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(54) Safety switch

(57) A push button safety switch comprising a box-like body (2) which houses therein at least one pair of stationary contacts (3, 4), a first slider (5) movable between two end positions (A, B), at least one pair of movable contacts (6, 7) operably connected to the first slider (5) to translate relative to the stationary contacts (3, 4) between the end positions (A, B), and to cause the circuit to open and close respectively, as well as a control push button (8) operably associated with the first slider (5) to cause it to slide within the box-like body (2), means for positive motion transmission (14) interposed between the push button (8) and the first slider (5) to cause positive opening of the circuit as the push button (8) is pressed, when the box-like body (2) is normally coupled to the push button (8), or as it accidentally disengages therefrom.

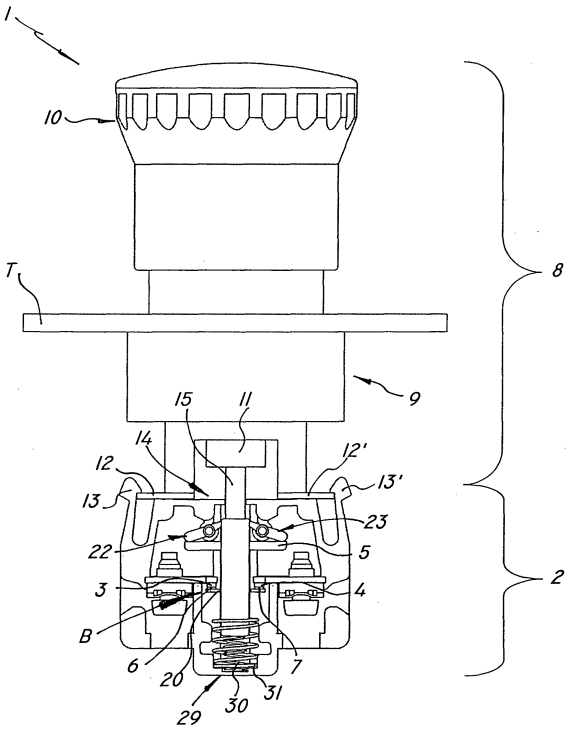

FIG. 1

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Description

Field of invention

[0001] The present invention generally finds application in the art of electric safety equipment and particularly relates to a push button safety switch adapted to be mounted in machines or systems to cut off the power supply thereto, particularly in case of emergency.

Background of the invention

[0002] Push button safety switches are known to be mounted to electric machines or systems to ensure safe operation thereof, by cutting off power supply in case of danger or whenever their operation needs to be stopped.

[0003] Typically, safety switches include a manually operable push button which is coupled to a stitching unit adapted to selectively open and close the power circuit, thereby switching the electric load.

[0004] As the push button is operated, a change of state occurs in the switching unit, which causes the contacts to open and the machine or system to be stopped.

[0005] For obvious reasons, the switches are required to keep the switching circuit open whenever the control push button is unable to properly transmit the contact opening control due to the switching unit being disengaged or improperly engaged therewith. Furthermore, a danger warning is required to be transmitted whenever the switching unit is not correctly operating.

[0006] Certain safety switch solutions, such as those disclosed in WO2006/094928 and EP1801830 include an additional electrically conductive element connected to the push button to allow the power circuit to only open if the switching unit is correctly coupled to the push button.

[0007] US6198058, DE10047998, EP0932171 and DE4101493 disclose prior art safety switches having a first contact that opens the power circuit as the push button is pressed, whereas a second contact only closes if the switching unit is properly coupled to the push button, possibly by a sliding bridge contact.

[0008] Further solutions, as disclosed in JP2003308756 and JP2003272468, provide a mechanical coupling device interposed between the switching unit and the push button, so that the circuit can only close if the coupling device is properly coupled to the push button by a lock lever.

[0009] Nevertheless, these prior art solutions have the apparent drawback of requiring a large number of parts, which add complexity and affect reliability.

[0010] Furthermore, certain applications provide indication of proper coupling between the push button and the switching unit by intermediate abutment members, such as movable tabs that actuate elastic contacts, without checking the position of the slider of the switching unit.

[0011] Here, there is a high risk of bending failure of the elastic elements which are particularly subjected to shocks when the switching unit is disengaged from the push button.

[0012] Further solutions only check proper engagement of the push button and the intermediate element, thereby involving the risk that, in case of accidental separation of the switching unit from the intermediate element, the electric contact will be unable to open, and any operation of the push button will not cause the contact to open, because the contact is separated from the rest of the switch.

[0013] EP1801827 discloses a prior art safety switch of the type described above, in which the switching contacts are coupled to a common bridge integral with a slider which is adapted to be driven by the control push button.

[0014] With the push button properly couple and not actuated, the power circuit is closed by a spring-biased snap mechanism and is held in the closed position by spring action.

[0015] While this solution provides a simpler and more reliable safety switch, by allowing the contact to open even in case of incorrect coupling between the push button and the switching unit, it still has the drawback of involving the use of elastic elements that are not easily mounted and exposed to higher jamming and rupture risks.

[0016] Furthermore, the presence of elastic elements for contact actuation does not ensure forced opening of the circuit, wherefore the switch might not operate if the switching contacts become "welded" to the terminals of the circuit being served, for example due to overload conditions.

Summary of the invention

[0017] The object of this invention is to overcome the above drawbacks, by providing a safety switch that achieves high efficiency and relative cost effectiveness.

[0018] A particular object is to provide a safety switch that ensures safety in case of improper coupling of its parts, using a considerably simplified construction, even in case of welded contacts.

[0019] A further object is to provide a safety switch that allows simple and inexpensive fabrication and assembly.

[0020] Yet another object is to provide a safety switch that ensures high reliability and has a relatively low risk of rupture and jamming of its parts.

[0021] Another important object of the invention is to provide a safety switch in which proper assembly is checked by direct checking of the slider of the switching unit.

[0022] These and other objects, as better explained hereafter, are fulfilled by a safety switch as defined in claim 1, which comprises a box-like body with a longitudinal axis and housing therein at least one pair of stationary contacts, which are designed to be connected to the power circuit of a machine or system, a first slider movable parallel to said longitudinal axis between two

end positions, i.e. open and closed circuit positions respectively, at least one pair of movable contacts operably connected to said first slider to translate relative to said stationary contacts between said end positions and cause the circuit to open and close respectively.

[0023] The switch further comprises a control push button which is designed to be fixed to the frame of a machine or system and is normally coupled to said box-like body, said push button being operably associated with said first slider to cause it to slide within said box-like body between said end positions.

[0024] The switch is **characterized in that** it comprises positive and continuous motion transmission means interposed between said push button and said first slider to cause interaction between said movable contacts and said stationary contacts and, as a result, positive opening of the circuit as said push button is pressed, when said box-like body is normally coupled to said push button or, alternatively, as said box-like body accidentally disengages, at least partially, from said push button.

