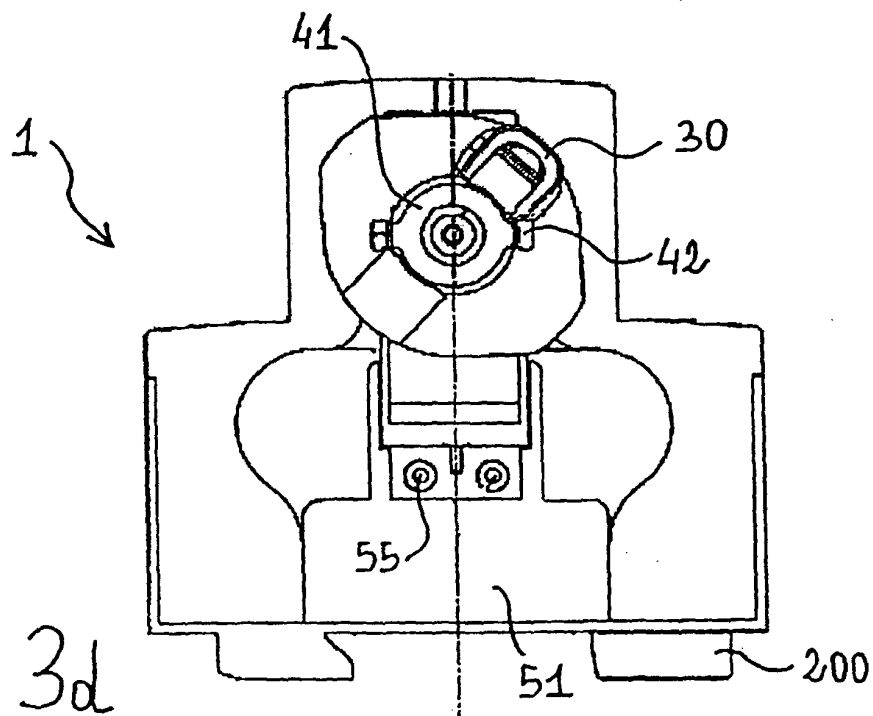
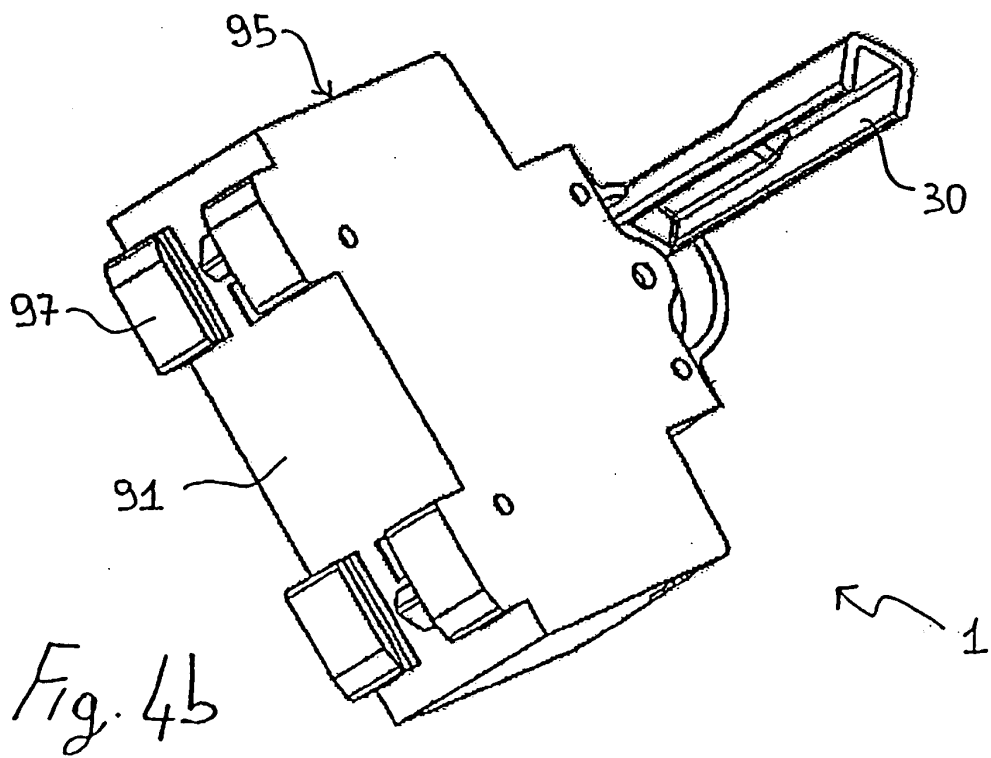
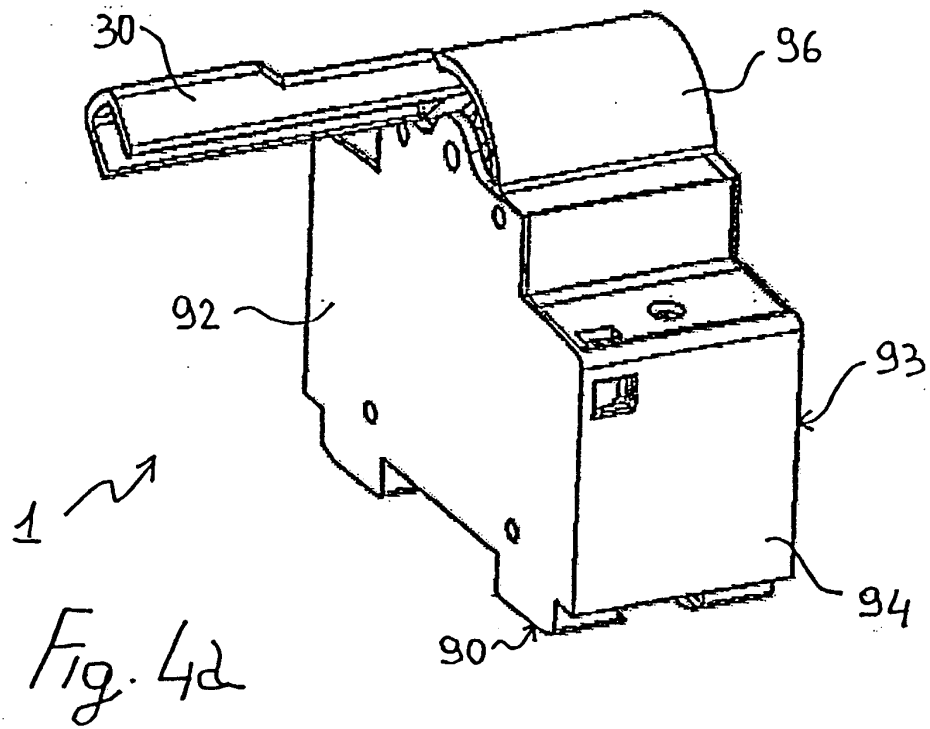
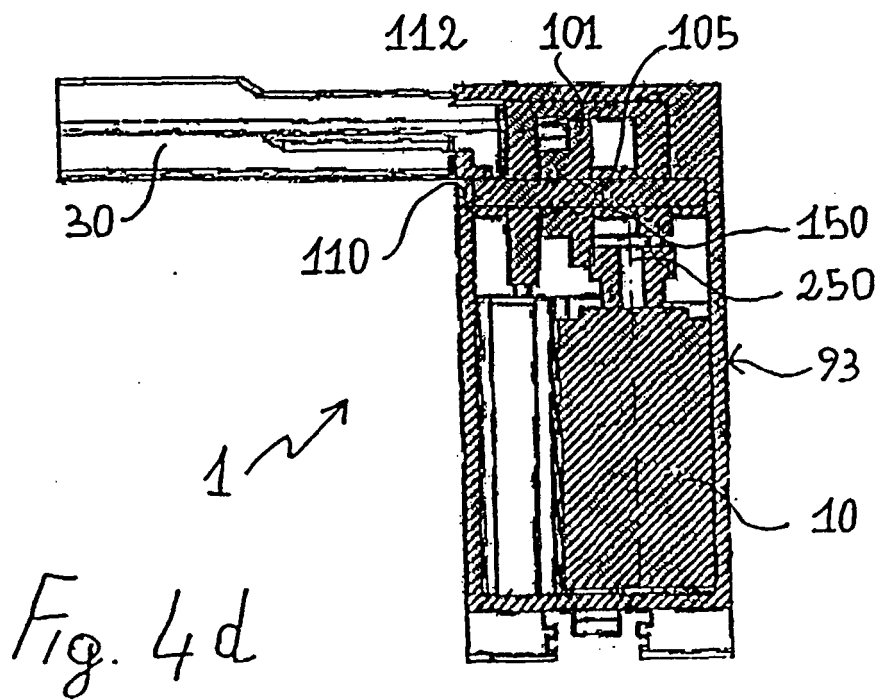
