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(54) CONTROL DEVICE FOR CIRCUIT BREAKERS

(57) A control device for circuit breakers, including a casing that can be coupled to an electrical device, such as a circuit breaker provided with a control for opening and closing the contacts; the casing includes a rotor that is mechanically associated with the control for opening and closing the contacts of the breaker; the control device includes an electric motor that drives a gear system by means of a worm screw; the gear system turns the rotor by means of a last gear that is actuated by the motor and a pusher gear that is integral with the rotor. The control device includes a decoupling gear, which always meshes with the last gear, and a switching means adapted to move the decoupling gear between two operating positions: an engagement position, in which the decoupling gear meshes with the pusher gear, and a neutral position, in which the decoupling gear does not mesh with the pusher wheel. In the engagement position the motor transmits motion to the rotor, which performs an operation for closing the handle of the circuit breaker.

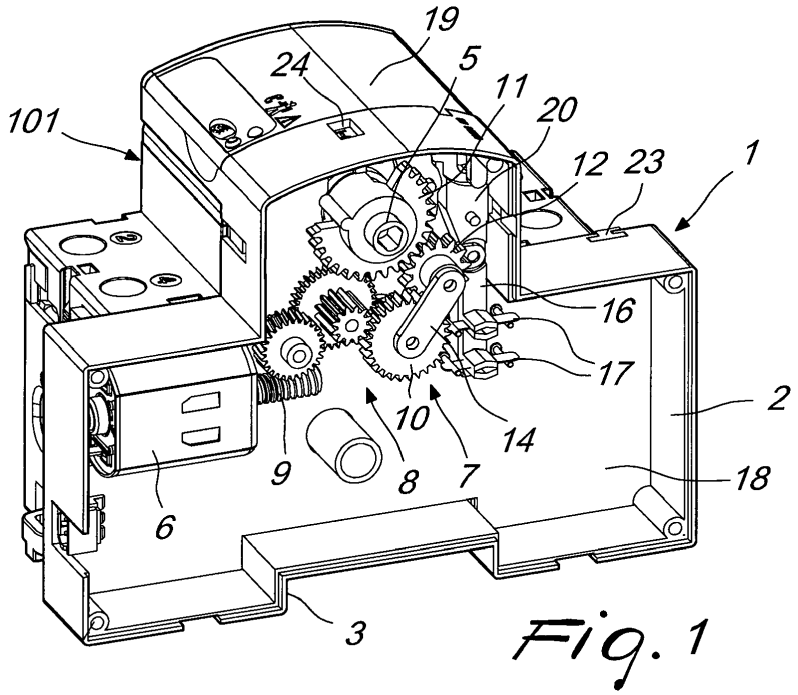

Fig. 1

EP 3 125 267 A1

Description

[0001] The present invention relates to a control device for circuit breakers.

[0002] More particularly, the invention relates to a device for automatically resetting a residual current operated circuit breaker or another similar apparatus.

[0003] As is known, electrical systems are provided with circuit breakers adapted to prevent a fault current from causing danger for users and for the loads connected to the electrical line. When the presence of the fault current is detected, a residual current operated circuit breaker disengages the line, thus interrupting the supply of power to the load or loads arranged downstream.

[0004] After the circuit breaker is disengaged, and once the correct operating conditions for the system have been restored, the residual current operated circuit breaker must be reset.

[0005] Motorized devices are known which are adapted to reset a circuit breaker or to disengage it by means of a remote control.

[0006] Prior art devices generally include a motor with a double winding, which is capable of rotating an actuation mechanism provided with a worm screw in one direction or the other depending on whether it is necessary to close or open the circuit breaker.

[0007] Resetting devices are generally contained in a casing that can be associated with the circuit breaker so that the actuation mechanism acts on the drum of the handle of the circuit breaker.

[0008] The known devices described above have the drawback of being rather bulky.

[0009] EP2131376 discloses a control device which includes a casing that can be coupled to a circuit breaker provided with a control for opening and closing the contacts; the casing includes a drum, which is mechanically connected to the control for opening and closing the contacts of the circuit breaker; the drum is turned by a single electric motor by means of a gear train driven by a worm screw. The gear train can turn the drum in one direction or the other by means of a rotation switching means, which includes a bar, moved by the gear train, which turns the drum alternately in one direction or the other, by virtue of the action of two contoured oscillating members.

[0010] The device described in EP2131376 is much more compact than the previous devices; its dimensions are in fact reduced to the equivalent of a single module, as defined by DIN standards, by virtue of the adoption of a single motor and of the particular actuation mechanism, which allows to reverse the direction of rotation of the actuation drum.

[0011] US2005/212628 discloses a circuit breaker configured to be remotely operated, wherein the decoupling takes place between levers.

[0012] The aim of the present invention is to provide a control device for circuit breakers that is more compact than the motorized control devices known so far.

[0013] Within the scope of this aim, an object of the invention is to provide a device that allows the automatic reclosing of circuit breakers.

[0014] Another object of the invention is to provide a control device that is functionally and constructively improved with respect to the devices of the prior art.

[0015] A further object of the invention is to provide a device that has a state in which the device cannot rearm the circuit breaker.

[0016] A further object of the invention is to provide a device that is significantly more economical from the point of view of production.

[0017] Another object is to provide a device which, by virtue of its particular constructive characteristics, is capable of giving the greatest assurances of reliability and safety in use.

[0018] This aim and these and other objects that will become better apparent hereinafter are achieved by a control device for circuit breakers, comprising a casing that can be coupled to an electrical device, such as a circuit breaker provided with a control member for opening and closing the contacts, said casing comprising a rotor that is mechanically associated with said control member for opening and closing the contacts of said breaker; said control device comprising an electric motor that drives a gear system by means of a worm screw, said gear system turning said rotor; said gear system comprising a last gear that is actuated by the motor and a pusher gear that is integral with said rotor; said control device being characterized in that it comprises a decoupling gear, which always meshes with said last gear, and a switching means adapted to move said decoupling gear between two operating positions: an engagement position, in which said decoupling gear meshes with said pusher gear, and a neutral position, in which said decoupling gear does not mesh with said pusher wheel; in said engagement position said motor transmits motion to said rotor, which performs an operation for closing said control member for opening and closing the contacts.

[0019] Further characteristics and advantages will become better apparent from the description of preferred not exclusive embodiments of the invention, illustrated by way of nonlimiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the control device according to the present invention, shown in conditions for use applied to a circuit breaker;

Figure 2 is another perspective view of the device, shown from the side of the circuit breaker;

Figure 3 is a perspective view of the device;

Figure 4 is a perspective view of an engagement member;

Figure 5 is a plan view of the device;

Figure 6 is a side view of the side of the device intended to be coupled to the circuit breaker;

Figure 7 is a side view of the device, which shows the side that lies opposite the one associated with

the breaker;

Figure 8 is a plan view of the device associated with the circuit breaker;

Figure 9 is a detail view of the region of application of an engagement member;

Figure 10 is a plan view of the device associated with the circuit breaker, shown in the condition in which the circuit breaker is open and the resetting device is deactivated;

Figure 11 is a side view of the device in the condition of the preceding figure;

Figure 12 is a plan view of the device associated with the circuit breaker, shown in the condition in which the circuit breaker is closed and the device is in the activation step;

Figure 13 is a side view of the device in the condition of the preceding figure;

Figure 14 is a plan view of the device associated with the circuit breaker, shown in the condition in which the circuit breaker is closed and the device is activated;

Figure 15 is a side view of the device in the condition of the preceding figure;

Figure 16 is a perspective view of the control device according to another aspect of the invention, shown in conditions for use applied to a circuit breaker;

Figure 17 is another perspective view of the device of the preceding figure, shown from the side of the circuit breaker;

Figure 18 is a plan view of the device of the preceding figure;

Figure 19 is a side view of the device of the preceding figure, showing the side intended to be coupled to the circuit breaker;

Figure 20 is a plan view of the device of the preceding figure associated with the circuit breaker, shown in the condition in which the circuit breaker is open and the resetting device is deactivated;

Figure 21 is a side view of the device in the condition of the preceding figure;

Figure 22 is a plan view of the device of the preceding figure associated with the circuit breaker, shown in the condition in which the circuit breaker is closed and the device is in the activation step;

Figure 23 is a side view of the device in the condition of the preceding figure;

Figure 24 is a detail view of the region of application of an engagement member of the device of Figure 23;

Figure 25 is a plan view of the device of Figures 16-23 associated with the circuit breaker, shown in the condition in which the circuit breaker is closed and the device is activated;

Figure 26 is a side view of the device in the condition of the preceding figure.

[0020] With reference to the cited figures, the control device for circuit breakers according to the invention, designated generally by the reference numeral 1, has a casing 2, which has the classic standardized shape and forms, at the rear face 3, a means for engagement with other apparatuses associated with an omega rail (not shown) according to the DIN standards.

[0021] The casing 2 has, at the upper face, a protrusion 4 in which a rotor 5 is placed.

[0022] The control device 1, also known as resetting device or resetting module, is studied to be arranged laterally adjacent to other modules and in particular to a circuit breaker 101.

[0023] The kinematic system of the resetting device 1 is connected to the kinematic system of the circuit breaker 101 by means of a bar 102 having a triangular cross-section, which constitutes the rotation axis of the rotor 5, so the rotation of the rotor 5 corresponds exactly to the rotation of the drum of the circuit breaker 101, which is provided with the usual external actuation lever or handle 103.

[0024] The device 1 has an electric motor 6, which actuates the rotor 5 by means of a gear system, generally designated by the reference numeral 7.

[0025] The gear system 7 has a reduction gear train 8 driven by a worm screw 9 associated with the shaft of the motor 6.

[0026] The reduction gear train 8 includes a last gear 10, which may or may not mesh with a pusher gear 11, which is integral with the rotor 5: when the pusher gear 11 meshes with the last gear 10, the rotation of the shaft of the motor 6 is transmitted to the rotor 5, which performs the operation for closing the handle 103 of the circuit breaker 101.

[0027] The meshing of the last gear with the pusher gear 11 is performed by a decoupling gear 12, which always meshes with the last gear 10.