[0025] As used herein, the term "positive opening of the power circuit" is intended to indicate an opening caused by a motion of the switching contacts caused by motion transmission means that do not include elastic elements, as defined in the standard IEC-947-5-1.

[0026] Thanks to this particular configuration, the switch of the invention allows safe opening of the circuit, in case of disengagement or improper engagement of the box-like body containing the contacts with respect to the push button, using a considerably simplified construction.

[0027] Furthermore, the rigidity of the motion transmission means allows reliable and constant operation of the switch with time, and also ensures positive opening of the contacts after a preset travel of the push button, which is also constant with time and not susceptible to changes caused by elastic elements.

Brief description of the drawings

[0028] Further characteristics and advantages of the invention will become more apparent upon reading the following detailed description of a few preferred non exclusive embodiments of a safety switch of invention, which are described by way of a non limiting example with the help of the accompanying drawings in which:

FIG. 1 is a front view of a safety switch of the invention according to a first embodiment, with the push button coupled and the circuit closed;

FIG. 2 is a front view of the switch of Fig. 1 with the push button coupled and the circuit open;

FIG. 3 is a front view of the switch of Fig. 1 with the push button disengaged;

FIG. 4 is a perspective view of a detail of the switch of Fig. 1 with the push button coupled and the circuit closed;

FIGS. 5 to 7 are sectional views of a detail of the switch of Fig. 1 in three operating conditions corresponding to the configurations of Figs. 1 to 3;

FIGS. 8 to 10 are sectional views of a detail of a switch of the invention in a second preferred configuration and in three operating conditions;

FIG. 11 shows the circuit opening and closing diagrams of a safety switch of the invention;

FIG. 12 shows the circuit opening and closing diagrams of a safety switch of the prior art.

Detailed description of a preferred embodiment

[0029] Referring to the above figures, the safety switch of the invention, generally designated by numeral 1, may be mounted to machines or industrial electric systems and be used, for instance, as a safety or emergency switch for cutting off the power supply to the machine or system by switching an electric load.

[0030] As shown in FIG. 1, a safety twitch of the invention comprises a box-like body 2 having a longitudinal axis L and housing therein at least one pair of stationary contacts 3, 4 to be connected to the terminals of a power circuit of the machines or system, not shown.

[0031] A first slider 5 is slideably housed in the box-like body 2 and is movable parallel to the longitudinal axis L between lower A and upper B end positions, corresponding to open and closed circuit positions respectively.

[0032] The first slider 5 has at least one pair of movable contacts 6, 7 operably connected thereto, to translate relative to the stationary contacts 3, 4 between the end positions A, B and cause the electric load to be stitched by opening and closing the circuit respectively.

[0033] The switch 1 further has a control push button 8 normally coupled to the box-like body 2 and operably associated to the first slider 5 to cause the latter to slide within the box-like body 2 between the end positions A, B.

[0034] The push button 8 may be, for instance, an emergency mushroom or a machine stop button and may have, as shown in the figures, a stationary portion 9, designed to be fastened to the frame T of a machine or system to be served and to be coupled to the box-like body 2, and a movable portion 10 with a pushing member 11 axially sliding in response to pressure exerted by a user.

[0035] For example, the push button 8 and the box-like body 2 may be coupled together by means of a pair of side tabs 12, 12' integral with the stationary portion 9 of the push button 8, which are designed for engagement with respective specially shaped side extensions 13, 13' of the box-like body 2.

[0036] Further embodiments of the coupling elements 12, 12'; 13, 13' may be provided, and the push button 8 may also be configure to be different from the one as shown herein, without departure from the scope of the present invention.

[0037] In accordance with a particular feature of the invention, positive motion transmission means 14 may

be interposed between the push button 8 and the first slider 5 to cause interaction between the movable contacts 6, 7 and the stationary contacts 3, 4 and, as a result, positive opening of the circuit both as the push button 8 is pressed, when it is normally coupled to the box-like body 2 and as the box-like body 2 accidentally disengages from the push-button 9 or when the box-like body 2 is not properly coupled thereto.

[0038] Conveniently, the positive motion transmission means 14 may be free of any elastic elements and snap mechanisms, to allow progressive separation of the movable switching contacts 6, 7 from the stationary contacts 3, 4 as the push button 8 is being pressed.

[0039] In a preferred, non exclusive embodiment of the invention, the motion transmission moans 14 may include a second slider 15, at least partially held within the box-like body 2 and free to axially slide within the box-like body 2.

[0040] The second slider 15 may be operably connected to the pushing member 11 of the push button 8 to transfer the pressing motion of the latter to the first slider 5, thereby causing translation of the movable contacts 6, 7 to open/close the circuit.

[0041] For instance, the two sliders 5, 15 may be arranged to be substantially parallel to the longitudinal axis L, with the second slider 15 having a first outer end portion 17 facing towards the pushing member 11 and interacting therewith to rigidly transfer the motion of the push button 8 to the first slider 5.

[0042] Furthermore, as shown in the sectional views of Figs. 5 to 7, the second slider 15 may have a hollow central portion 18 for receiving the first slider 5, which will be able to axially slide therein.

[0043] The first slider 5 may have a T-shape and be operably, connected to the movable contacts 6, 7 by a contact bridge 20 which may be either separated from such first slider 5 or integrated with the latter at one end thereof.

[0044] Nonethess, alternative configurations for the bridge 20 and the movable contacts 6, 7 may be provided. For example, the single bridge 20 may be replaced by two separate bridges, in parallel arrangement or connected together, and having each at least one pair of movable contacts 6, 7.

[0045] In the embodiment of Figs. 1 to 7, the motion transmission means 14 may include an articulated linkage 21 with a pair of levers 22, 23, each having a pair of arms 24, 24'; 25, 25' designed for interaction with the first 5 and the second sliders 15 respectively to force the movable contacts 6, 7 into an open position C intermediate between the two end positions A, B in a state of disengagement or improper coupling of the box-like body 2.

[0046] The levers 22, 23 may be arranged symmetrically with respect to the longitudinal axis L and may be articulated at a central portion about respective axes of rotation X, Y substantially transverse and perpendicular to the longitudinal axis L.

[0047] Nonetheless, it shall be understood that the number of levers 22, 23 and their mutual positions and locations in the box-like body 2 may differ from what is shown herein, without departure from the scope of the invention.

[0048] As more clearly shown in Figs. 5 to 7, the second slider 15 may have a substantially transverse wall 26 in its hollow central portion 18, with a substantially flat inner surface 27, adapted to interact with the first slider 5 to drive it in its longitudinal motion after a first longitudinal translation t_1 of the second sliders 15 in the direction of introduction thereof in the box-like body 2 with a predetermined maximum travel.

