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(54) **Switch-disconnector**

Lasttrennschalter

Interrupteur de puissance

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(56) References cited:
EP-A- 0 708 461 **FR-A- 2 628 261**

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Description

[0001] The present invention relates to electric switches and, more particularly, a switch-disconnector.

[0002] Switch-disconnectors are items of equipment utilized in many electrical installations in order to make it possible for portions of the plant to be isolated or brought back into service. They do not perform functions of protecting the plant from fault currents and must therefore be capable of withstanding the high currents and the consequent electrodynamic loads that occur during short circuits without suffering damage. This requirement imposes the use of high contact pressures, obtained - for example - by having recourse to jaw contacts, and therefore the use of operating mechanisms capable of developing relatively high energies, normally greater than those needed for other types of switches, circuit breakers being a case in point.

[0003] The greater part of the switch-disconnectors at present in the market have a two-state mechanism (contacts open or contacts closed) that can be operated by hand. Typically, the mechanism comprises a spring that is manually compressed every time the switch is operated either to open or close the contacts and releases the stored energy to open or close the contacts. As a general rule, the mechanism in question is simple and effective, capable of being produced economically.

[0004] There is an ever more strongly felt need for operating switch-disconnectors with mechanisms capable of opening the contacts by means of remote-controlled electromagnets, for example, when emergency situations have to be faced. Two solutions are known for satisfying this need.

[0005] One solution consist of adapting a circuit breaker for use as switch-disconnector. In that case the designer exploits the capacity of these circuit breakers of being remote-controlled, but has to take account of their poor electric performance in the event of fault currents: in fact, a circuit breaker has the function of isolating an electric circuit by interrupting the fault currents in the shortest possible time, but its contacts are not designed for withstanding high fault currents while yet remaining closed without suffering damage. Furthermore, this solution is decidedly disadvantageous from the economic point of view, because circuit breakers are far costlier than two-state switch-disconnectors.

[0006] "FR 2628261" discloses a circuit breacker having a pivotable moving contact spring loaded to open and a mobile hooked element adapted to rotate the moving contact for closing the contact in contrast to the action of said spring loading.

[0007] Another solution consists of realizing switch-disconnectors with specific mechanisms that permit the contacts being opened by means of electromagnets. A commonly employed mechanism is provided with two springs: a closing spring and an opening spring, and is characterized by an operating sequence (opening-closure cycle) that envisages the following operational steps:

- manual loading of both springs until a dead point of the mechanism is reached,
- closure of the contacts by means of the liberation of the energy accumulated in the closure spring (the opening spring remains loaded),
- aperture of the contacts by means of the liberation of the energy accumulated in the opening spring (operation performed either manually or by an electromagnet),
- re-setting of the aperture-blocking device when the opening was effected by an electromagnet.

[0008] This solution is likewise associated with some disadvantages. The opening-closing mechanism is more complex and- more expensive and is also completely different from the mechanism of a two-state switch-disconnector so that two distinct production lines have to be constituted for two-state switches and switches of which the opening may be remote-controlled, with consequent industrial management complications. From the user's viewpoint, too, there are some negative aspects: in fact, the energy needed for both the closing and the opening of the switch has to be provided already during the closing operation, so that this operation calls for a greater effort than is needed for operating the mechanism of a two-state switch.

[0009] One aim of the present invention is therefore to provide a switch-disconnector that can be opened by remote control and calls only for minimal variants of the operating mechanism of a two-state switch and leaves its volume unchanged.

[0010] This aim is attained by realizing the switch described and characterized in general terms in Claim 1.

[0011] The invention will be understood more clearly from the following detailed description of an embodiment thereof, which is given purely by way of example and is not therefore to be considered limitative in any way, the description making reference to the attached drawings, of which:

- Figure 1 shows a perspective view of a two-state switch without its covering part,
- Figures 2 to 4 show side elevations, partly in section, of the switch of Figure 1 as configured in three different operating steps,
- Figure 5 shows a perspective view of a switch in accordance with an embodiment of the invention, again with the cover part removed;
- Figures 6 to 9 show side elevations, partly in section, of the switch of Figure 5 as configured in four different operating steps, and
- Figure 10 shows a perspective view of a detail of the switch of Figure 5.