[0028] The decoupling gear 12 is associated with the last gear 10 by means of a linkage 14, which allows the axis of the decoupling gear 12 to rotate with respect to the axis of the last gear 10, determining at least two operating positions: an engagement position, visible in Figures 1, 7, 13 and 15, in which the decoupling gear 12 meshes with the pusher gear 11, and a neutral position, visible in Figure 11, in which the decoupling gear 12 does not mesh with the pusher gear 11.

[0029] The movement of the linkage 14, in order to couple or decouple the decoupling gear 12 and the pusher gear 11, is actuated by a disconnecting slider 16, which can move along its own longitudinal axis.

[0030] Two connect-disconnect blades 17 are arranged on the disconnecting slider 16 and allow to supply power and remove power from an electronic board, not visible in the figures, which is arranged in the casing 2, in a region designated by the reference numeral 18.

[0031] The disconnecting slider 16 has the function of closing the electric circuit of the electric board supplying power to the board and disconnecting a control circuit when the device is disabled. The disconnecting slider 16 furthermore, or as an alternative, has the function of en-

gaging and disengaging the decoupling gear 12 of the gear system in order to convey motion to the rotor 5.

[0032] The device 1 includes an activation member, constituted by a cover 19, which can be mechanically connected to, or disconnected from, the disconnecting slider 16 by means of a lever system 20.

[0033] The disconnecting slider 16 is moved by the cover 19 when the cover 19 is rotated in the direction of activation of the system.

[0034] The device 1 includes a locking lever 21 that is pivoted to the body 2, inside the protrusion 4, and is actuated by the rotor 5.

[0035] The locking lever 21 has at least one position for mechanically locking the disconnecting slider 16 in the open position, as shown in Figure 7.

[0036] The locking lever 21 moves an indicator lever 22, which indicates the position of the contacts of the circuit breaker and/or of the disconnector.

[0037] The device 1 includes two engagement members 23 which firmly engage the device 1 with the circuit breaker 101.

[0038] The engagement members 23 may be made of a different material with respect to the body 2 so as to provide better flexibility.

[0039] The engagement members 23 can be integrated in the body 2 during production or can be supplied separately to be installed during the coupling of the device 1 to the circuit breaker 101.

[0040] The device 1 according to the present invention allows the automatic closure of the circuit breaker 101 by means of the gear system that transfers motion from the motor 6 to the rotor 5, which in turn is coupled to the handle 103 of the circuit breaker 101 by means of the bar 102.

[0041] The decoupling gear 12 always meshes with the last gear 10 and its axis can rotate with respect to the axis of the last gear 10 between two operating positions: an engagement position, in which the decoupling gear 12 meshes with the pusher gear 11, allowing the rotor 5 to perform the operation of closing the handle 103, and a neutral position, in which the decoupling gear 12 does not mesh with the pusher gear 11 and does not allow transmission of motion from the motor 6 to the rotor 5.

[0042] The two engagement and neutral positions are determined by the movement of the disconnecting slider 16 connected to the axis of the decoupling gear 12.

[0043] The disconnecting slider 16 also has the function of closing the electric circuit of the electronic board, supplying power to the board, and of disconnecting the control circuit when the device is disabled. The disconnecting slider 16 is moved by the cover 19 when the cover 19 is rotated in the direction of activation of the system.

[0044] The connect-disconnect blades 17, arranged on the disconnecting slider 16, allow to supply power to the electronic board and remove power from it.

[0045] The rotor 5 performs a 90° rotation and moves the locking lever 21, which has two functions: mechanical locking of the disconnecting slider 16 and actuation of the indicator lever 22.

[0046] The locking lever 21 performs the mechanical locking of the disconnecting slider 16 when the handle 103 of the associated circuit breaker 101 is in the open position and the cover 19 is open. In this condition, which is shown in Figures 10 and 11, the locking lever 21 prevents the rotation of the cover 19, locking the sliding of the disconnecting slider 16 and therefore the activation of the resetting device.

[0047] Also, the locking lever 21 moves the indicator lever 22, which indicates the position of the contacts of the breaker and/or of the disconnector by means of the opening 24 provided in the upper part of the protrusion 4.

[0048] The indicator lever 22 is in the I-ON position, i.e., the position in which the circuit breaker contacts are closed, in three cases:

- when the handle 103 of the circuit breaker 101 is closed and the cover 19 is open (Figures 12 and 13);
- when the handle 103 of the circuit breaker 101 is closed and the cover 19 is closed (Figures 14 and 15);
- when the handle 103 of the circuit breaker 101 is open and the cover 19 is closed (the contacts of the circuit breaker are open but the resetting device can proceed with closure).

[0049] The indicator lever 22 is in the O-OFF position i.e., the position in which the contacts of the circuit breaker are open, when the handle 103 of the circuit breaker 101 is open and the cover 19 is open (Figures 10 and 11).

[0050] Figures 16-26 show a further embodiment of the control device, designated by the reference numeral 201.

[0051] The device 201 is substantially similar to the embodiment shown in Figures 1-15, but with an arrangement of some components that is rotated symmetrically with respect to the first embodiment.

[0052] In Figures 16-26, the reference numerals that are identical to the numerals used in Figures 1-15 designate identical elements.

[0053] Device 201 has a sliding button 225 that has the function of locking the cover 19.

[0054] In practice it has been found that the invention achieves the intended aim and objects, providing a compact resetting module that performs the automatic reclosing of modular automatic circuit breakers, with a solution that is simple and low in cost in order to allow mechanical decoupling of the handle of the associated circuit breaker when the activation member, known as cover, is actuated.

[0055] The placement of the components inside the device allows to optimize the spaces assigned to mechanical components and to the electronics.

Claims

1. A control device for circuit breakers, comprising a casing that can be coupled to an electrical device, such as a circuit breaker provided with a control member for opening and closing the contacts, said casing comprising a rotor that is mechanically associated with said control member for opening and closing the contacts of said breaker; said control device comprising an electric motor that drives a gear system by means of a worm screw, said gear system turning said rotor; said gear system comprising a last gear that is actuated by the motor and a pusher gear that is integral with said rotor; said control device being **characterized in that** it comprises a decoupling gear, which always meshes with said last gear, and a switching means adapted to move said decoupling gear between two operating positions: an engagement position, in which said decoupling gear meshes with said pusher gear, and a neutral position, in which said decoupling gear does not mesh with said pusher wheel; in said engagement position said motor transmits motion to said rotor, which performs an operation for closing said control member for opening and closing the contacts.

2. The device according to claim 1, **characterized in that** said decoupling gear is associated with said last gear by means of a linkage; said linkage allowing the axis of said decoupling gear to rotate with respect to the axis of said last gear, determining said two functional positions.

3. The device according to claim 2, **characterized in that** said switching means comprises a disconnecting slider that can move along its longitudinal axis.

4. The device according to claim 3, **characterized in that** two connect-disconnect blades are arranged on said disconnecting slider; said blades allowing to supply power to, and remove power from, an electronic board arranged in said casing.

5. The device according to claim 3, **characterized in that** said disconnecting slider has a function of closing the electric circuit of the electronic board, supplying power to said board and disconnecting a control circuit when said device is disabled; said slider further having, or having as an alternative, a function of engaging and disengaging said decoupling gear in said gear system in order to transfer motion to said rotor.

6. The device according to claim 3, **characterized in that** it comprises an activation member that is constituted by a cover that is pivoted to said body.

7. The device according to claim 6, **characterized in that** said cover is mechanically connected to said disconnecting slider by means of a lever system; said disconnecting slider being moved by said cover when said cover is turned in the direction of activation of the system.

8. The device according to claim 3, **characterized in that** it comprises a locking lever that is pivoted to said body and is actuated by said rotor; said locking lever having at least one position for mechanical locking said disconnecting slider in the open position and accordingly locking said cover, preventing it from reaching the position for activation of the device; said locking lever also moving an indicator lever that is configured to indicate the position of the contacts of the circuit breaker and/or of the disconnector.

9. The device according to one or more of the preceding claims, **characterized in that** it comprises engagement members that are configured to firmly engage said device with said circuit breaker; said engagement members being made of flexible material.

