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(54) **VOLTAGE MONITORING DEVICE**

SPANNUNGSÜBERWACHUNGSVORRICHTUNG

DISPOSITIF DE SURVEILLANCE DE TENSION

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• **Reutner, Holger**

69214 Eppelheim (DE)

• **Schulmann, Boris**

69469 Weinheim (DE)

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(74) Representative: **Beetz & Partner mbB**

Patentanwälte

Robert-Koch-Str. 1

80538 München (DE)

(73) Proprietor: **ABB Schweiz AG**

5400 Baden (CH)

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(72) Inventors:

• **Tüysüz, Arda**

64295 Darmstadt (DE)

• **Breisch, Sebastian**

69239 Neckarsteinach (DE)

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Description

[0001] The present invention relates to a device for monitoring an input voltage and for tripping an appropriate action if the input voltage drops below a predetermined threshold. A common device of this type is referred to as an undervoltage release and functions to switch off a consumer of electrical power if an input voltage to the undervoltage release drops below predetermined first switching level, and to switch on the consumer or at least to enable it to resume operation it when the input voltage has returned to a second switching level.

[0002] Usually, an undervoltage release comprises input connectors for receiving the input voltage, a linkage, a spring for urging the linkage towards a first stable position, a solenoid powered by the input voltage and adapted to displace the linkage from the first position to a second position if a voltage applied to the solenoid exceeds a switching-on threshold, and to maintain the linkage in the second position while the voltage applied to the solenoid exceeds a switching-off threshold lower than the switching-on threshold, and a switch controlled by the linkage. Conventionally the switch controls whether the input power is supplied to the consumer or not.

[0003] A certain difference between the two thresholds is necessary in order to prevent the device from toggling when the input voltage is close to the thresholds. On the other hand, if the difference is large, and a strong current that is needed in order to bring the linkage into the second position is maintained continuously while the linkage is held in the second position, electric power is consumed unnecessarily, possibly overheating the solenoid.

[0004] US 4 370 635 A discloses a voltage monitoring device according to the preamble of the independent claim 1.

[0005] DE 201 10 741 U1 discloses an undervoltage release device in which the magnetic field of the solenoid at a time in which the solenoid is drawing the linkage towards the second position can be stronger than when it has reached the second position. This device uses a resistor and a capacitor connected in parallel to each other and in series with the solenoid. In a steady state, while the input voltage is constant, no current flows through the capacitor. When there is a rise in the input voltage, current flowing through the capacitor will add to the current through the resistor. However, this will have a noticeable effect only if the capacitor is big enough to provide a noticeable increase in current before being charged up to a stable voltage level defined by the final value of the input voltage and the values of the other components of the circuit. Therefore, the prior art device needs a large and expensive capacitor, the lifetime of which tends to be limited, in particular if used at elevated temperatures. Further, the effect of the capacitor varies depending on the rate of change of the input voltage, whereas that of the undervoltage release device should depend on input voltage level alone.

[0006] It is therefore an object of the present invention

to provide a voltage monitoring device that is energy efficient and that will operate at predetermined threshold voltages regardless of the rate of change of the input voltage.

[0007] This object is achieved by a voltage monitoring device comprising input connectors for receiving an input voltage, a linkage, a spring for urging the linkage towards a first stable position, and a solenoid powered by the input voltage and adapted to displace the linkage from the first position to a second position if a voltage applied to the solenoid exceeds a first threshold, and to maintain the linkage in the second position while the voltage applied to the solenoid exceeds a second threshold lower than the first threshold, and a switch controlled by the linkage, in which the switch is connected not to a consumer but to the input connectors and the solenoid so as to apply a first percentage of the input voltage to the solenoid in a steady state in which the linkage is in the first position and to apply a second percentage of the input voltage to the solenoid in a steady state in which the linkage is in the second position, the second percentage being less than the first percentage.

[0008] In practice, the percentages will be less than 100%, but this is not necessarily so; it would be conceivable to provide a voltage booster between the input connectors and the solenoid, so that one or both of the threshold voltages could be higher than the input voltage.

[0009] The switch can be connected so as to connect a resistor in series with the solenoid when the linkage is in the second position, whereas the resistor is idle or at least has a reduced current flowing through it when the linkage is in the first position.

[0010] The switch preferably is a mechanical switch, i. e. it comprises first and second contact pads that are in physical and electrical contact while the linkage is in the first position, and that are spaced from each other while the linkage is in the second position.

[0011] A shunt diode can be connected in parallel to the solenoid in order to suppress voltage oscillations that might arise under transient conditions and might cause the linkage to move in an unexpected way.