[0012] Referring to Figures 1 to 4, the switch comprises a shell, consisting of a base 2 and a cover part (not

shown) that can be superposed on the base, input and output terminals 3 (four pairs in the present example), a contact-carrier shaft 4 made of insulating material, a mechanism 5 for operating the contact-carrier shaft and an operating handle 7.

[0013] The contacts are constituted by metallic elements 8 with jaw ends mounted in positions diametrically opposite with respect to the axis of the contact-carrier shaft 4 and such as to become engaged with corresponding knife elements 9 of an input terminal and an output terminal.

[0014] The operating mechanism 5 comprises a control shaft 6, an arm 16 constrained to the internal end of the control shaft 6 with a predetermined angular play (for example 30°) and a snap organ consisting of a helicoidal torsion spring 17 that has one of its ends constrained to the base 2 and the other end constrained to the end of the arm 16. The contact-carrier shaft 4 is mounted on the base 2 with its axis of rotation coaxial with the control shaft 6 and has an end part 10 shaped in such a manner as to form a cavity 19 that defines a circular sector in which the arm 16 may move in rotation between two angular positions delimited by the walls of this cavity.

[0015] Let us now consider the functioning of the switch, making reference, in particular, to Figures 2, 3 and 4, which show the switch, respectively, in the position with open contacts, in an intermediate position during the closing operation and in the closed position. When the control shaft 6 is rotated in the direction indicated by the arrow on the drawings, the arm 16 rotates in the cavity 19, but without becoming engaged with the contact-carrier shaft 4, until the spring 17 is fully loaded (Figure 3). At this point the arm 16 bears against the upper wall of the cavity 19 and the spring 17 tends to become discharged, thus applying a torque to the arm 16. The arm therefore undergoes a sudden acceleration of its rotation, becomes disengaged from the control shaft 6, thanks to its coupling with angular play, and drags the contact-carrier shaft 4 into rotation. The spring 17 is chosen in such a way that its discharge energy will be sufficient to force the jaw contact elements 8 into the position in which they close onto the knife elements of the input terminals and the output terminals of the switch (Figure 4).

[0016] The operation of opening the contacts is performed in a wholly similar manner by displacing the handle 7 in the direction opposite to the one indicated by the arrow on the drawings.

[0017] Referring now to Figures 5 to 10, where elements equal to those of Figures 1 to 4 are indicated by the same reference numbers, the switch differs from the one described because its operating mechanism, here indicated by 5', comprises a snap organ that is not only capable of applying to the contact-carrier shaft a torque that will close or open the contacts, but is also a tripping organ. In other words, it is capable of performing a tripping function, i.e. opening the contacts, independently of the operating handle. More particularly, the snap organ comprises a plate 20 mounted within the shell of the switch in such a way as to slide in a plane perpendicular to the axis of rotation of the control shaft 6, a helicoidal torsion spring equal to the one of the switch of Figures 1 to 4 and therefore again indicated by the reference number 17, a compression spring 21 mounted between an internal wall of the base 2 and an arm 22 projecting at right angles from an end of the plate 20 and integral with it, dragging means, plate arrester means with a tripping device and means for loading the tripping device.

[0018] The torsion spring 17 has one end constrained to the arm 16, as in the switch of Figures 1 to 4, and the other end constrained to the plate 20.

[0019] The loading means comprise an inclined surface 30 (Figure 9) formed on the edge of an opening of the plate and a pusher element, integral with the arm 17, constituted in the present example by a bushing 31 that acts as seating for the end of the torsion spring 17 constrained to the arm 16. The inclined surface 30 and the bushing 31 are arranged in such a way that a rotation of the arm 16 towards the open position of the contacts will displace the plate 20 in the direction that compresses the spring 21 and thus loads the tripping device.