[0049] The transverse wall 26 may also have an appropriately shaped outer surface 28 with an outwardly directed convexity, which is designed to interact with respective arms 24', 25' of the levers 22, 23, after a second longitudinal translation t_2 in the direction opposite the first translation t_1 with a predetermined travel, upon even partial disengagement of the box-like body 2.

[0050] Thus, by its outward axial translation the second slider 15 will drive the levers 22, 24 to pivot about their respective transverse axes X, Y, with a predetermined angle a, which is sufficient to allow interaction of the arms 24, 25 with the first slider 5.

[0051] The levers 22, 23 will be thereby locked in a tilted position, whereby they will lock the first slider 5 in an intermediate position C between the two end positions A, B, to cause forced disengagement of the movable contacts 6, 7 from the stationary contacts 3, 4 and open the circuit.

[0052] Elastic counteracting means 29 may be also provided in the box-like body 2 to operate on the first 5 and second sliders 15 and exert respective forces of predetermined strength on the first 5 and second sliders 15.

[0053] The elastic means 29 will be also used to return the sliders 5, 15, particularly when the box-like body 2 is coupled and the push button 8 is not pressed, to move the first slider 5 in the closed circuit, upper end position B.

[0054] Conversely, upon disengagement of the box-like body 2, the elastic means 29 will operate to counteract the pivotal motion of the levers 22, 23.

[0055] In the exemplary configuration of Figs. 1 to 7, the elastic means 29 will include a first spring 30 operating on the contact bridge 20 and hence on the first slider 5 to force the bridge 20 outwards and move the movable contacts 6, 7 from the open power circuit position A to the closed power circuit position B.

[0056] If the bridge 20 is separated from the first slider 5, in the closed circuit condition corresponding to the end position B, the elastic force generated by the first spring 30 will be entirely transmitted to the bridge 20. Therefore, the first spring 30 will not have to overcome the resistance of the first slider 5, and this will allow the circuit to close.

[0057] The elastic means 29 may include a second spring 31 operating on the second slider 15 to counteract its sliding introduction motion and urge it outwards.

[0058] The first 30 and second 3i springs may have different spring moduli, with the spring modulus of the

second spring 31 higher than the spring modulus of the first spring 30.

[0059] Figs. 8 to 10 show a second preferred embodiment of a box-like body 2 with its motion transmission means 14 and elastic means 29, as shown in three different operating positions identical to those that are shown in Figs. 5 to 7 respectively.

[0060] In this embodiment, the positive motion transmission means 14 may include an actuator mechanism 32 of the rack-and-pinion type.

[0061] The mechanism 32 may consist of a pair of first and second racks, 33, 33'; 34, 34' respectively, which face towards each other and are rigidly connected to the first slider 5 and the second slider 15 respectively, and a pair of pinions 35, 36 pivoting about respective fixed transverse axes relative to the box-like body 2, and interposed between and meshing with the respective first and second racks 33, 33'; 34, 34'.

[0062] The size of the pinions 35, 36 may be selected so that a longitudinal translation of one of the sliders 5, 15 in a given direction will cause a translation of the other slider 15, 5 in the opposite direction, thereby obtaining an effect similar to that produced by the above described transmission means 14.

[0063] The first slider 5 may be designed as a bridge integral with the movable contacts 6, 7 for two elastic counteracting and return elements 37, 38 to operate thereon, with the same function as the above described first spring 30.

[0064] In operation, when the push button 8 is properly engaged with the box like body 2, as shown in Figs. 1, 4 and 5, the pushing member 11 associated therewith may interact with the second sliders 15 to push it into the box-like body 2 and cause its translation t_1 against the elastic action of the second spring 31.

[0065] Under these conditions, the first slider 5 may be axially disengaged from the second slider 15 and the transverse wall 26 will not be in contract with the levers 22, 23, which will allow the first slider 5 to translate integrally with the bridge 20 by the bias of the first spring 30, to reach the upper end position B corresponding to the closed circuit condition.

[0066] As the push button 8 is pressed by a user to cut off the power supply to the machine or systems, the pushing member 11 will press the second slider 15 into the box-like body 2.

[0067] Thus, the second slider 15 will translate longitudinally with a translational motion t_3 having a predetermined maximum travel value, thereby moving the transverse wall 26 to contact with the first slider 5 and to push it from the upper end position B to the open circuit lower end position A, by overcoming the resistance of both springs 30, 31, as shown in Figs. 2 and 6.

[0068] If the box-like body 2 disengages from the slider 8, or is not correctly coupled thereto, the pushing member 11 cannot exert its action on the second slider 15, wherefore the latter will undergo a translation t_2 due to the bias of the second spring 31.

[0069] As a result, the convex surface 28 of the transverse wall 26 may interact with the arms 24', 25' of the levers 22, 23 to cause them to pivot, thereby transferring the translational motion t_2 to the first slider 5. Particularly, the levers 22, 23 will push the first slider 5 in a direction opposite the direction of motion of the second slider 15.

[0070] The first slider 5 will move from one of the two end positions A, B to the intermediate position C, which may even be coincident with the end position A, thereby separating the movable contacts 6, 7 from the stationary contacts 3, 4 and open the circuit.

[0071] In this operating condition, which is shown in figs. 3 to 7, the counteraction of the first spring 30 will be overcome by the return force exerted by the second spring 31 with a higher spring modulus, wherefore the first spring 30 will not be able to prevent the release of the second slider 15.

[0072] Nonetheless, the presence of the elastic means 29 will apparently not interfere with the transmission of motion from the push button 8 to the first slider 5 and hence to the contact bridge 20.

[0073] Motion will be anyway transmitted in a rigid manner, and the circuit opening mechanism will be always of positive opening type.

[0074] The operation of the switch 1 according to the embodiment of Figs. 8 to 10 will be substantially similar to that described hereinabove.

[0075] In this case, the function of the levers 22, 23 will be performed by the pinions 35, 36 and the first racks 33, 33', which will operate to push the first slider 5 from the closed circuit end position B to the open circuit intermediate position C upon the release of the second slider 15 resulting from the disengagement of the box-like body 2 from the push button 8, as shown in Fig. 10.

[0076] When the push button 8, is correctly coupled and not pressed, as shown in Fig. 8, the first racks 33, 33' will not interact with the first slider 5, which will be pushed by the elastic elements 37, 38 into the closed circuit end position B.

[0077] As the push button 8 is pressed, the second slider 15 is allowed to rigidly interact with the first slider 5 to push it to the open circuit lower end position A, as shown in Fig. 9.

[0078] The pivotal motion of the pinions 35, 36 will be generated by their interaction with the second racks 34, 34', upon translation of the second slider 15.