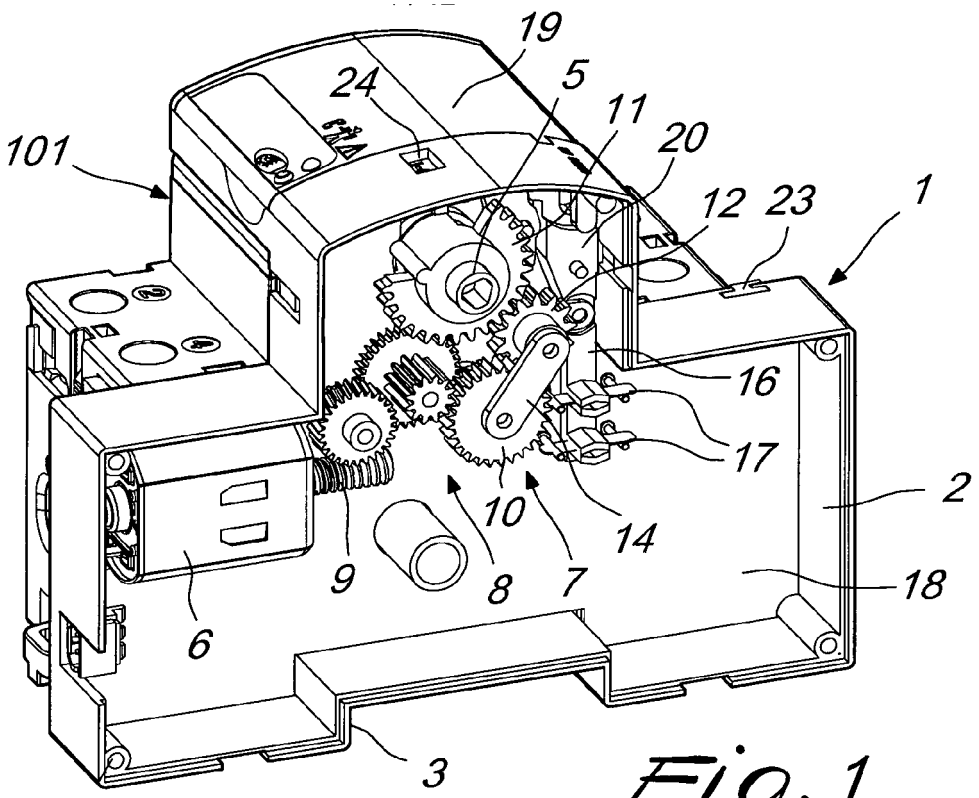

Fig. 1

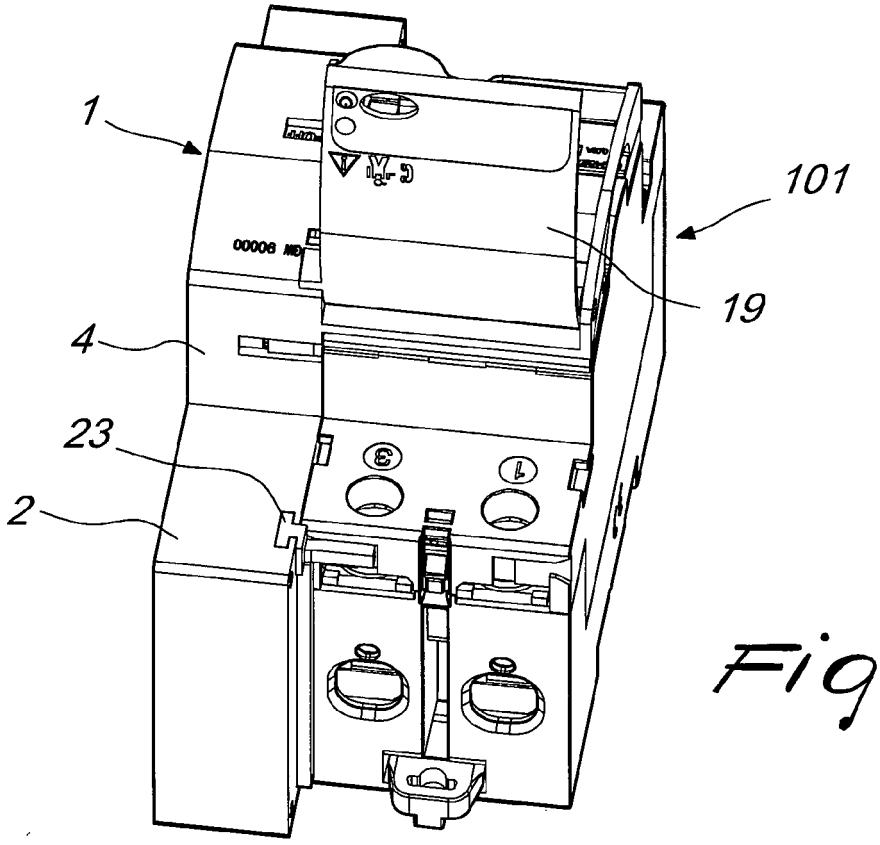

Fig. 2

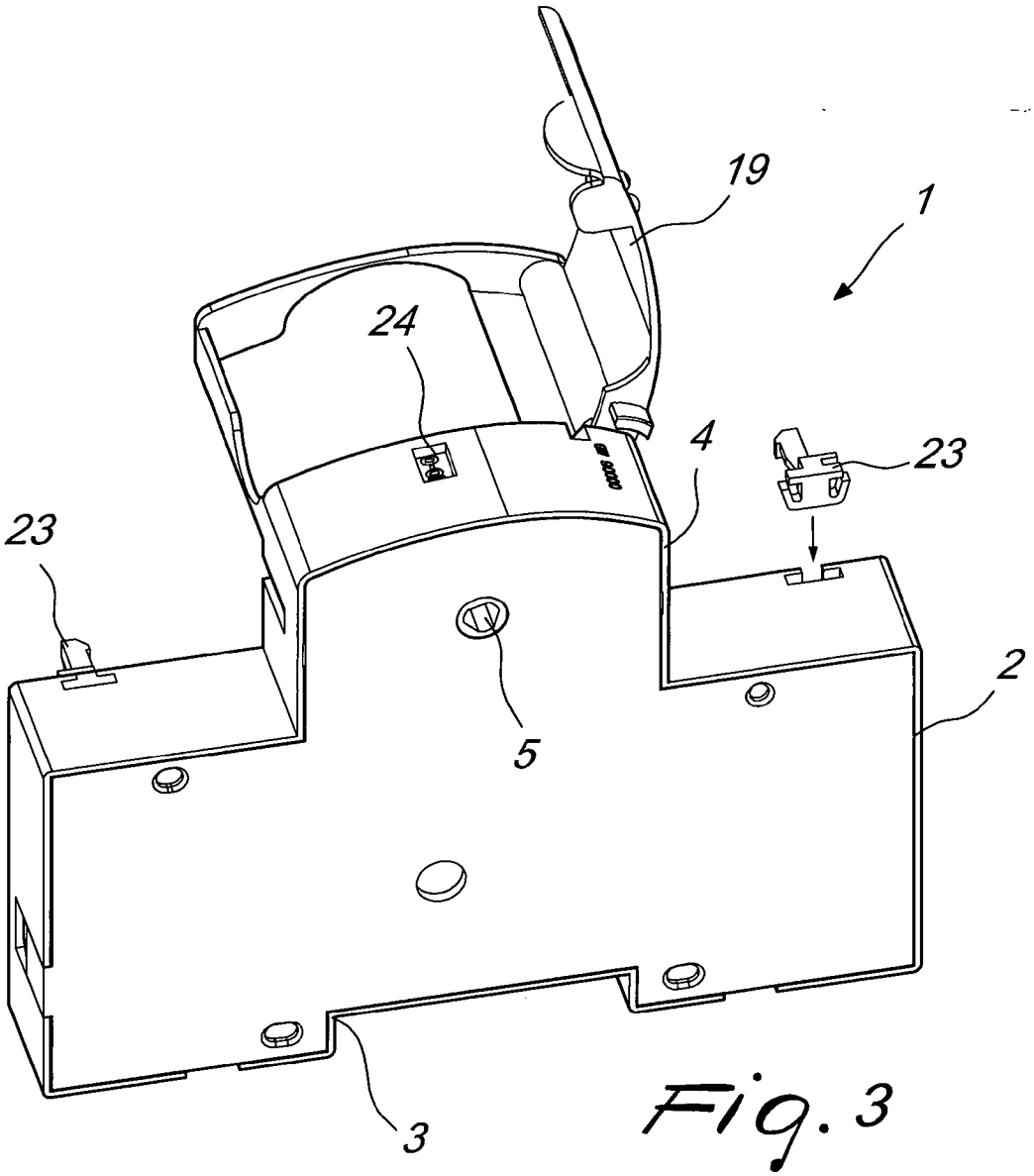

Fig. 3

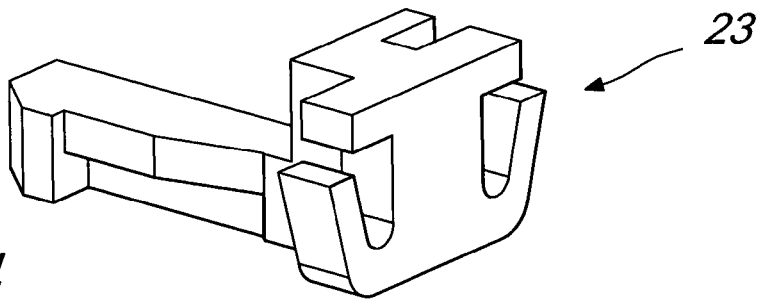

Fig. 4

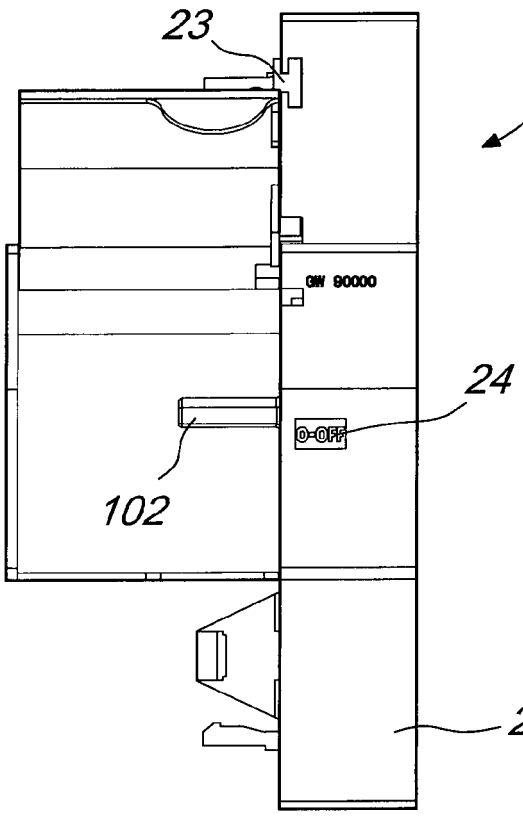

Fig. 5

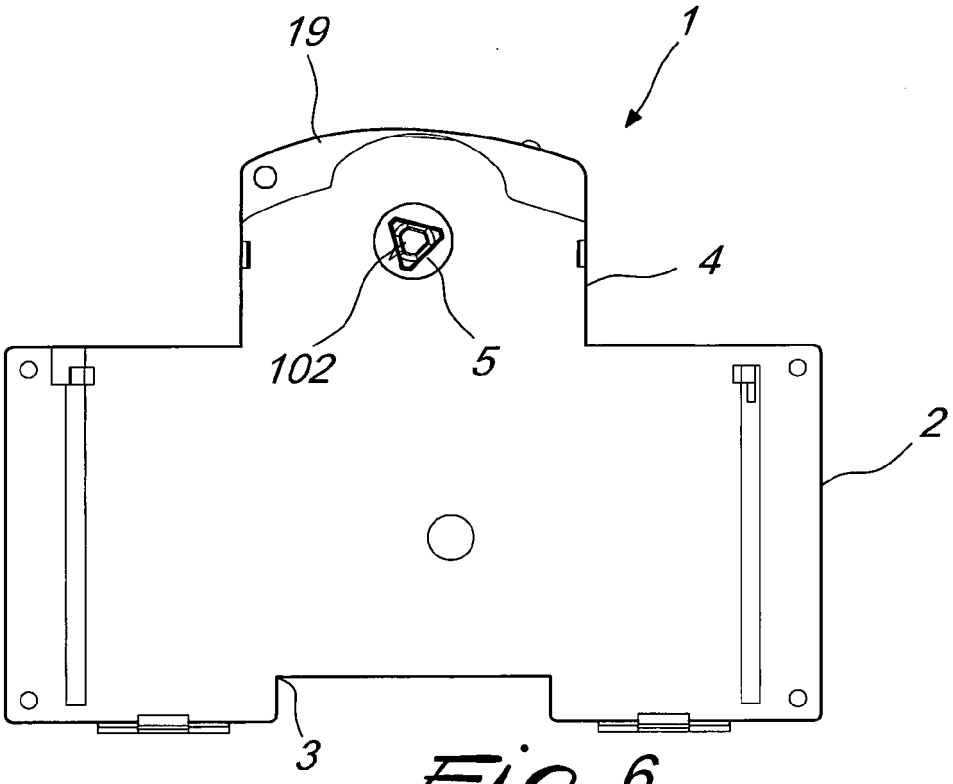

Fig. 6