[0020] The dragging means comprise a cam surface 24 formed on the end part 10 of the contact-carrier shaft 4 and a pin 25 projecting from the plate 20. The surface 24 and the pin 25 are arranged in such a way that a displacement of the plate 20 in the direction that discharges the compression spring 21 will make the contact-carrier shaft 4 rotate in the contact-opening direction.

[0021] The arrester means 23 with the tripping device (Figure 10) comprise a body pivotably mounted on the base 2 and shaped in such a way as to have a hook-on element, in the present example a roller 33 (Figure 9), and a tripping lever 27. A spring 28 stresses the body 23 in such a way that, in a given position of the plate 20, the roller 33 will enter a cut-out 32 provided in the external profile of the plate 20. In this position, a lateral surface of the cut-out, indicated by 34 in Figure 9, is in contact with the roller 33 and opposes the action of the spring 21. A rotation of the body 23 caused by a displacement of the lever 27 in the direction indicated by an arrow in Figures 6 and 9, will release the surface 34 from its engagement with the roller 33, so that the plate 20 becomes free to slide and, due to the force exerted by the spring 21, move away from the device 23.

[0022] Let us now consider the functioning of the switch, starting from the situation in which the plate 20 is situated in the position shown in Figure 6, i.e. with the spring 21 compressed and the arrester surface 34 engaged with the roller 33. As far as operation of the switch by means of the operating handle 7 is concerned, this situation is wholly equal to the situation shown in Figure 4. It should be noted, in fact, that the position of the end part 10 of the contact-carrier shaft 4, the position of the arm 16 and the position of the torsion spring 17 are equal to those of the corresponding elements of the switch of Figures 1 to 4. In particular, the position of the end of the spring 17, here constrained to the plate 20, is equal to

the position of the spring 17 constrained to the supporting element 18 fixed to the base 2 of Figures 1 to 4. The switch can be opened and closed exactly as explained in connection with Figures 1 to 4.

[0023] Figures 7 and 8 show the operating mechanism 5' in the situations corresponding to those of, respectively, Figures 3 and 2 and Figure 9 shows the same mechanism during the loading of the tripping device.

[0024] Unlike the switch in accordance with Figures 1 to 4, however, the switch of Figures 5 to 9 can be operated without making use of the operating handle 7. More particularly, acting on the tripping lever 27, for example by means of a remote-controlled electromagnet (not shown) attached to the base 2, the plate 20 will become released and, under the action of the tripping spring 21 and due to the movement of the pin 25 on the cam surface 24, will act on the contact-carrier shaft 4 in the opening direction of the contacts. The movement of the contact-carrier shaft 4 drags the arm 16 (by means of the upper wall of the cut-out 19), displacing it in the direction that loads the spring 17; the latter, nevertheless, cannot become loaded, because its end mounted on the plate will become displaced together with the plate. The spring 17 does not therefore oppose the movement of the plate and all the energy accumulated in the tripping spring 21 is utilized for opening the contacts.

[0025] When the tripping device has to be loaded, the operating handle 7 is used to rotate the control shaft 6 as if the switch were to be opened: as soon as the bushing 31 of the arm 16 becomes engaged with the inclined surface 30, the plate 20 becomes dragged in the charging direction of the tripping spring 21 until it reaches the point at which the hook-on roller 33 of the device 23 snaps into the cut-out 32 of the plate 20.

[0026] As is made clear by what has been explained above, the switch-disconnector in accordance with the invention is a switch with a remote-controlled opening device that has the same electrical characteristics as a two-state switch. Furthermore, it can be produced by using components that for the most part are identical with those necessary for producing a two-state switch and has the same overall shape. This implies considerable advantages in terms of costs and management of the products store.