[0079] FIG. 11 shows the typical circuit opening and closing diagrams of a safety switch of the invention. In these diagrams, the position C corresponds to the state in which the second slider 15 is entirely removed, which occurs when the box-like body 2 is disengaged from or not correctly coupled to the push button 8. The positions B and A, corresponding to the closed circuit and open circuit states, are reached by the second slider 15 as a result of longitudinal translations, with travels c_1 and c_2 respectively, with respect to the position C.

[0080] These diagrams show that the motion transmission means 14 are specially designed for the switch 1 to

have the same behavior both when it moves from the position C into the position A through the position B and vice versa.

[0081] This diagram is very different from that of a prior art switch, as exemplarily shown in Fig. 12, which has snap transmission means and will have different behaviors when passing from the disengaged box-like state to the pressed push button state and vice versa.

[0082] The above disclosure clearly shows that the invention fulfils the intended objects and particularly meets the requirement of providing a safety switch that allows safe opening of the circuit in case of disengagement or incorrect coupling of the push button and the box-like body containing the contacts, through the use of a considerably simpler construction and positive motion.

[0083] The switch of this invention is susceptible to a number of changes and variants, within the inventive principle disclosed in the appended claims. All the details thereof may be replaced by other technically equivalent parts, and the materials may vary depending on different needs, without departure from the scope of the invention.

[0084] While the switch has been described with particular reference to the accompanying figures, the numerals referred to in the disclosure and claims are only used for the sake of a better intelligibility of the invention and shall not be intended to limit the claimed scope in any manner.

Claims

1. A push button safety switch comprising:

- a box-like body (2) with a longitudinal axis (L) and housing therein:
- at least one pair of stationary contacts (3, 4), which are designed to be connected to the power circuit of a machine or system;
- a first sliders (5) movable parallel to said longitudinal axis (L) between two end positions (A, B), i.e. open circuit and closed circuit positions respectively;
- at least one pair of movable contacts (6, 7) operably connected to said first slider (5), to translate relative to said stationary contacts (3, 4) between said end positions (A, B) and cause opening and closing of the circuit respectively; and also
- a control push button (8) which is designed to be fixed to a machine or system and is normally coupled to said box-like body (2), said push button being operably associated with said first sliders (5) to cause it to slide within said box-like body (2) between said end positions (A, B).

characterized in that it comprises positive motion transmission means (14) interposed between said push button (8) and said first slider (5) to cause interaction between said movable contacts (6, 7) and said stationary contacts (3, 4) and, as a result, positive opening of the circuit as said push button (8) is pressed, either when said box-like body (2) is normally coupled to said push button (8) or as said box-like body (2) accidentally disengages, at least partially, from said push button (8).

2. A switch as claimed in claim 1, **characterized in that** said positive motion transmission means (14) are free of any elastic elements and snap mechanisms.

3. A switch as claimed in claim 2, **characterized in that** it comprises a second slider (15) slideably housed in said box-like body (2) and operably connected to said push button (8) to transmit the pressing motion from the latter to said first slider (5).

4. A switch as claimed in claim 3, **characterized in that** said first slider (5) and said second slider (15) are substantially parallel to said longitudinal axis (L).

5. A switch as claimed in claim 4, **characterized in that** said second slider (15) has a hollow central portion (18) for slideably housing said first slider (5).

6. A switch as claimed in claim 5, **characterized in that** said motion transmission means (14) include a linkage (21) with one or more levers (22, 23), each lever (22, 23) having a pair of arms (24, 24'; 25, 25') designed for interaction with said first slider (5) and said second slider (15) respectively, to force said movable contacts (6, 7) into said open position (A) in a state of disengagement or improper coupling of said box-like body (2) and said push button (8).

7. A switch as claimed in claim 6, **characterized in that** said lever linkage (21) includes a pair of levers (22, 23) substantially symmetrical with respect to said longitudinal axis (L) and centrally articulated about respective axes of rotation (X, Y) substantially transverse and perpendicular to said longitudinal axis (L).

8. A switch as claimed in claim 6 or 7, **characterized in that** said second slider (15) has a transverse wall (26) in said hollow central portion (18), with a substantially flat inner surface (27), adapted to interact with said first slider (5) to drive it along said longitudinal axis (L) after a first longitudinal translation (t_1) of said second slider (15) with a predetermined maximum travel (c_2).

9. A switch as claimed in claim 8, **characterized in that** said transverse wall (26) has a specially shaped outer surface (28) which is designed to interact with respective arms (24', 25') of said levers (22, 23), after

a second translation (t_2) in the direction opposite the first translation (t_1) of said second slider (15), with a predetermined longitudinal travel (c_1), to drive said, levers (22, 23) into rotation about said respective transverse axes (X, Y) and lock said movable contacts (6, 7) into an open position (C) intermediate between said end positions (A, B).

10. A switch as claimed in claim 9, **characterized in that** said levers (22, 23) are designed of such a size as to pivot, after said second translation (t_2) of said second slider (15), through a predetermined angle (α) sufficient to allow interaction of said arms (24, 25) with said first slider (5) and look said movable contacts (6, 7) in said intermediate position (C).

11. A switch as claimed in any one of the preceding claims, **characterized in that** it comprises elastic return means (29) operating on said first slider (5) and said second slider (15) respectively, to exert respective counteracting forces of predetermined strength thereon, to counteract the pivotal motion of said levers (22, 23).

12. A switch as claimed in claim 11, **characterized in that** said elastic return means (29) include a first spring (30) operating on said first slider (5) to urge it outwards and move said movable contacts (6, 7) from said open position (A) to said close position (B) of the power circuit and a second spring (31) operating on said second slider (15) to urge it outwards.

13. A switch as claimed in claim 12, **characterized in that** said first and second springs (30, 31) have different spring moduli, the spring modulus of said second spring (31) being higher than the spring modulus of said first spring (30).

14. A switch as claimed in any one of the preceding claims, **characterize in that** said positive motion transmission means (14) include a mechanism (32) of the rack-and-pinion type.

15. A switch as claimed in claim 14, **characterized in that** said rack-and-pinion mechanism (32) comprises at least one first (33) and at least one second (34) racks, which face towards each other and are operably connected to said first (5) and said second (15) sliders respectively, and a pinion (35) interposed between and meshing with said first (33) and said second (34) racks and pivoting about a fixed axis relative to said box-like body (2), so that a longitudinal translation of one of said sliders (5, 15) in a given direction causes a translation of the other slider (15, 5) in the opposite direction.