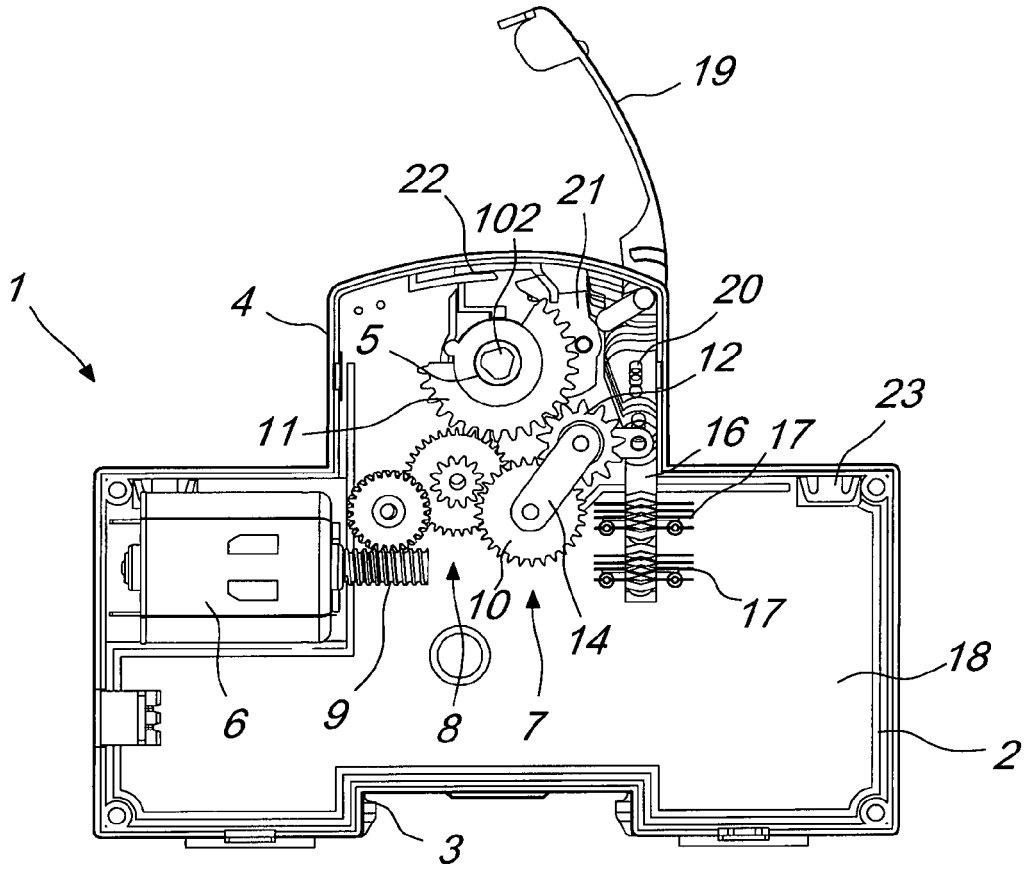

Fig. 7

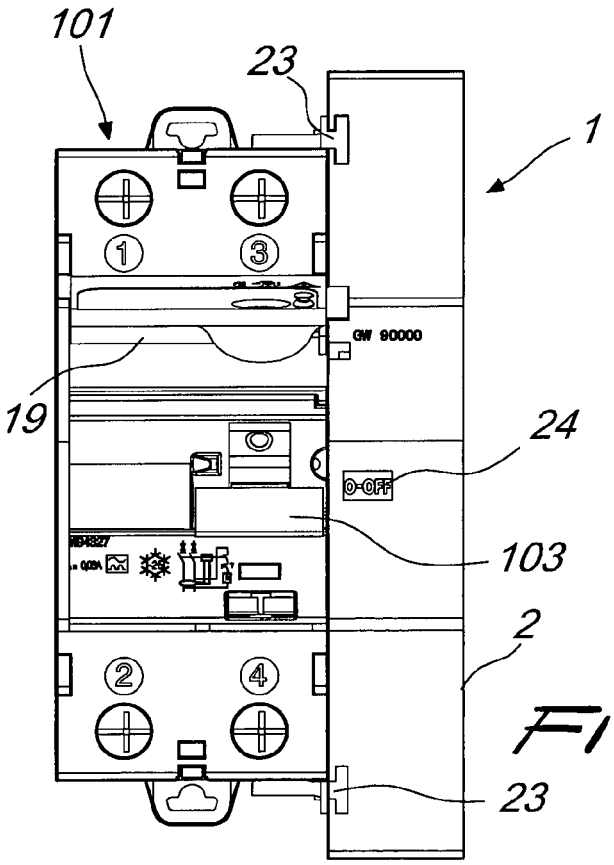

Fig. 8

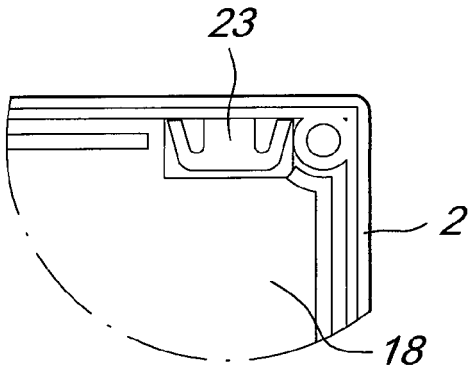

Fig. 9

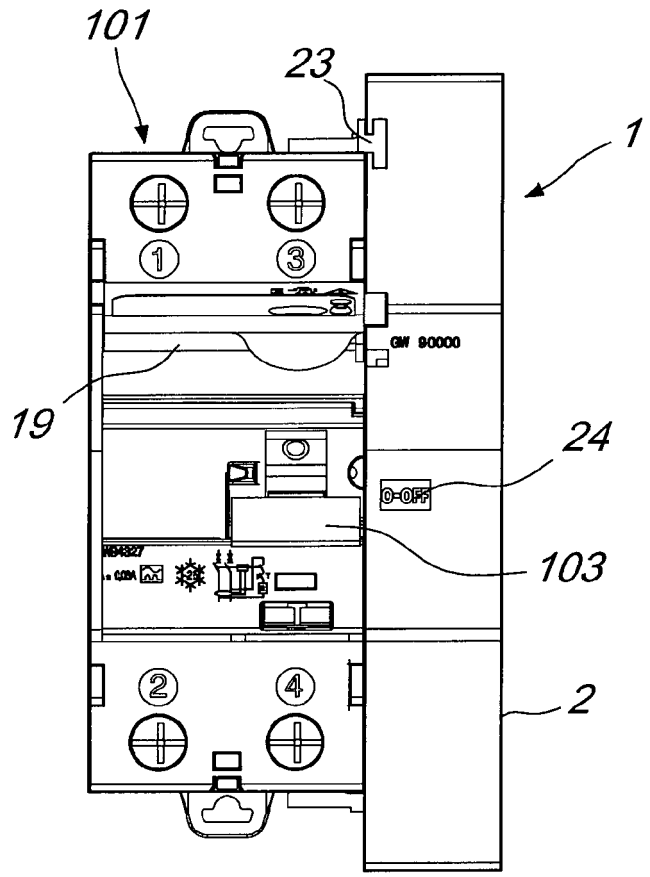
101
23
1
19
24
0-OFF
103
2

Fig. 10

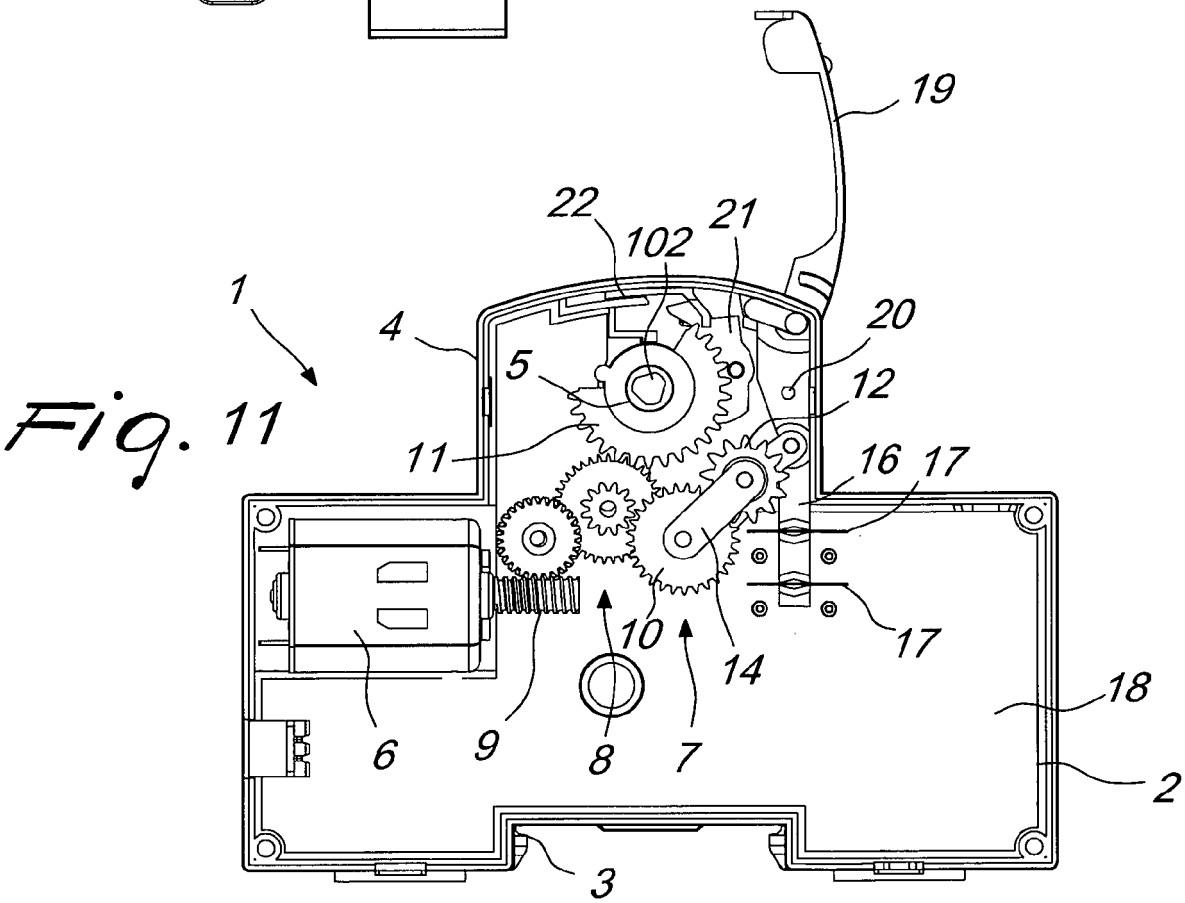
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Fig. 11