[0012] A second switch for controlling the supply of the input power to a consumer can be integrated into an embodiment of the voltage monitoring device.

[0013] Alternatively, the device can be designed to control an external switch. Such a device may comprise a casing from which a portion of the linkage projects, the displacement of which can be used for operating the external switch.

[0014] Conventionally, control devices such as undervoltage releases and circuit breakers come in casings having two parallel flat sidewalls and a narrow side provided with a rail mount, by which a plurality of such devices can be mounted side by side on a shared rail. In such a device, if the above-mentioned projecting portion projects from one of the flat sides, it can engage in an adjacent device and control it.

[0015] Preferably, the projecting portion is a shaft and

is rotatable about an axis extending in the longitudinal direction of the rail. Such a projecting portion is easy to mount since the sidewalls of the casing can serve as bearings.

[0016] The angle of rotation between the two positions of the shaft should not be too small, in order to enable reliable control of the adjacent device in spite of possible tolerances. This can be achieved by a linkage comprising first and second displaceable members, wherein the shaft is part of the second displaceable member driven to rotate by the solenoid via the first displaceable member. The closer to the axis a connection between the first and second parts is located, the larger will be the angle of rotation of the shaft associated to a given displacement of the first displaceable member.

[0017] The displaceable members can be coupled by a pin of one of the first and second displaceable members engaging an edge of the other.

[0018] In order to maximize the achievable angle of rotation, a straight line that connects first and second positions of the pin should be located so that there is a radius that extends from the axis and intersects the line orthogonally.

[0019] For the device to fit into a compact housing, the spring is preferably helicoidal. Such a spring can be accommodated adjacent to the solenoid and substantially parallel to it.

[0020] The helicoidal spring can be accommodated in a cavity of the first displaceable member.

[0021] The invention can further be embodied in an assembly comprising the voltage monitoring device as described above, a slave device controlled by the monitoring device and a rail on which the voltage monitoring device and the slave device are adapted to be mounted in a side-by-side relationship in which the projecting portion engages the slave device.

[0022] Further features and advantages of the invention will become apparent from the subsequent description of embodiments thereof, referring to the appended drawings.

- Fig. 1 is a schematic view of a solenoid and of displaceable members driven the solenoid in a voltage monitoring device according to the invention;
- Fig. 2, Fig. 3 are circuit diagrams of the monitoring device.
- Fig. 4 is a schematic exploded view of a monitoring device, a slave device and a mounting rail.

[0023] Fig. 1 schematically illustrates an embodiment of an undervoltage release device. The device has a plastics casing 1, one sidewall of which is removed in Fig. 1 in order to show mechanical and electromechanical components inside casing 1. One of these is an electromagnet 2. The electromagnet 2 comprises a core 3 made from ferromagnetic material, extending along an axis 4,

and a solenoid 5 extending around core 3 and along axis 4. An L-shaped yoke 6 has a first branch, a distal end of which is fixed to a first pole face of the core 3 and a second branch that extends along the core 3 so that a second end of the yoke 6 is substantially aligned with the second pole face of the core 3.

[0024] A first displaceable member 7 is pivotably linked to the second end of the yoke 6. The first displaceable member 7 is at least in part made of ferromagnetic material; preferably it is integrally made of ferromagnetic material.

[0025] On the side of the electromagnet 2 opposite to the second arm of yoke 6, a second displaceable member 8 is mounted displaceably in a direction parallel to axis 4. The second displaceable member 8 can be injection molded from plastics. In the embodiment shown, a rail that defines the direction of displacement and the stroke of member 8 is formed by a slot 9 of member 8, extending in parallel to axis 4, which is engaged by a web or by two spaced-apart pins 10 of casing 1.

[0026] Slot 9 opens into an elongate cavity 11 formed inside an elongate main body of member 8. A helicoidal spring 12 is compressed between one of pins 10 and an end face of cavity 11, thus urging member 8 against a distal end of member 7, and urging member 7 against an abutment 13 formed in casing 1, thus defining a first stable position of members 7 and 8 in which member 7 is spaced apart from the second pole face of core 3.

[0027] A third displaceable member 14 comprises a shaft 15 which extends in along an axis 16 perpendicular to the plane of Fig. 1 and is pivotably mounted by being received in circular holes 17 of parallel sidewalls 17 of casing 1. In Fig. 1, the hole 18 of the only sidewall 17 shown is represented as a dashed line because it is hidden beneath an arm 19 of member 14 that extends from shaft 15 in a radial direction. Shaft 15 is biased counter-clockwise by a second spring, not shown.