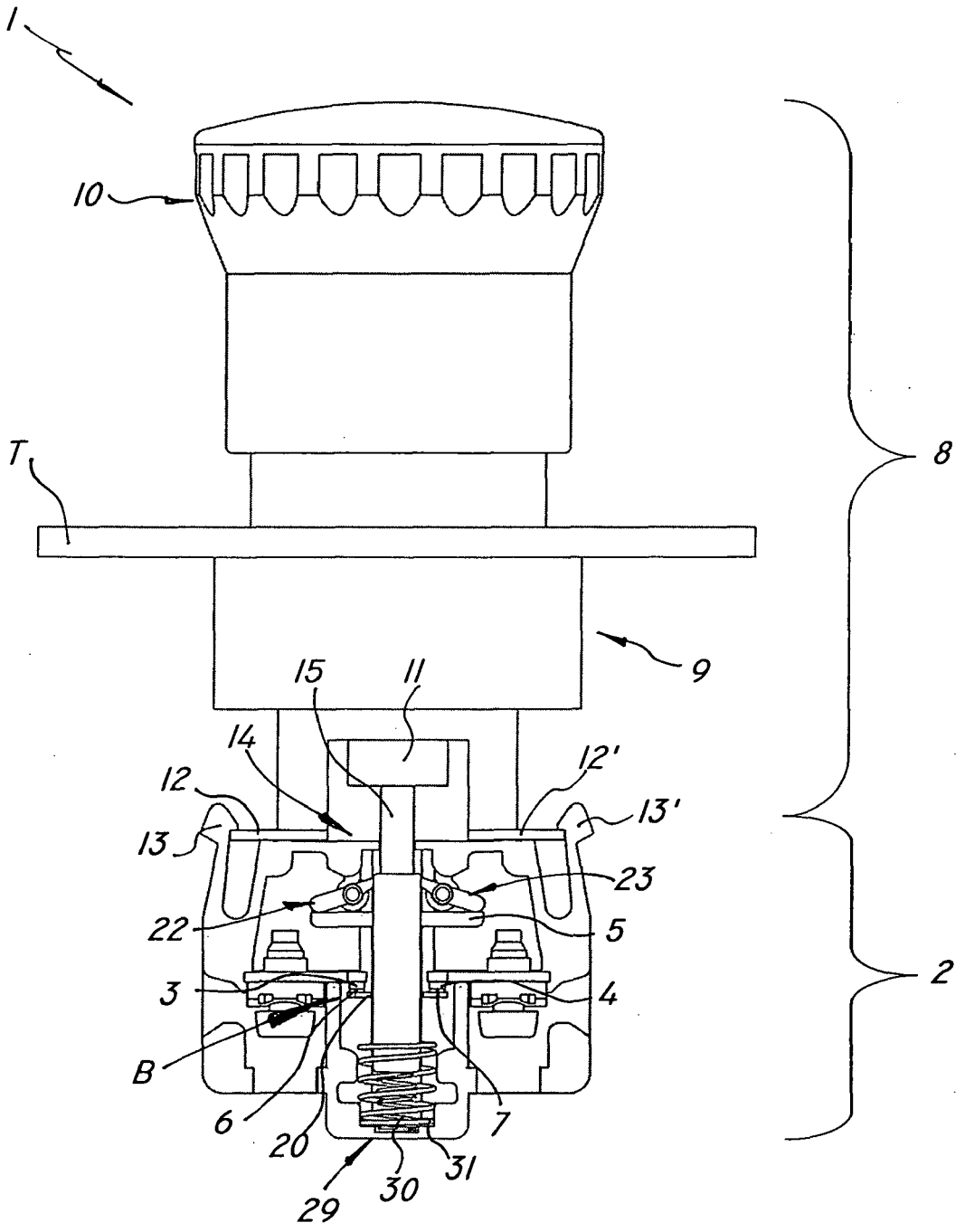


FIG. 1

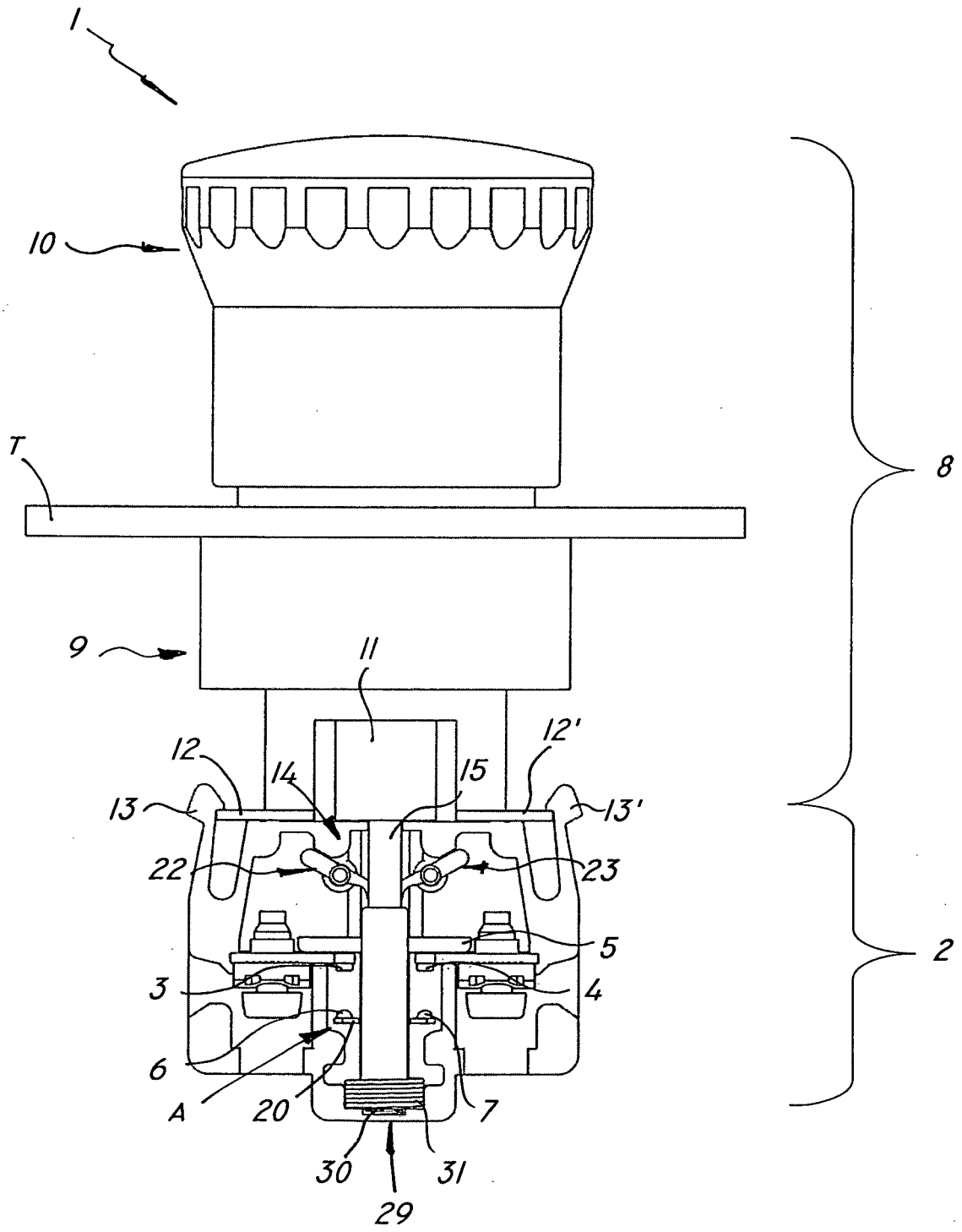