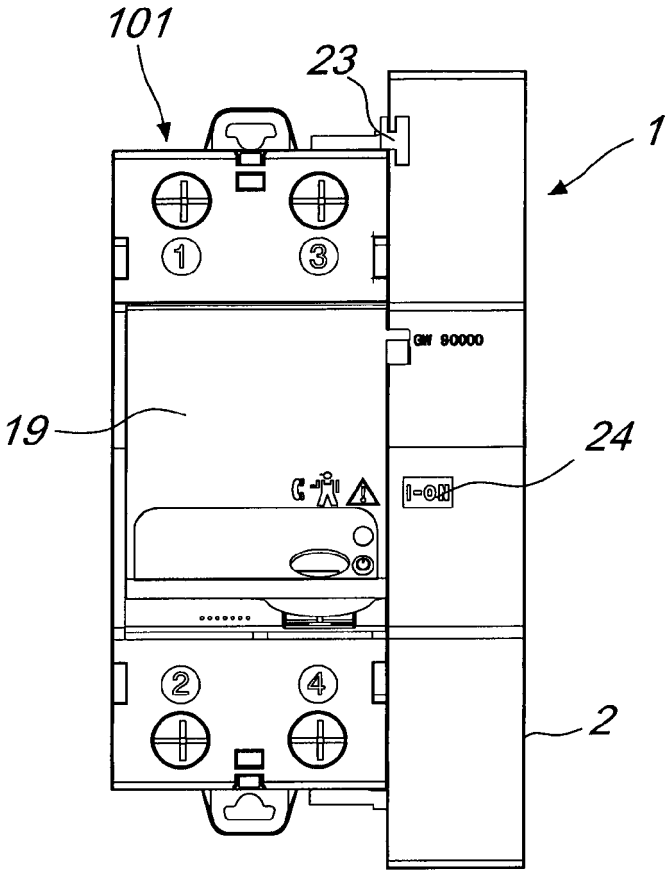


Fig. 12

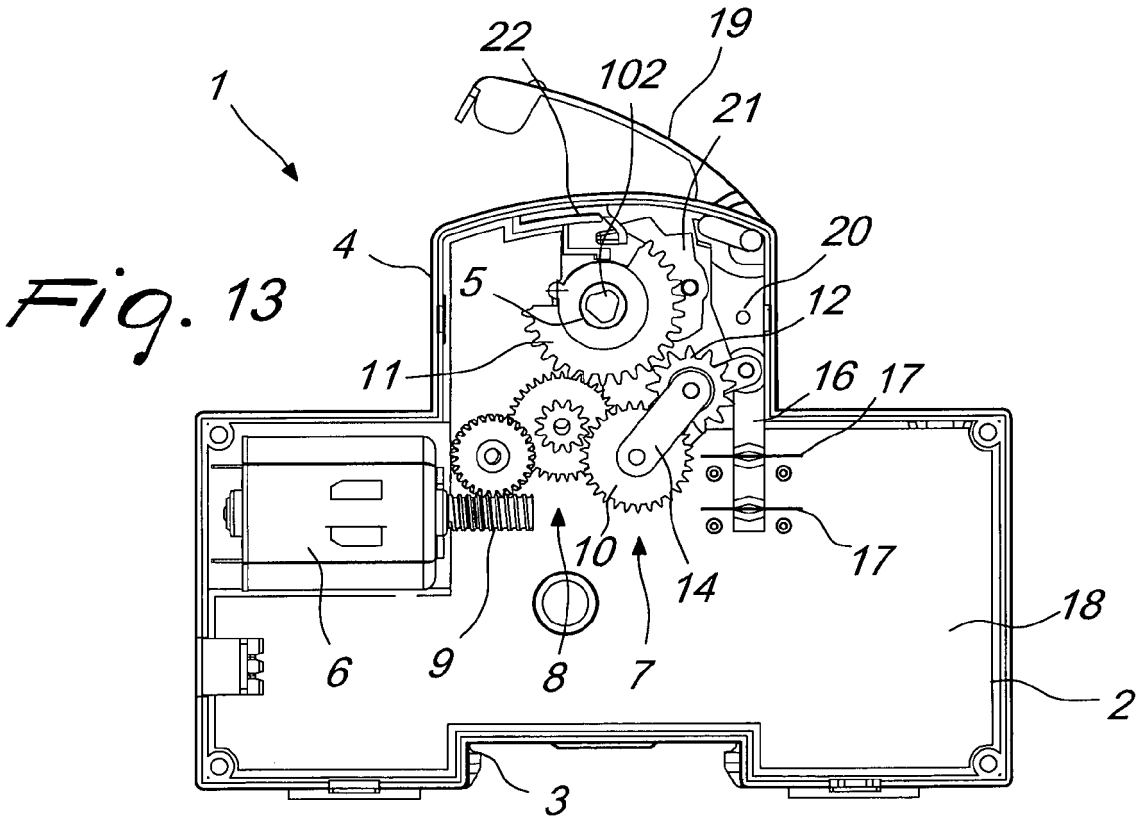


Fig. 13

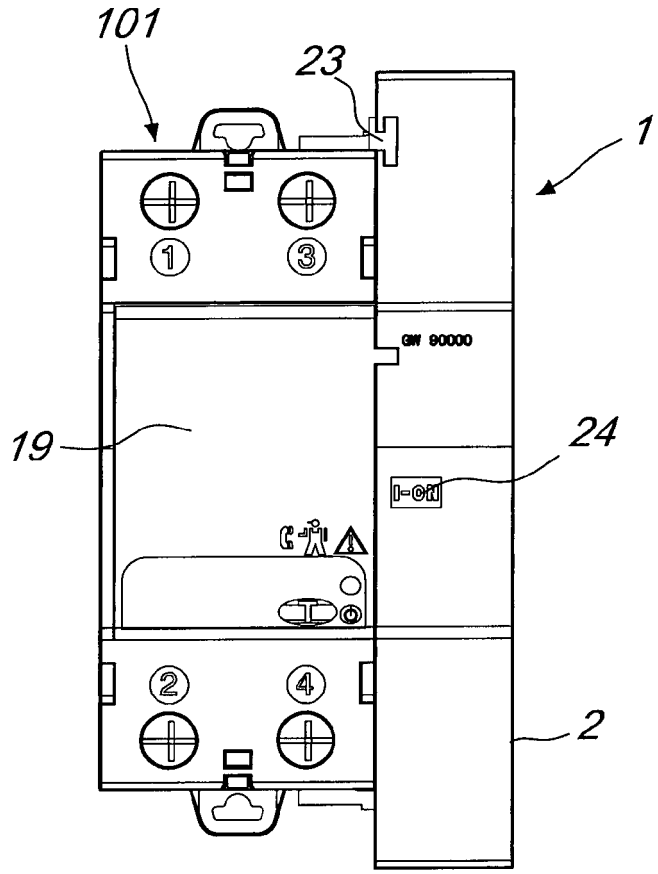


Fig. 14

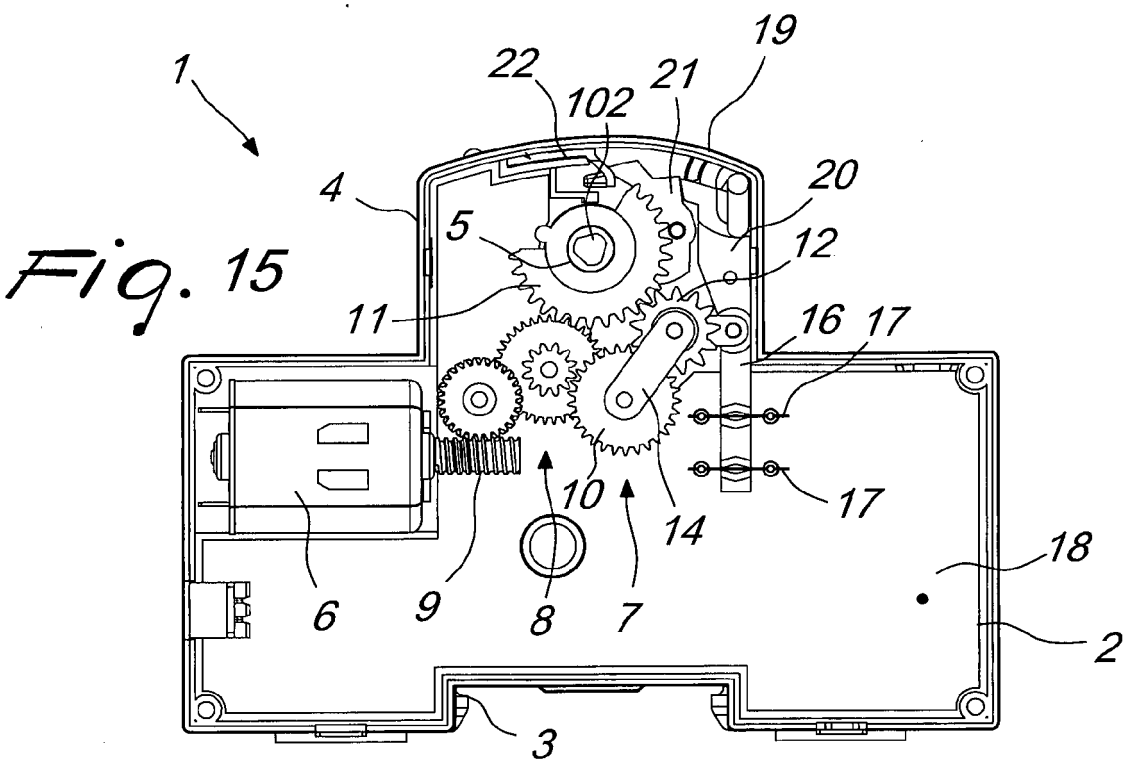


Fig. 15

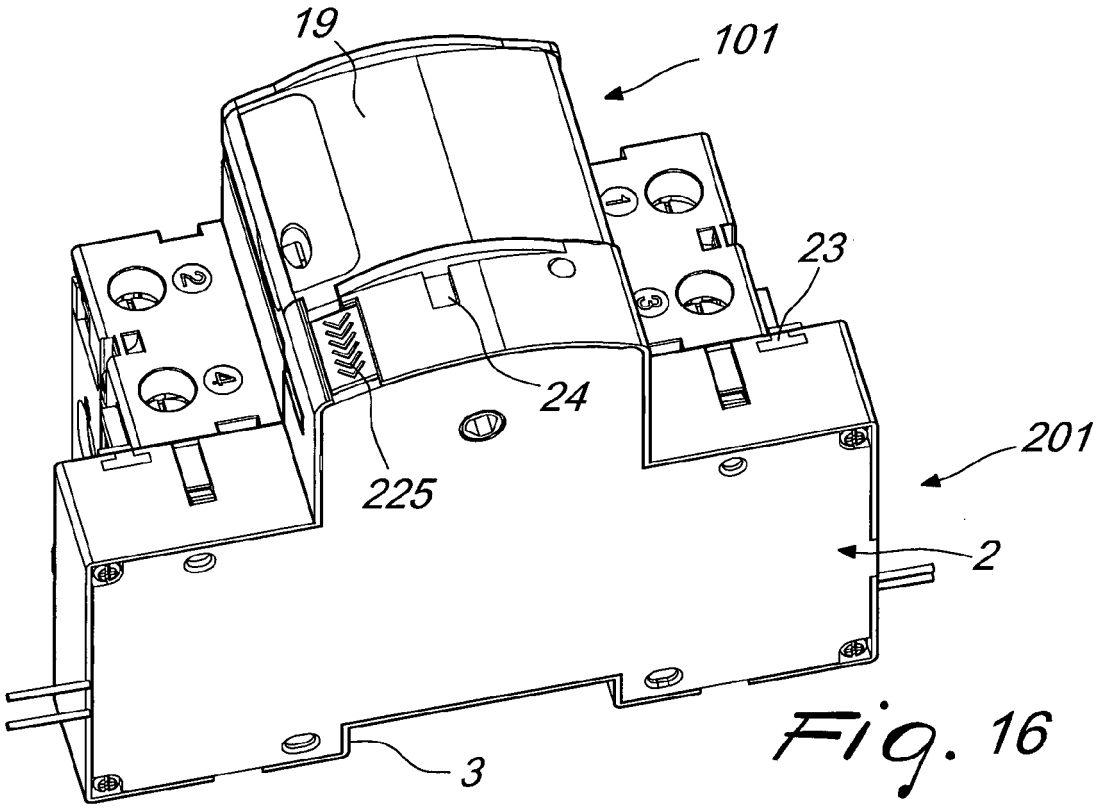


Fig. 16