[0028] At a distal end of arm 19, an edge 20 is formed, which, by the biasing action of the second spring, is pressed against a pin 21 of member 8 extending in parallel to axis 16.

[0029] A dotted line 25 illustrates the displacement of pin 21 between the first and second stable position. A radius 26 extending from axis 16 intersects line 25 at right angles.

[0030] A switch 22 is coupled to member 8, for example by an arm 23 of member 8 operating a lever 24 of switch 22 whenever member 8 is displaced.

[0031] When an electrical current flows through solenoid 5, member 7 is magnetically attracted to the second end face of core 3. When the current exceeds a predetermined threshold, the magnetic attraction is sufficient to compress the spring 12, so that a second stable position is reached in which member 7 abuts against core 3, as shown in dashed lines in Fig. 1. In the simplest case, member 7 may be made entirely of a ferromagnetic material. Alternatively, it may comprise a ferromagnetic body and a layer of non-magnetic material provided on a side

of the ferromagnetic body facing core 3. There is an inherent hysteresis in the way member 7 is displaced between its first and second stable positions since in the second stable position, the magnetic attraction between member 7 and electromagnet 2 generated by a given current flowing in solenoid 5 is stronger than in the first, due to the reduced air gap. By choosing an appropriate thickness of the non-magnetic layer, the width of the air gap in the second stable position and, hence, the amount of hysteresis can be controlled.

[0032] By moving to its second stable position, member 7 pushes down member 8, compresses spring 12 and operates switch 22. Urged by the second spring, pivoting member 14 rotates counterclockwise, so that edge 20 keeps in touch with pin 21, and member 14 also assumes its second stable position, shown in dashed lines. However, an external torque applied to the shaft 15 may compensate the torque of the second spring, so that when members 7 and 8 are in their respective second positions, member 14 can still pivot between its first and second positions.

[0033] Fig. 2 is a circuit diagram of the monitoring device of Fig. 1 according to a first embodiment. Between input connectors 27, resistors R1, R2 are mounted in series with solenoid 5. R1 is optional. A flywheel diode D can be provided in parallel to solenoid 5. Switch 22 is a single pole single throw switch 22, a switch having one stationary contact pad 31 and one mobile pad 32 that can touch contact pad 31 or be spaced apart from it. Switch 22 is mounted in parallel to resistor R2. The open state of switch 22 shown in Fig. 2 corresponds to the second stable position described above, in the first stable position, switch 22 is closed. Thus, in the first stable position, overall resistivity of the circuit of Fig. 2 is low, and a low input tension at input connectors 27 is sufficient to produce a magnetic field that will attract displaceable member 7 and cause it to move towards the second stable position.

[0034] When the second stable position has been reached, switch 22 is open, and the overall resistivity of the circuit is increased by R2. Thereby, the current through solenoid is decreased, but since member 7 is in contact with the second end face, a much weaker current is sufficient for maintaining the second stable position than for reaching it. Since the time in which switch 22 is closed is only a tiny fraction of the total operating time of the device, solenoid 5 doesn't have to be rated to support the current flowing through the switch over a prolonged period of time. Therefore, a compact, economic solenoid can be used.

[0035] In Fig. 3, switch 22 is a single pole double throw switch, i.e. a switch having a second stationary contact pad 33, stable positions of the mobile pad 32 being in contact with either pad 31 or 33. The switch 22 allows a current to flow through solenoid 5 either by resistor R1 or R3. As in Fig. 2, R1 is optional, i.e. its resistivity may be zero. R3 has a higher resistivity than R1. When pads 31, 32 of switch 22 are in contact, a large current can

flow through solenoid 5, generating a magnetic attraction strong enough to set displaceable member 7 in motion from the first stable position towards the second. The resistivity of R3 is chosen so as to keep member 7 in motion towards the second stable position and to hold it there.

[0036] If an input voltage Vcc supplied to input connectors 27 decreases, the current through solenoid 5 and the magnetic attraction decrease in proportion, so that when a predetermined first threshold (which is adjustable by an appropriate choice of resistivities R1, R2 or R1, R3) is passed, the magnetic attraction is no longer sufficient to overcome the force of spring 12, and displaceable members 7, 8, 14 revert to the first stable position. By this movement, switch 22 is closed, causing the current to increase. However, the resistors are chosen so that the increase in current is not sufficient to compensate the decrease in attraction due to the increase in gap width between member 7 and core 3. Therefore, in spite of the increase in current, member 7 will remain in the first stable position unless the input voltage Vcc increases again up to a second predetermined threshold. When that happens, the displaceable members 7, 8, 14 will be drawn back to the second stable position, and switch 22 will close again.