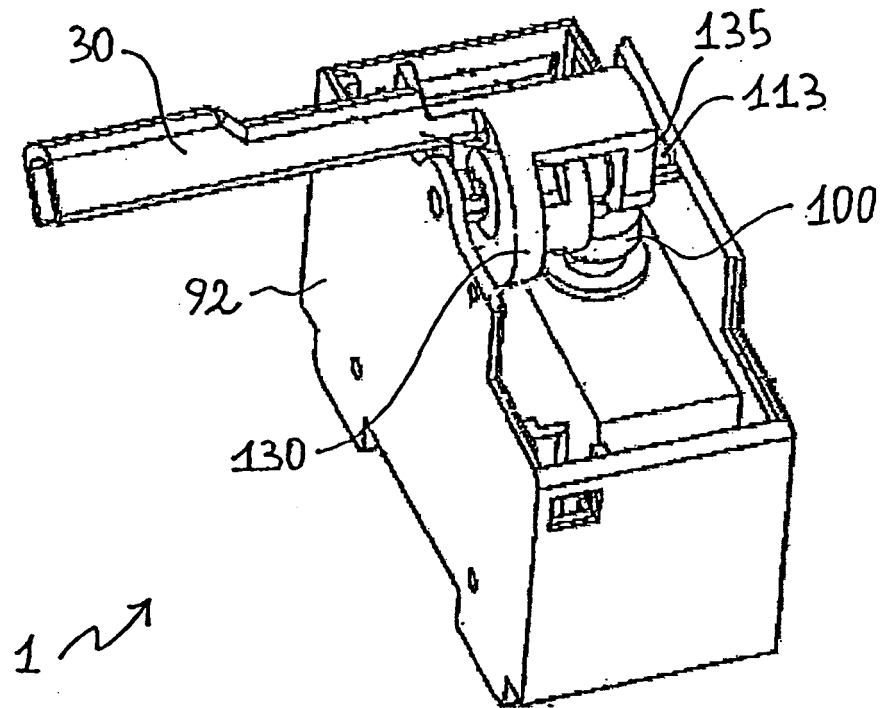


Fig. 3d





REFERENCES CITED IN THE DESCRIPTION

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