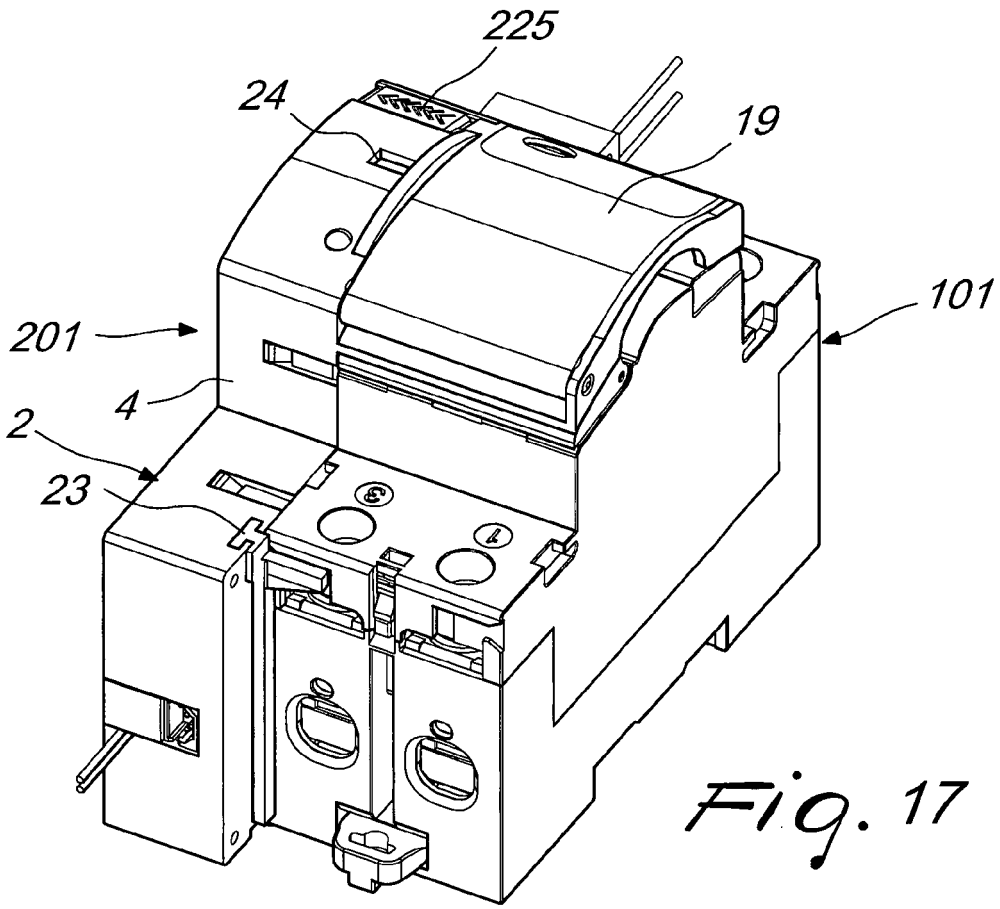


Fig. 17

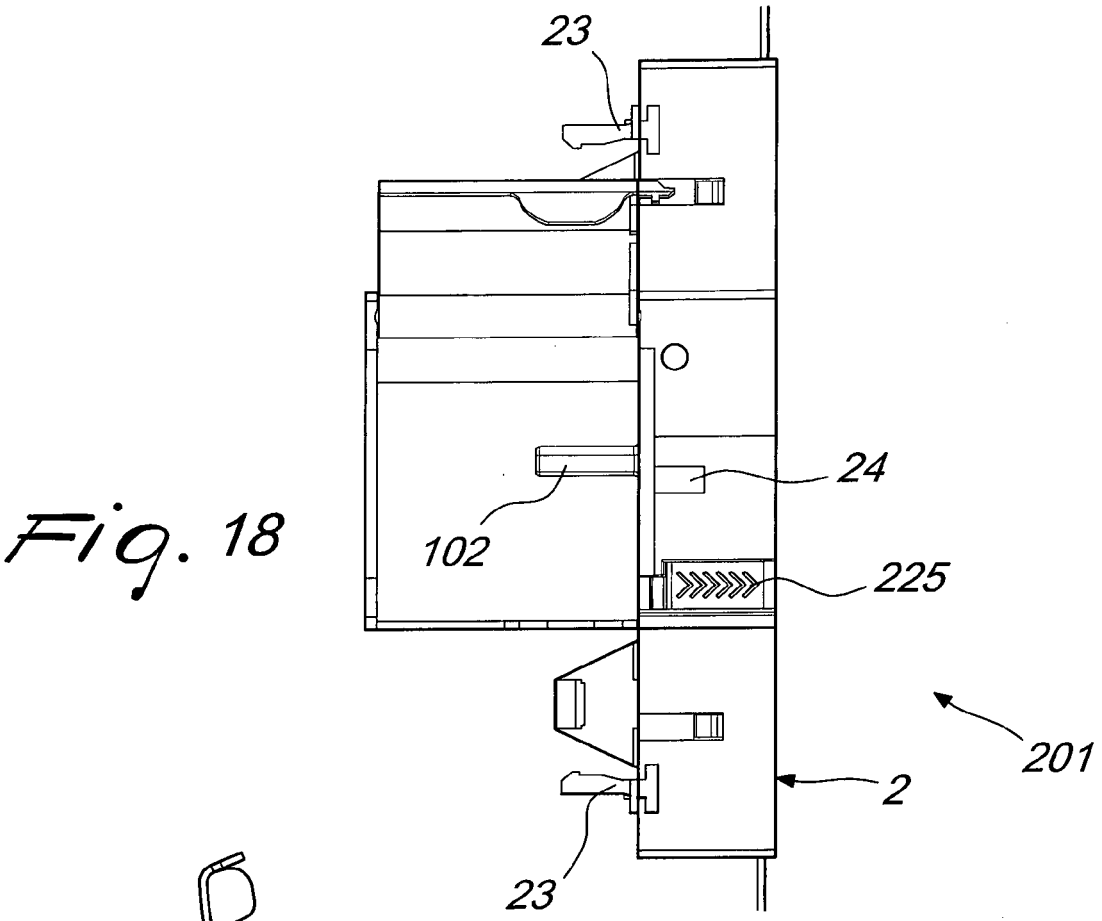


Fig. 18

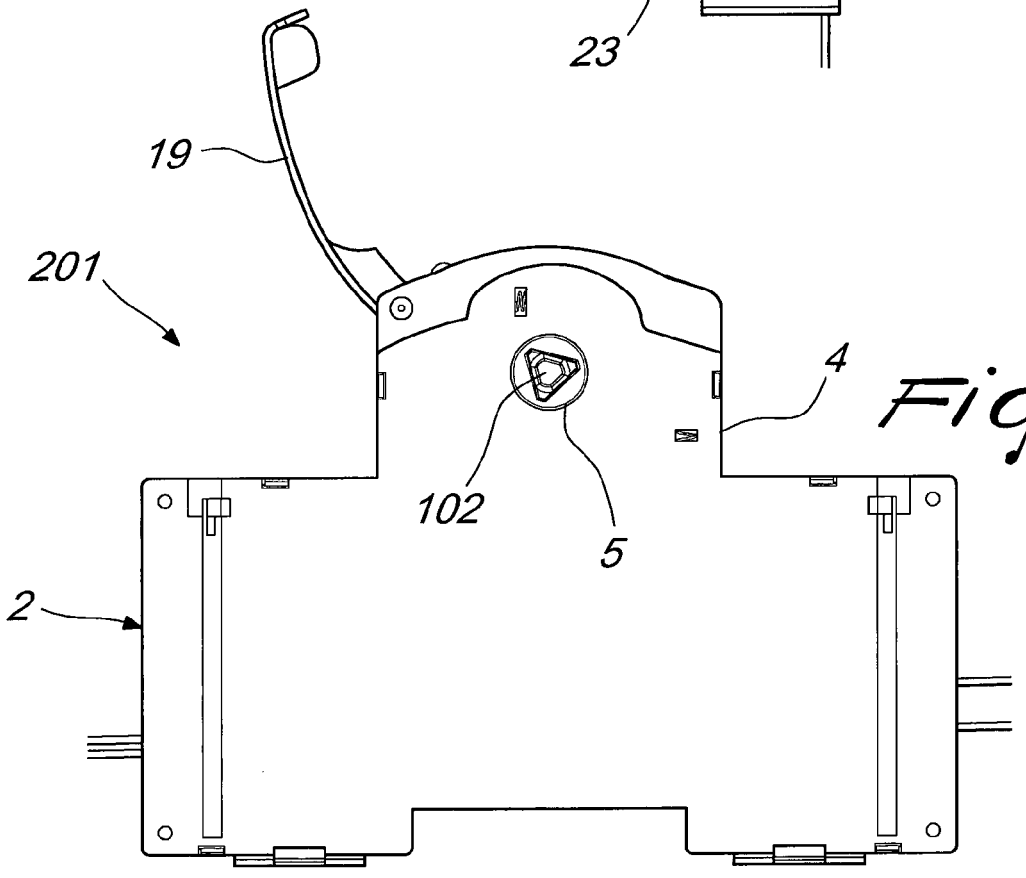
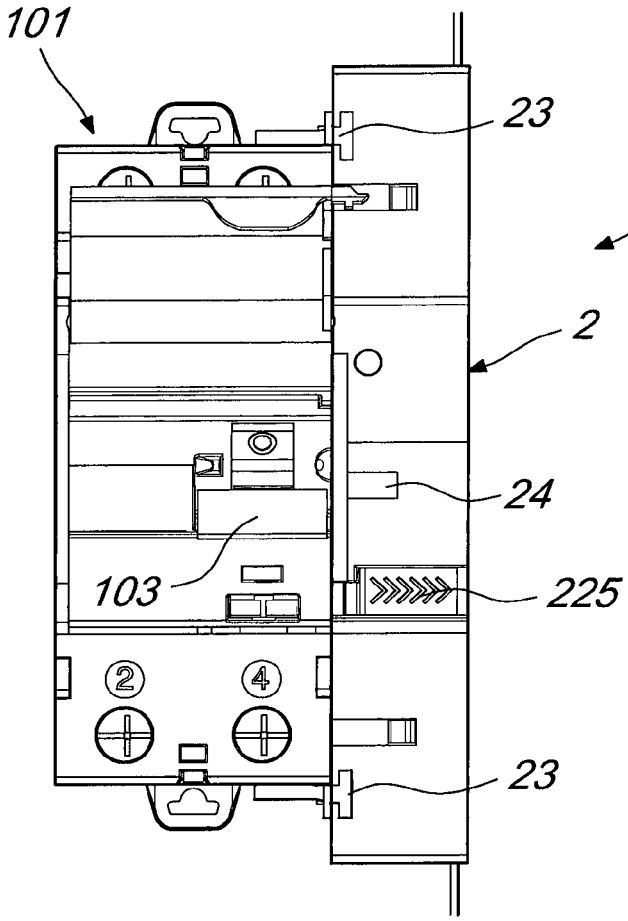


Fig. 19


101
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103
225
2