FIG. 2

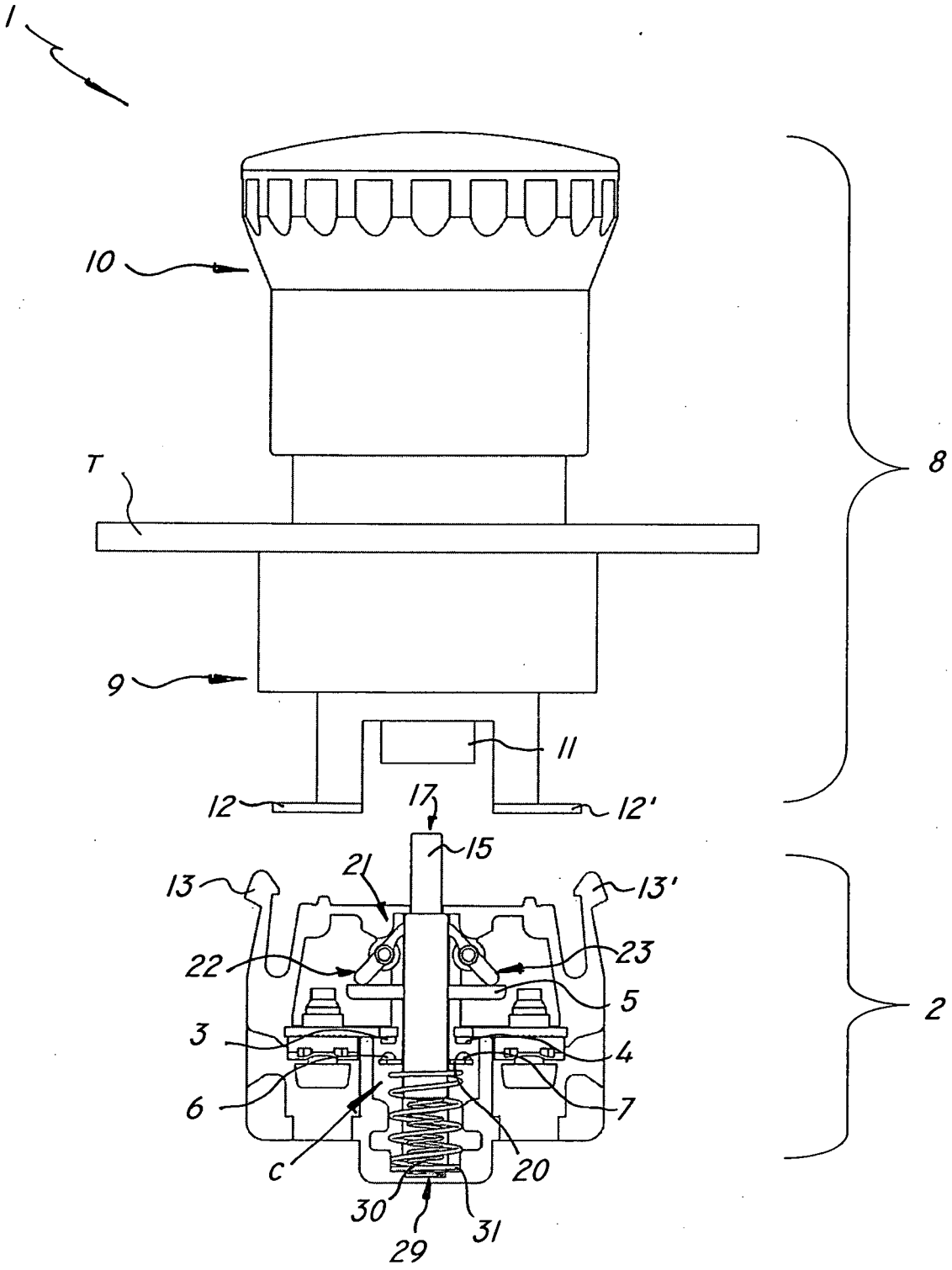


FIG. 3

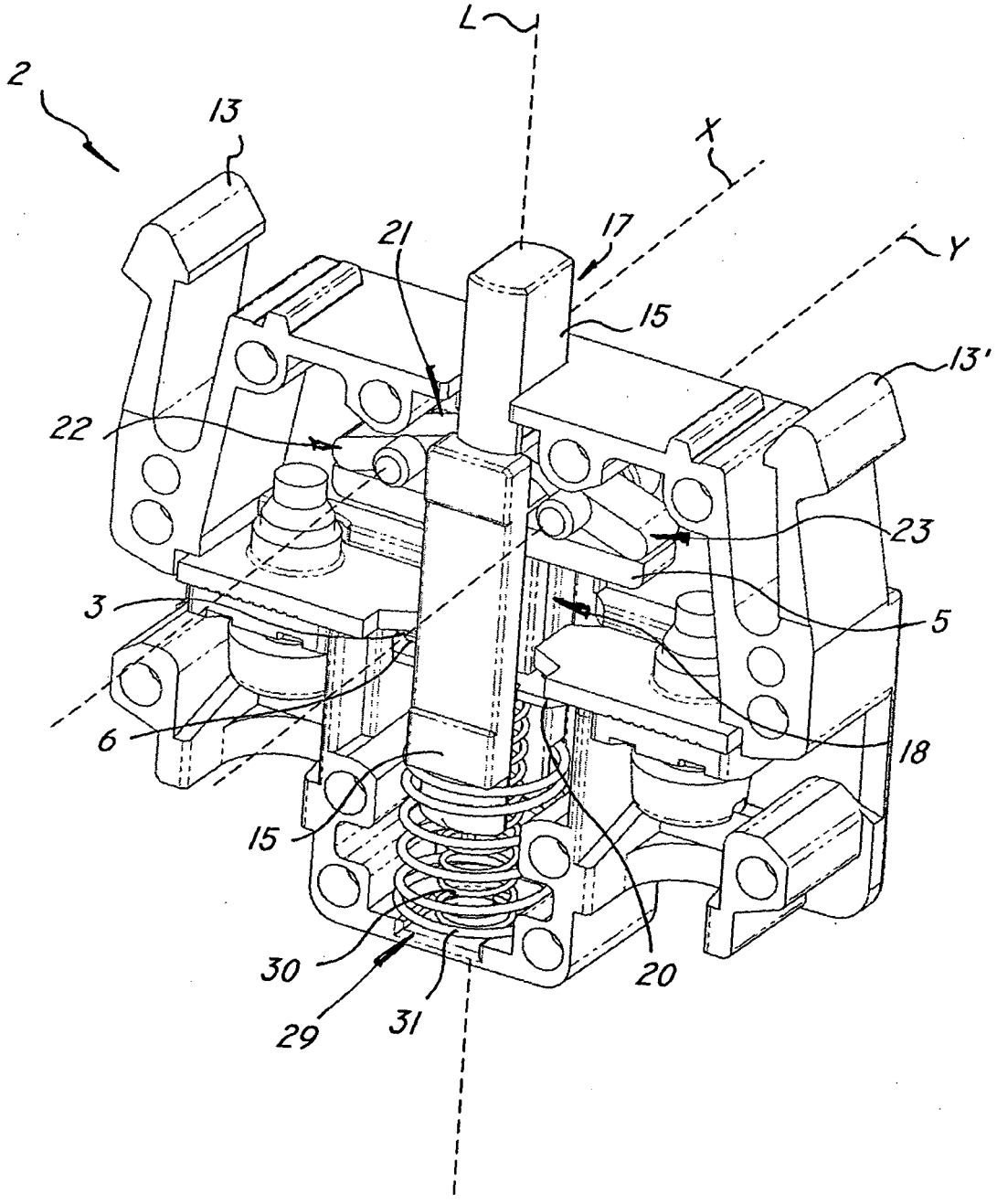