[0037] Fig. 4 is a perspective view of the undervoltage release device of Fig. 1, and of a slave device controlled by it. Casings 1, 28 of the two devices are substantially identical in outline and have connectors, not shown, for mounting on a rail 29 in an orientation in which sidewalls 17 of the two casings extend normally with respect to a longitudinal direction of the rail 29, and in which facing sidewalls 17 of the two casings 1, 28 touch each other. The rail 29 can e.g. be a top hat rail according to IEC/EN 60715. A portion of shaft 15 protrudes beyond the sidewall 17 of casing 1. The facing sidewall, not shown, of casing 28, has an opening designed to receive the projecting portion of shaft 15. A circuit breaker inside casing 28 is operable by a rotation of shaft 15 engaging casing 28, so as to cut off power to a consumer, not shown, when the input voltage Vcc drops below the first threshold, and arm 19 is forced into its first stable position. When the input voltage rises above the second threshold, and members 7, 8 move into their second stable positions, member 14 can do so, too, but might also be withheld by torque applied to shaft 15 by the circuit breaker. I.e. while the circuit breaker will always be open when the linkage formed by members 7, 8, 14 is in the first position, it can be controlled to be open or closed, e.g. by means of a control knob 34, when the linkage is in the second position.

[0038] In the embodiment of Fig. 4, shaft 15 is mounted in casing 1 so as to be displaceable along axis 16, and its length is somewhat less than twice the thickness of the casing 1, so that it can protrude from one sidewall 17 of casing 1 as shown in Fig. 4 while being flush with the other. The casing 28 has a second opening 30 in the sidewall 17 facing away from casing 1. Both openings 30

of casing 28 are aligned with axis 16. Thus the shaft 15 can engage casing 28 from either side, and the voltage monitoring device of casing 1 can control a slave device mounted on either side of it.

Reference numerals

[0039]

1	casing
2	electromagnet
3	core
4	axis
5	solenoid
6	yoke
7	displaceable member
8	displaceable member
9	slot
10	pin
11	cavity
12	spring
13	abutment
14	displaceable member
15	shaft
16	axis
17	sidewall
18	hole
19	arm
20	edge
21	pin
22	switch
23	arm
24	lever
25	line
26	line/radius
27	input connector
28	casing
29	rail
30	opening
31	contact pad
32	contact pad
33	contact pad
34	control knob

Claims

1. A voltage monitoring device comprising input connectors (27) for receiving an input voltage (Vcc), a linkage (7, 8, 14), a spring (12) for urging the linkage (7, 8, 14) towards a first stable position, and a solenoid (5) powered by the input voltage (Vcc) and adapted to displace the linkage (7, 8, 14) from the first position to a second position if a voltage applied to the solenoid (5) exceeds a first threshold, and to maintain the linkage in the second position while the voltage applied to the solenoid exceeds a second threshold lower than the first threshold, and a switch

(22) controlled by the linkage (7, 8, 14), **characterized in that** the switch (22) is connected to the input connectors (27) and the solenoid (5) so as apply a first percentage of the input voltage (Vcc) to the solenoid (5) while the linkage (7, 8, 14) is in the first position and to apply a second percentage of the input voltage (Vcc) to the solenoid (5) while the linkage (7, 8, 14) is in the second position, the second percentage being less than the first percentage.

2. The voltage monitoring device of claim 1, further comprising a resistor (R2, R3) which is connected in series with the solenoid (5) when the linkage (7, 8, 14) is in the second position and in which the current is reduced when the linkage (7, 8, 14) is in the first position.

3. The voltage monitoring device of claim 1 or 2, wherein the switch (22) comprises first and second contact pads (31, 32) that are in physical and electrical contact while the linkage (7, 8, 14) is in the first position, and that are spaced from each other while the linkage (7, 8, 14) is in the second position.

4. The voltage monitoring device of any of the preceding claims wherein a flywheel diode (D) is connected in parallel to the solenoid (5).

5. The voltage monitoring device of any of the preceding claims, further comprising a casing (1) from which a portion (15) of the linkage (7, 8, 14) projects.

6. The voltage monitoring device of claim 5, wherein the casing (1) comprises a rail mount connector for mounting on a rail (29), preferably a DIN rail, and the projecting portion (15) of the linkage (7, 8, 14) projects through a sidewall (17) of the casing (1) which is perpendicular to a longitudinal direction of the rail (29).