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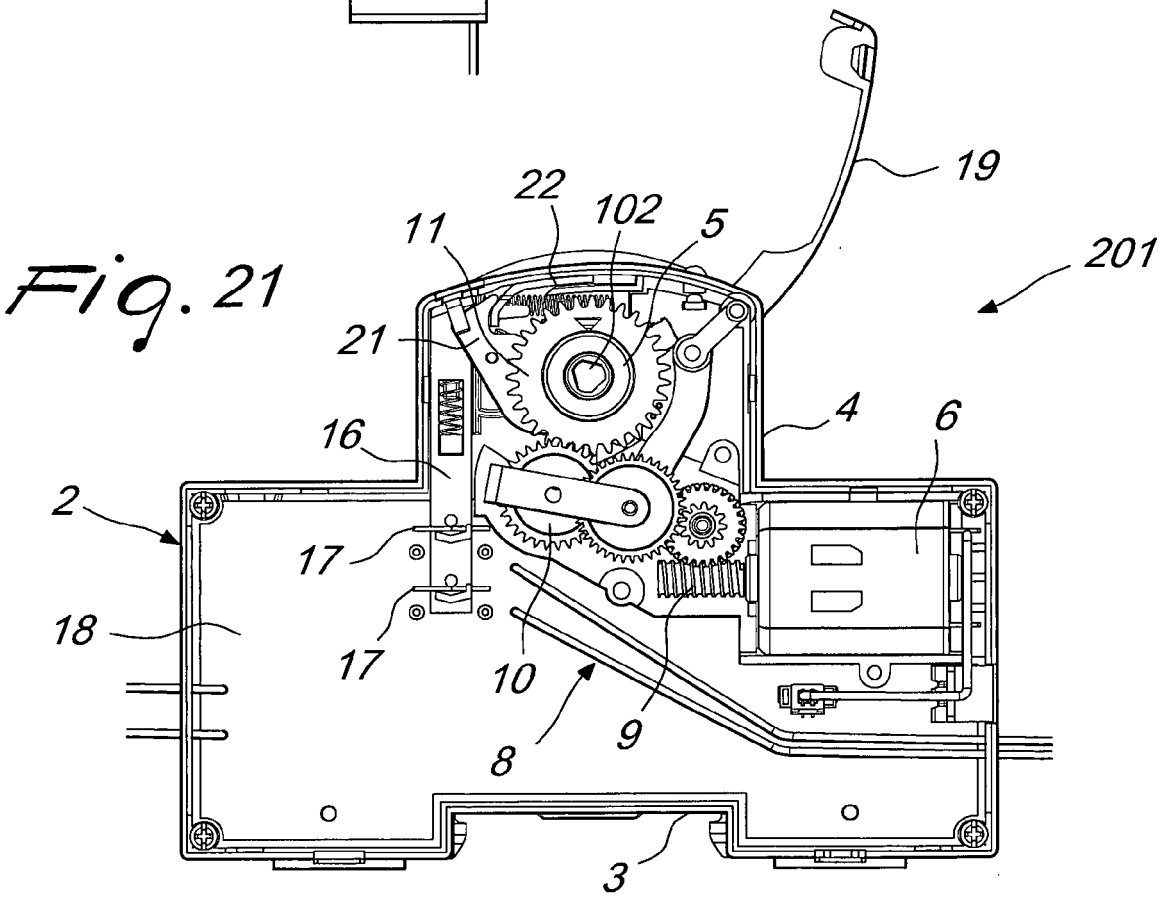
Fig. 20


19
22
102
11
5
201
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4
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16
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3