FIG. 4

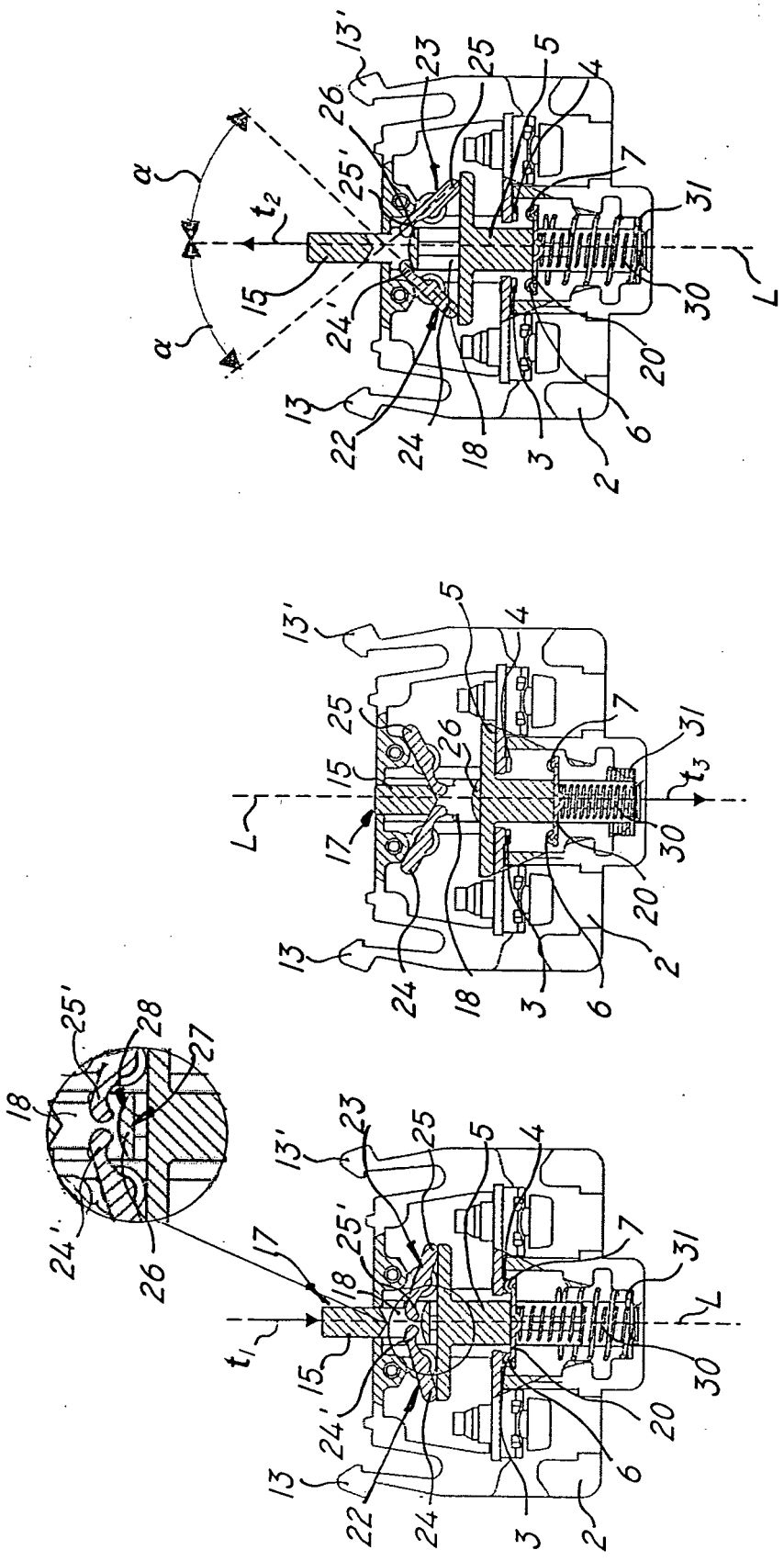
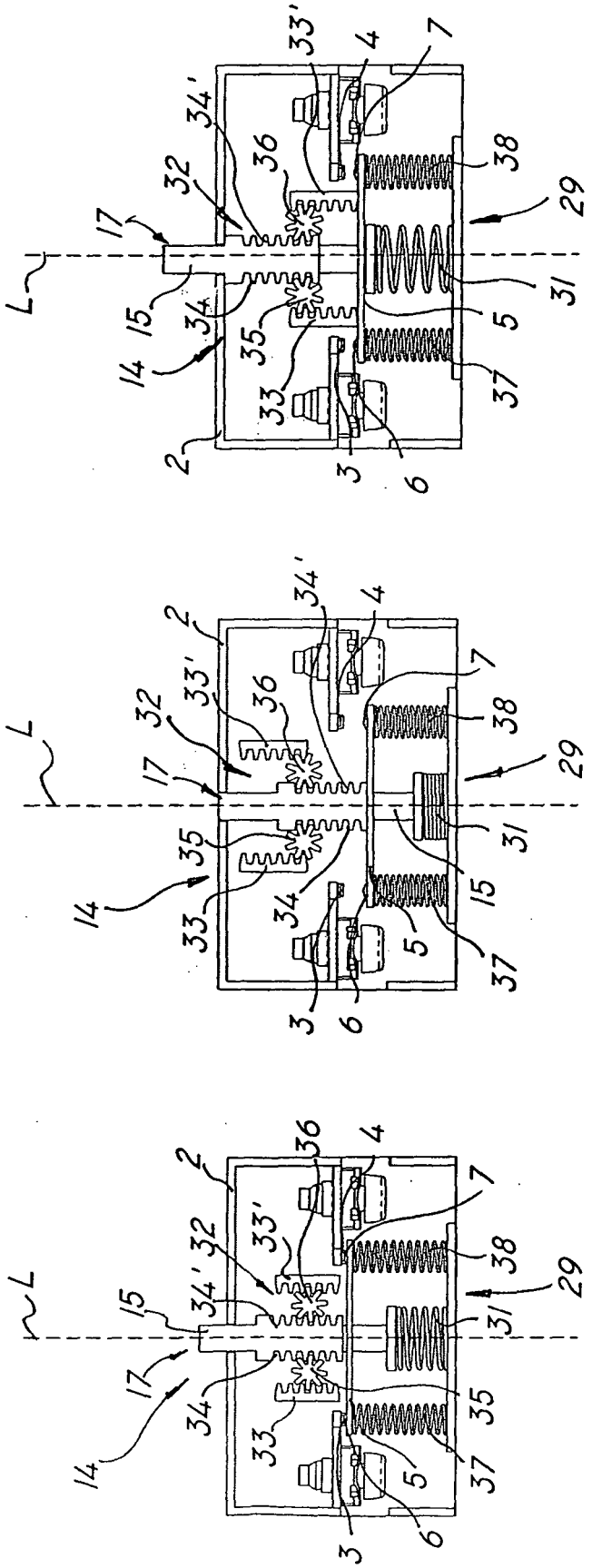