7. The voltage monitoring device of claim 6, wherein the projecting portion is a shaft (15) and is rotatable about an axis (16) extending in the longitudinal direction.

8. The voltage monitoring device of claim 7, wherein the linkage (7, 8, 14) comprises first and second displaceable members, and the shaft (15) is part of the second displaceable member (14) driven to rotate by the solenoid (5) via the first displaceable member (7, 8).

9. The voltage monitoring device of claim 8, wherein the first (7, 8) and second (14) displaceable members are coupled by a pin (21) of one of the first and second displaceable members engaging an edge (20) of the other.

10. The voltage monitoring device of claim 8 or 9, wherein a radius (26) extending from the axis (16) intersects a straight line (25) connecting first and second positions of the pin (21) under an angle of at least 45°.
11. The voltage monitoring device of claim 8, 9 or 10, wherein the spring (12) is a helicoidal spring received in a cavity (11) of the first displaceable member (8).
12. An assembly comprising the voltage monitoring device of any of claims 6 to 11, a slave device and a rail (29) on which the voltage monitoring device and the slave device are adapted to be mounted in a side-by-side relationship in which the projecting portion (15) engages the slave device.

Patentansprüche

1. Spannungsüberwachungsvorrichtung mit Eingangsanschlüssen (27) zum Empfangen einer Eingangsspannung (Vcc), einem Gestänge (7, 8, 14), einer Feder (12) zum Drücken des Gestänges (7, 8, 14) in Richtung einer ersten stabilen Position und einer Magnetspule (5), die mit der Eingangsspannung (Vcc) gespeist ist und eingerichtet ist, das Gestänge (7, 8, 14) aus der ersten Position in eine zweite Position zu verlagern, wenn eine an die Magnetspule (5) angelegte Spannung einen ersten Schwellenwert überschreitet, und das Gestänge in der zweiten Position zu halten, während die an die Magnetspule angelegte Spannung einen zweiten Schwellenwert überschreitet, der niedriger als der erste Schwellenwert ist, und einem durch das Gestänge (7, 8, 14) gesteuerten Schalter (22),
dadurch gekennzeichnet, dass der Schalter (22) mit den Eingangsanschlüssen (27) und der Magnetspule (5) verbunden ist, um einen ersten Prozentsatz der Eingangsspannung (Vcc) an die Magnetspule (5) anzulegen, während sich das Gestänge (7, 8, 14) in der ersten Position befindet, und einen zweiten Prozentsatz der Eingangsspannung (Vcc) an die Magnetspule (5) anzulegen, während sich das Gestänge (7, 8, 14) in der zweiten Position befindet, wobei der zweite Prozentsatz kleiner als der erste Prozentsatz ist.
2. Spannungsüberwachungsvorrichtung nach Anspruch 1, ferner mit einem Widerstand (R2, R3), der mit der Magnetspule (5) in Reihe geschaltet ist, wenn sich das Gestänge (7, 8, 14) in der zweiten Stellung befindet, und in dem der Strom reduziert ist, wenn sich das Gestänge (7, 8, 14) in der ersten Stellung befindet.
3. Spannungsüberwachungsvorrichtung nach Anspruch 1 oder 2, bei der der Schalter (22) eine erste und eine zweite Kontaktfläche (31, 32) umfasst, die

in physischem und elektrischem Kontakt stehen, wenn sich das Gestänge (7, 8, 14) in der ersten Position befindet, und die voneinander beabstandet sind, wenn sich das Gestänge (7, 8, 14) in der zweiten Position befindet.