Fig. 21

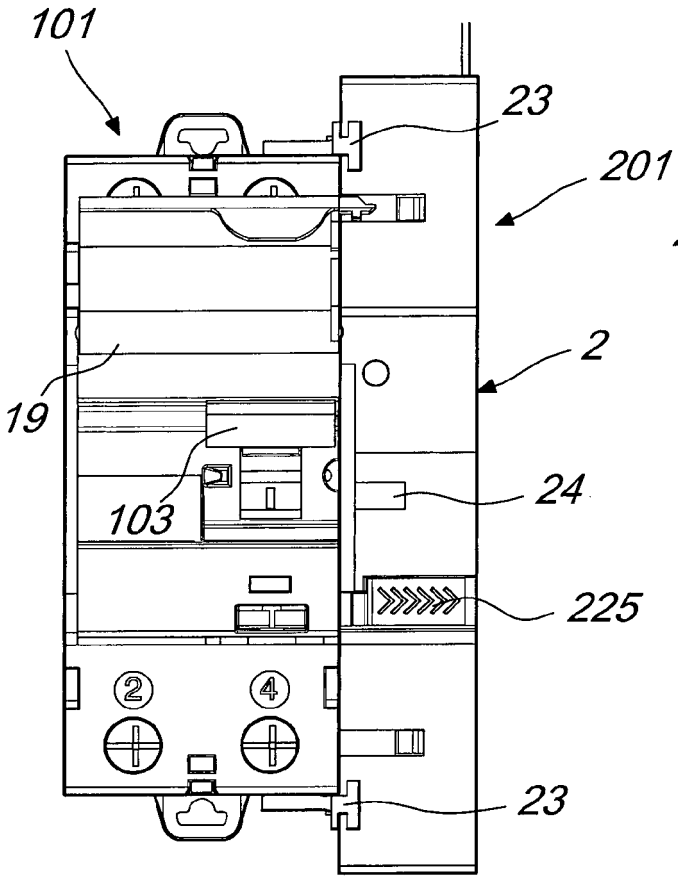


Fig. 22

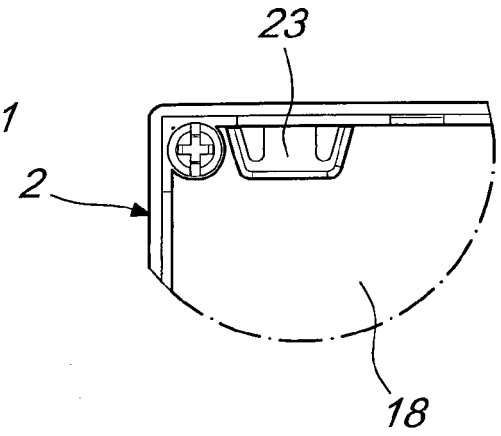


Fig. 24

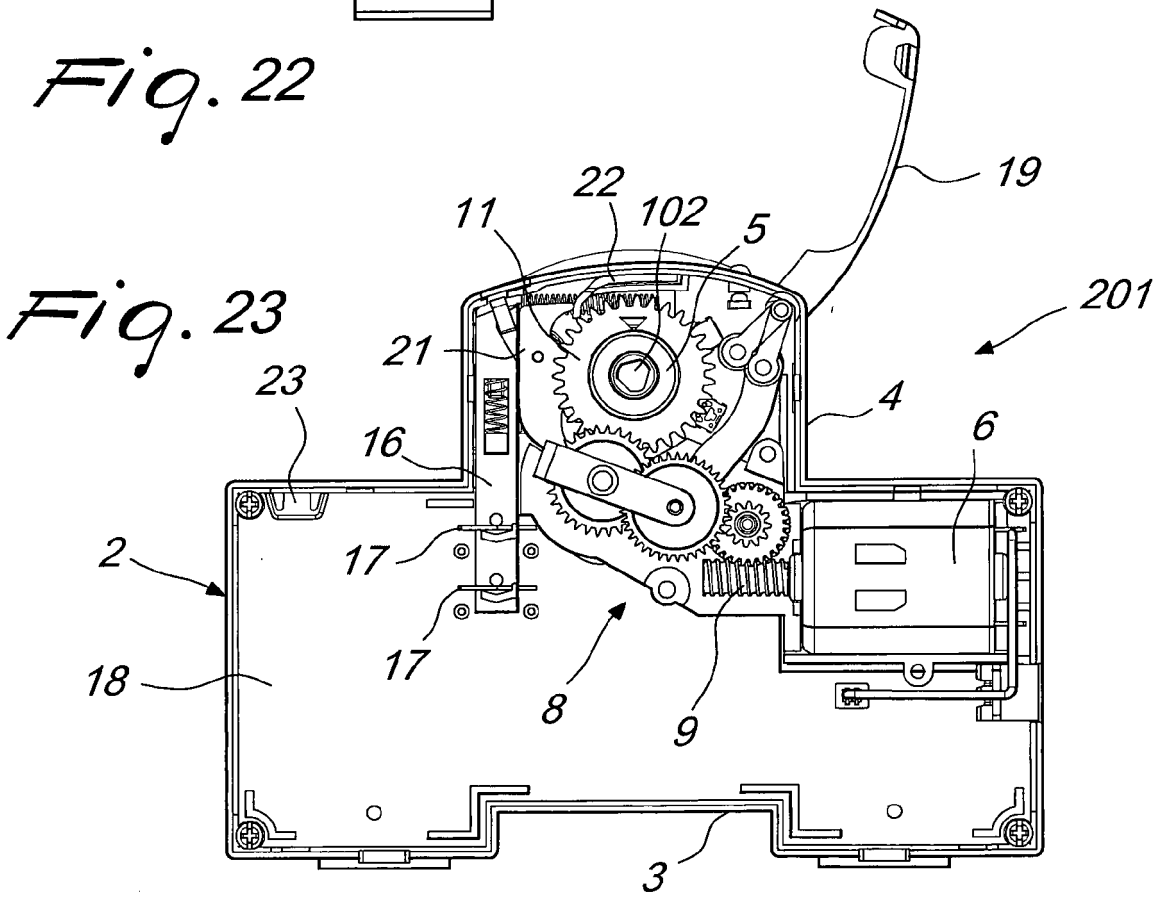
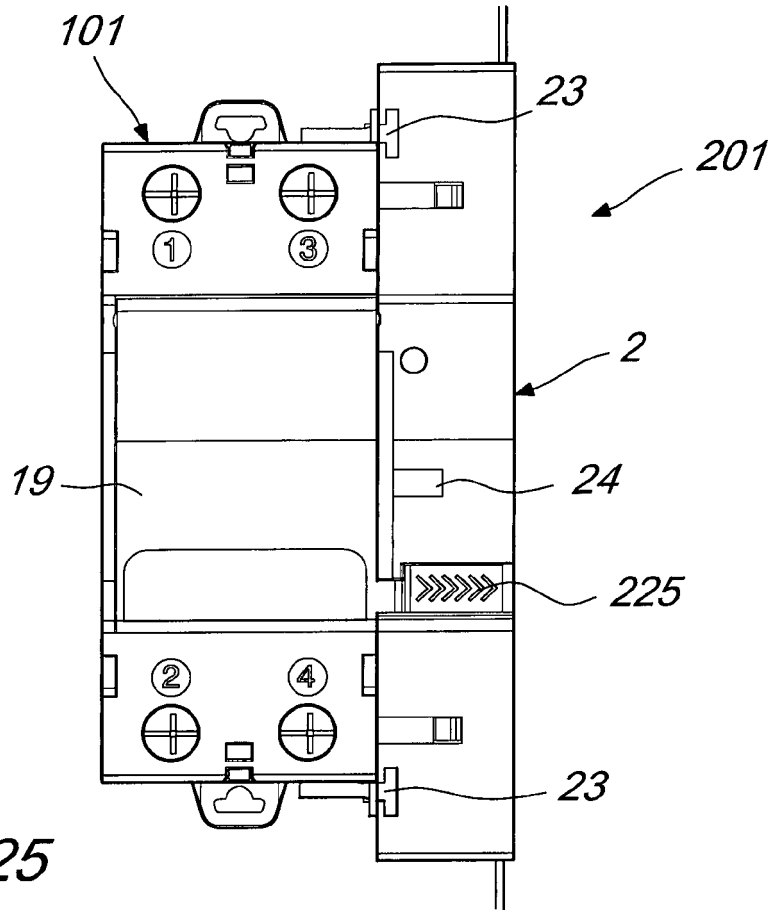


Fig. 23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201
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3
2
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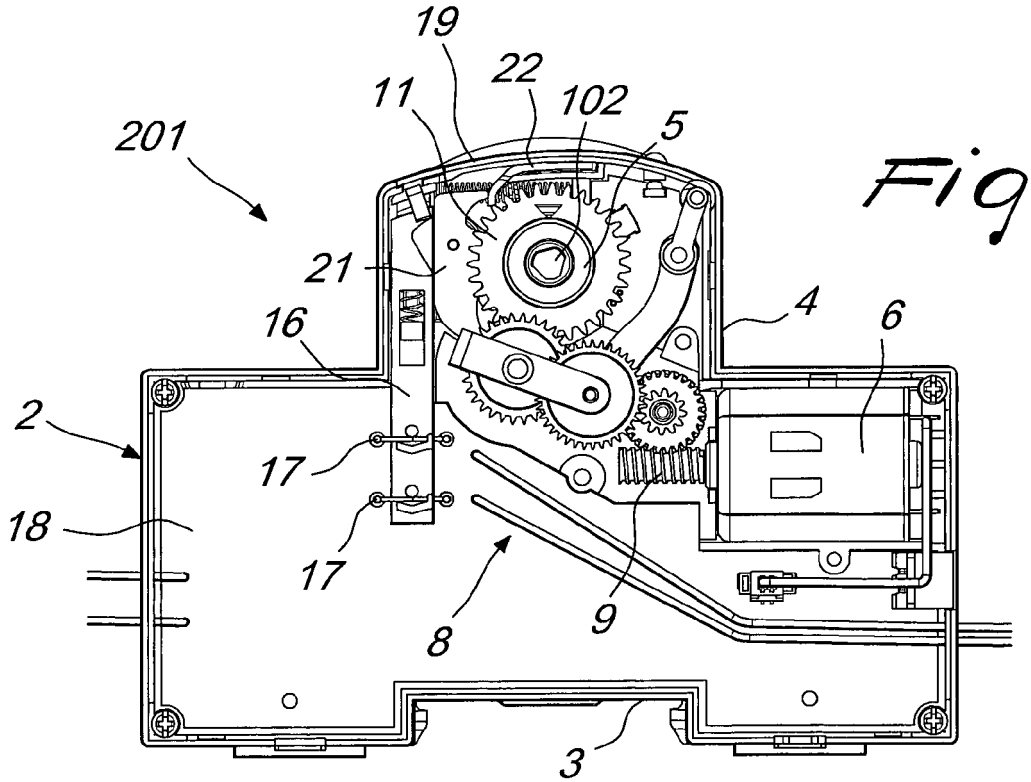
225
2
4
23

Fig. 25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11
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102
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201
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16
2
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18
17
8
9
3

Fig. 26

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EUROPEAN SEARCH REPORT

Application Number
EP 16 00 1625

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 2 131 376 A1 (GEWISS SPA [IT]) 9 December 2009 (2009-12-09) * abstract; figures 1,4 *	1-9	INV. H01H71/70
A,D	US 2005/212628 A1 (CASTONGUAY ROGER [US] ET AL) 29 September 2005 (2005-09-29) * paragraph [0039]; figures 7,8 *	1	ADD. H01H71/02

TECHNICAL FIELDS SEARCHED (IPC)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 November 2016	Simonini, Stefano

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07-11-2016

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		ES 2452346 T3	01-04-2014
US 2005212628 A1	29-09-2005	NONE	

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- EP 2131376 A **[0009] [0010]**
- US 2005212628 A **[0011]**