FIG. 5

FIG. 6

FIG. 7



B A C

FIG. 8 FIG. 9 FIG. 10

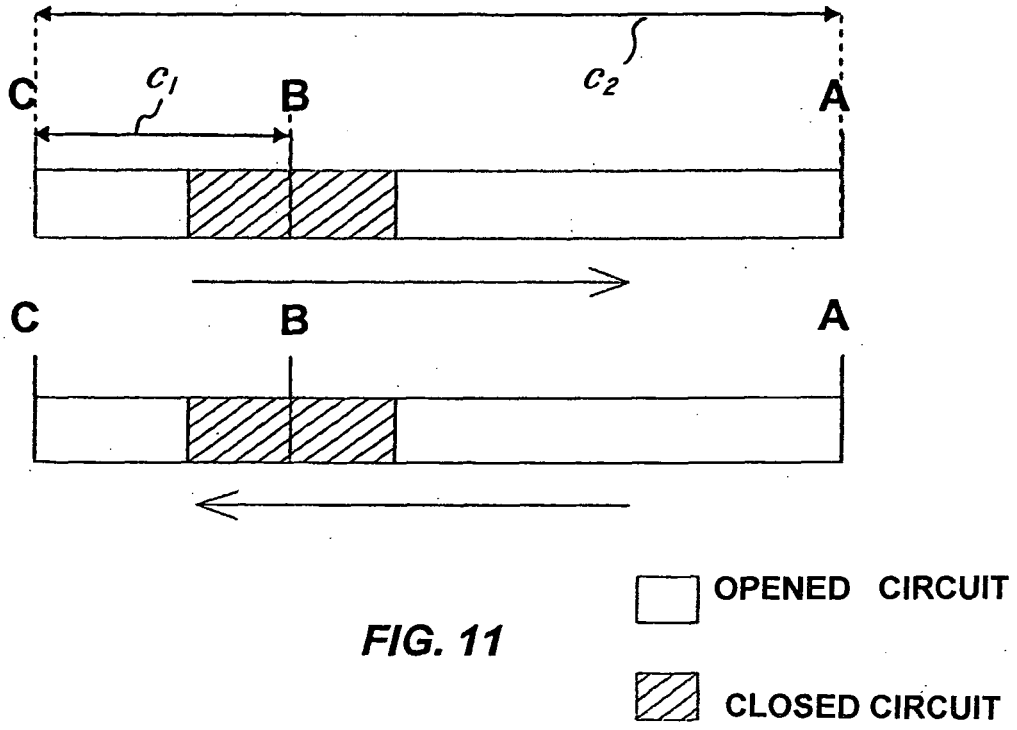


FIG. 11

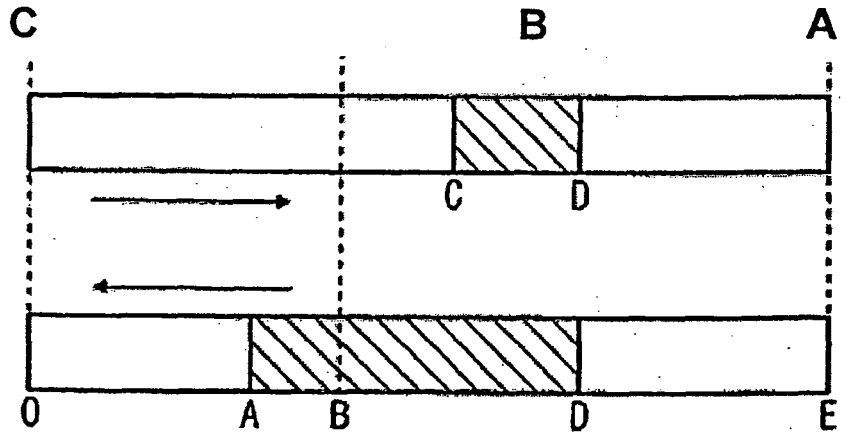


FIG. 12 – STATE OF THE ART

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EUROPEAN SEARCH REPORT

Application Number
EP 08 01 1840

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 198 058 B1 (GRANINGER FRANK J [US] ET AL) 6 March 2001 (2001-03-06) * column 4, line 51 - column 7, line 23; figures 1-6 * -----	1-15	INV. H01H3/02
D,A	EP 1 801 827 A (SIEMENS AG [DE]) 27 June 2007 (2007-06-27) * the whole document * -----	1	

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	6 October 2009	Nieto, José Miguel

CATEGORY OF CITED DOCUMENTS

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06-10-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6198058 B1	06-03-2001	DE 10047998 A1	29-03-2001
EP 1801827 A	27-06-2007	AT 405940 T	15-09-2008
		CN 101030493 A	05-09-2007
		US 2007137995 A1	21-06-2007

EPO FORM P0459

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Patent documents cited in the description

- WO 2006094928 A **[0006]**
- EP 1801830 A **[0006]**
- US 6198058 B **[0007]**
- DE 10047998 **[0007]**
- EP 0932171 A **[0007]**
- DE 4101493 **[0007]**
- JP 2003308756 B **[0008]**
- JP 2003272468 B **[0008]**
- EP 1801827 A **[0013]**