4. Spannungsüberwachungsvorrichtung nach einem der vorhergehenden Ansprüche, bei der eine Freilaufdiode (D) parallel zu der Magnetspule (5) geschaltet ist.
5. Spannungsüberwachungsvorrichtung nach einem der vorhergehenden Ansprüche, ferner mit einem Gehäuse, aus dem ein Teil (15) des Gestänges (7, 8, 14) vorspringt.
6. Spannungsüberwachungsvorrichtung nach Anspruch 5, bei dem das Gehäuse (1) einen Schienenverbinder zur Montage auf einer Schiene (29), vorzugsweise einer DIN-Schiene, umfasst und der vorspringende Teil (15) des Gestänges (7, 8, 14) durch eine Seitenwand (17) des Gehäuses (1) ragt, die senkrecht zu einer Längsrichtung der Schiene (29) verläuft.
7. Spannungsüberwachungsvorrichtung nach Anspruch 6, bei der der vorspringende Teil eine Welle (15) ist und um eine in der Längsrichtung verlaufende Achse (16) drehbar ist.
8. Spannungsüberwachungsvorrichtung nach Anspruch 7, bei der das Gestänge (7, 8, 14) ein erstes und ein zweites bewegliches Element umfasst und die Welle (15) ein Teil des zweiten beweglichen Elements (14) ist, das von der Magnetspule (5) über das erste bewegliche Element (7, 8) in Drehung versetzt wird.
9. Spannungsüberwachungsvorrichtung nach Anspruch 8, bei der das erste (7, 8) und das zweite (14) bewegliche Element dadurch gekoppelt sind, dass ein Stift (21) des ersten oder zweiten beweglichen Elements an einer Kante (20) des anderen Elements angreift.
10. Spannungsüberwachungsvorrichtung nach Anspruch 8 oder 9, bei der ein Radius (26), der sich von der Achse (16) aus erstreckt, eine gerade Linie (25), die die erste und zweite Position des Stifts (21) verbindet, unter einem Winkel von mindestens 45° schneidet.
11. Spannungsüberwachungsvorrichtung nach Anspruch 8, 9 oder 10, bei der die Feder (12) eine Schraubenfeder ist, die in einem Hohlraum (11) des ersten beweglichen Elements (8) aufgenommen ist.
12. Baugruppe, umfassend die Spannungsüberwa-

chungsvorrichtung nach einem der Ansprüche 6 bis 11, eine Slave-Vorrichtung und eine Schiene (29), wobei die Spannungsüberwachungsvorrichtung und die Slave-Vorrichtung eingerichtet sind, Seite an Seite auf der Schiene montiert zu werden, wobei der vorspringende Teil (15) mit der Slave-Vorrichtung in Eingriff steht.

Revendications

1. Dispositif de surveillance de tension comprenant des connecteurs d'entrée (27) pour recevoir une tension d'entrée (Vcc), un mécanisme de liaison (7, 8, 14), un ressort (12) pour pousser le mécanisme de liaison (7, 8, 14) vers une première position stable, et un solénoïde (5) alimenté par la tension d'entrée (Vcc) et adapté pour déplacer le mécanisme de liaison (7, 8, 14) de la première position à une seconde position si une tension appliquée au solénoïde (5) dépasse un premier seuil, et pour maintenir la liaison dans la seconde position lorsque la tension appliquée au solénoïde dépasse un second seuil inférieur au premier seuil, et un commutateur (22) commandé par le mécanisme de liaison (7, 8, 14),
caractérisé en ce que le commutateur (22) est connecté aux connecteurs d'entrée (27) et au solénoïde (5) de manière à appliquer un premier pourcentage de la tension d'entrée (Vcc) au solénoïde (5) lorsque le mécanisme de liaison (7, 8, 14) est dans la première position, et à appliquer un second pourcentage de la tension d'entrée (Vcc) au solénoïde (5) lorsque le mécanisme de liaison (7, 8, 14) est dans la seconde position, le second pourcentage étant inférieur au premier pourcentage.
2. Dispositif de surveillance de tension selon la revendication 1, comprenant en outre une résistance (R2, R3) qui est connectée en série avec le solénoïde (5) lorsque le mécanisme de liaison (7, 8, 14) est dans la deuxième position et dans laquelle le courant est réduit lorsque le mécanisme de liaison (7, 8, 14) est dans la première position.
3. Dispositif de surveillance de tension selon la revendication 1 ou 2, dans lequel le commutateur (22) comprend des premier et second plots de contact (31, 32) qui sont en contact physique et électrique lorsque le mécanisme de liaison (7, 8, 14) est dans la première position, et qui sont espacés l'un de l'autre lorsque le mécanisme de liaison (7, 8, 14) est dans la seconde position.
4. Dispositif de surveillance de la tension selon l'une quelconque des revendications précédentes, dans lequel une diode de retour (D) est connectée en parallèle au solénoïde (5).

5. Dispositif de contrôle de tension selon l'une quelconque des revendications précédentes, comprenant en outre un boîtier (1) duquel fait saillie une partie (15) du mécanisme de liaison (7, 8, 14).
6. Dispositif de surveillance de tension selon la revendication 5, dans lequel le boîtier (1) comprend un connecteur de montage sur rail pour le montage sur un rail (29), de préférence un rail DIN, et la partie en saillie (15) du mécanisme de liaison (7, 8, 14) fait saillie à travers une paroi latérale (17) du boîtier (1) qui est perpendiculaire à une direction longitudinale du rail (29).
7. Dispositif de surveillance de tension selon la revendication 6, dans lequel la partie en saillie est un arbre (15) et est susceptible de tourner autour d'un axe (16) s'étendant dans la direction longitudinale.
8. Dispositif de surveillance de tension selon la revendication 7, dans lequel la liaison (7, 8, 14) comprend des premier et second éléments mobiles, et l'arbre (15) fait partie du second élément mobile (14) entraîné en rotation par le solénoïde (5) par l'intermédiaire du premier élément mobile (7, 8).
9. Dispositif de surveillance de tension selon la revendication 8, dans lequel les premier (7, 8) et second (14) éléments mobiles sont couplés par une goupille (21) de l'un des premier et second éléments mobiles s'engageant sur un bord (20) de l'autre.
10. Dispositif de surveillance de tension selon la revendication 8 ou 9, dans lequel un rayon (26) s'étendant à partir de l'axe (16) intersecte une ligne droite (25) reliant les première et seconde positions de la goupille (21) sous un angle d'au moins 45°.
11. Dispositif de surveillance de tension selon la revendication 8, 9 ou 10, dans lequel le ressort (12) est un ressort hélicoïdal logé dans une cavité (11) du premier élément mobile (8).
12. Ensemble comprenant le dispositif de surveillance de tension selon l'une quelconque des revendications 6 à 11, un dispositif asservi et un rail (29) sur lequel le dispositif de surveillance de tension et le dispositif asservi sont adaptés pour être montés dans une relation côte à côte dans laquelle la partie en saillie (15) engage le dispositif asservi.

Fig. 1

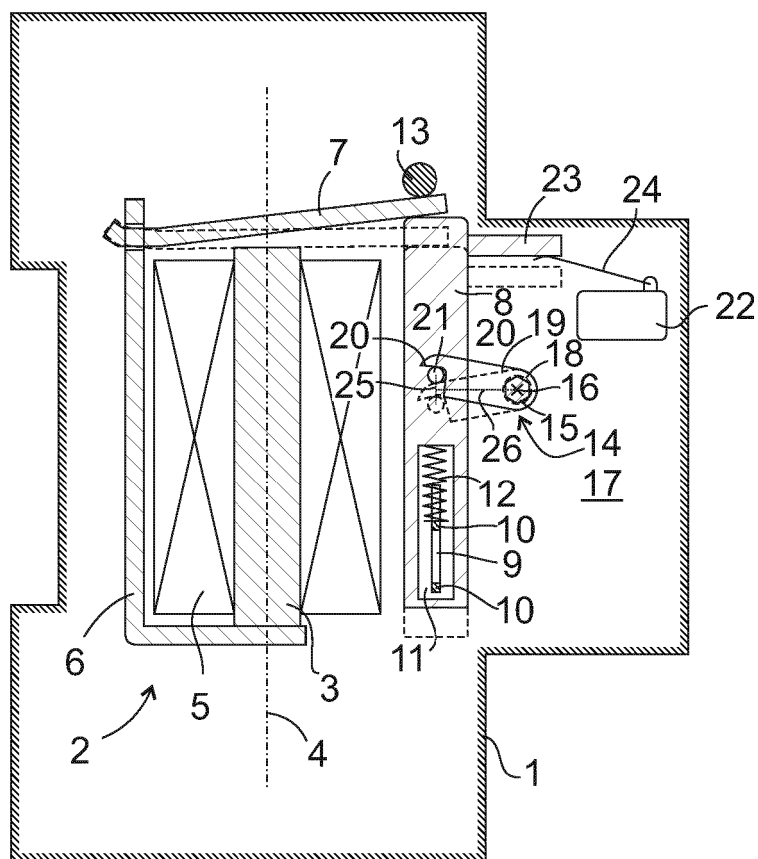


Fig. 2

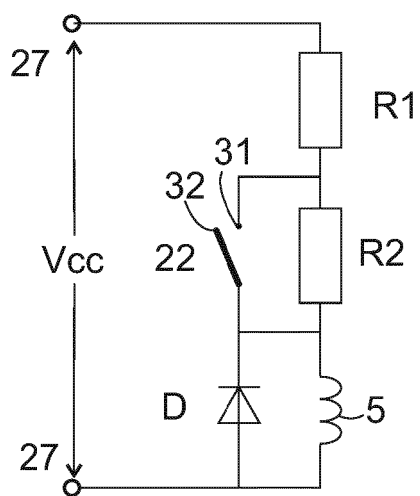


Fig. 3

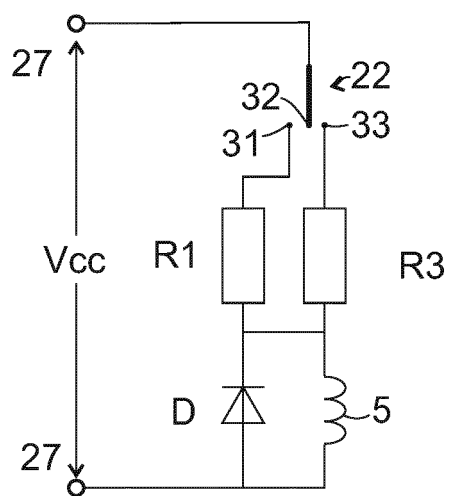
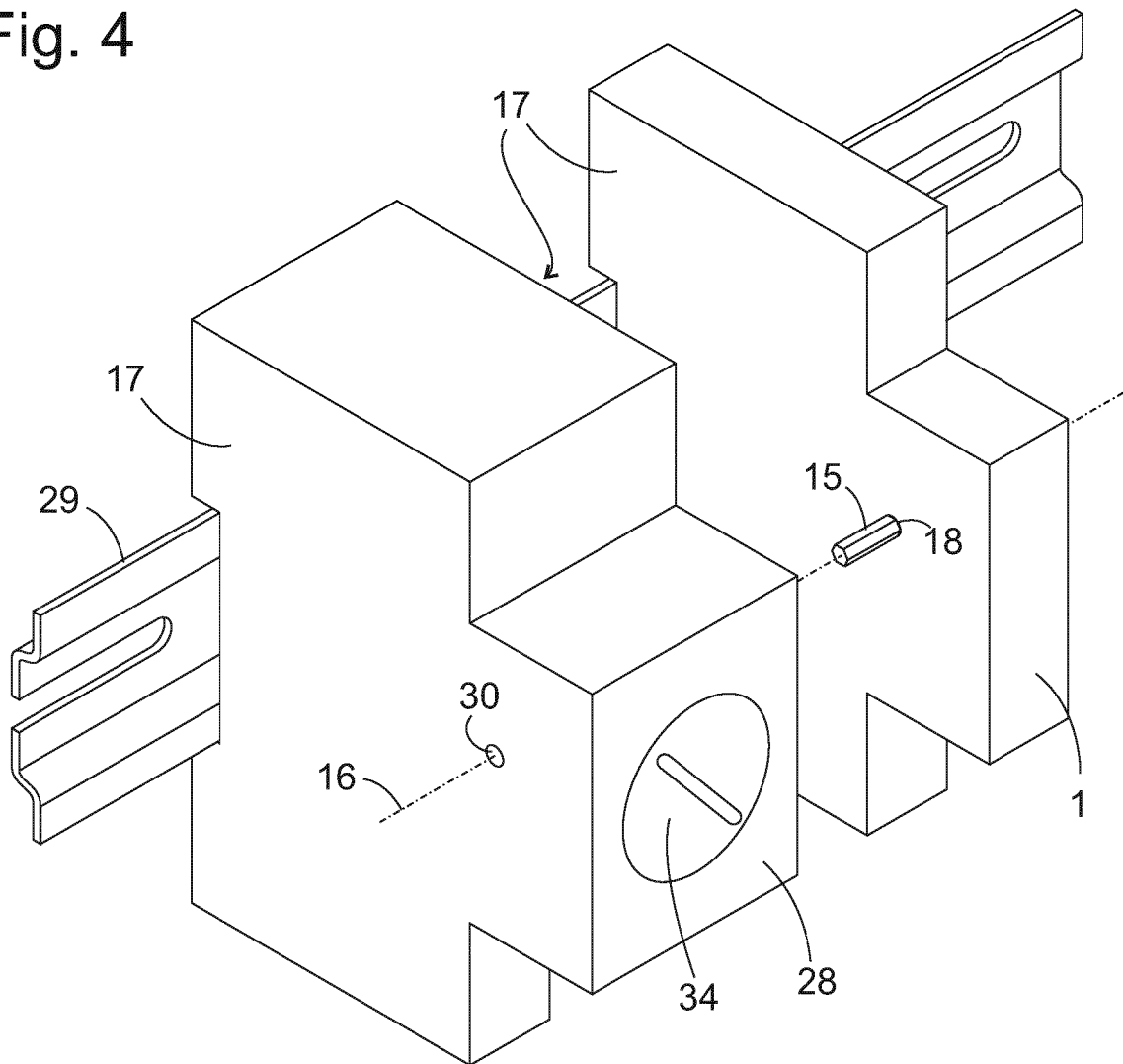


Fig. 4



REFERENCES CITED IN THE DESCRIPTION

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