Claims

1. A switch-disconnector comprising

- a supporting structure (2),
- a contact-carrier shaft (4) pivotable between an opening position and a closing position of the contacts, and
- means (5') for operating the contact-carrier shaft (4) comprising
- an operating handle (7),
- a control shaft (6) operated by the operating handle (7),
- coupling means (10, 16) between the control shaft (6) and the contact-carrier shaft (4), comprising an arm (16) constrained to the control shaft (6), and
- a snap organ (17, 20, 21, 23) associated with the coupling means (10, 16) to apply an elastic force to the contact-carrier shaft for both opening and closing;

the snap organ comprising

- an element (20) that is mobile with respect to the supporting structure (2),
- elastic means (21) associated with the mobile element (20),
- a torsion spring (17) having a first end constrained to the coupling means (10, 16) and a second end constrained to the mobile element (20),
- an arrester device (23) capable of maintaining the mobile element (20) in a predetermined position,
- tripping means capable of releasing the arrester device (23),
- dragging means (21, 24, 25) capable of acting on the contact-carrier shaft (4) in the opening direction of the contacts when the tripping means releases the arrester device (23), and
- loading means (7, 16, 30, 31) capable of displacing the mobile element (20) in the direction that loads the elastic means (21) until it reaches the position predetermined by the arrester device (23), **characterized in that**
- said arm (16) is operatively interposed between said torsion spring (17) and said contact carrier shaft (4); and
- said torsion spring (17) is operatively interposed between said arm (16) and said mobile element (20), said first end of the torsion spring being constrained to said arm (16).

2. A switch in accordance with Claim 1, wherein the elastic means comprise a compression spring (21).

3. A switch in accordance with Claim 1 or Claim 2, wherein the arrester device (23) comprises a body, said body being pivotably mounted on the supporting structure (2) and provided with a hook-on element (33) capable of becoming engaged with the mobile element (20), and a tripping lever (27).

4. A switch in accordance with any one of the preceding claims, wherein the tripping means comprise an electromagnet capable of operating the tripping lever (27).

5. A switch in accordance with any one of the preceding claims, wherein the contact-carrier shaft (4) and the control shaft (6) are pivotable around substantially

the same axis.

6. A switch in accordance with Claim 5, wherein the mobile element comprises a plate (20) that can slide in a plane perpendicular to the axis of the control shaft (6).

7. A switch in accordance with Claim 6, wherein the hook-on element comprises a roller (33) and the plate (20) comprises a cut-out (32) that constitutes a seating for the roller (33).

8. A switch in accordance with Claims 5, 6 or 7, wherein the arm (16) is constrained to the control shaft (6) with a predetermined angular play and wherein said coupling means between the control shaft (6) and the contact-carrier shaft (4) comprise an end part (10) of the contact-carrier shaft (4) shaped in such a way as to form a cavity (19) that defines a circular sector within which the arm (16) may move between two angular positions delimited by the walls of the cavity (19).

9. A switch in accordance with Claims 6, 7 or 8. wherein the dragging means comprise a cam surface (24) integral with the contact-carrier shaft (4) and a pin (25) integral with the arm (16).

10. A switch in accordance with Claim 8 or Claim 9, wherein the loading means comprise an inclined surface (30) integral with the plate (20) and a pusher element (31) integral with the arm (16).

11. A switch in accordance with claims 2 and 6, wherein said plate (20) is adapted to slide along a compression/discharge direction of said compression spring (21).

12. A switch in accordance with any of the preceding claims, wherein said mobile element (20) is operatively interposed between said torsion spring (17) and said elastic means (21).

Patentansprüche

1. Ein Trennschalter, der folgende Merkmale aufweist:

- eine Haltestruktur (2),
- eine Kontaktträgerwelle (4), die zwischen einer Öffnungsposition und einer Schließposition der Kontakte schwenkbar ist, und
- eine Einrichtung (5') zum Betreiben der Kontaktträgerwelle (4), die folgende Merkmale aufweist:
- einen Bediengriff (7),
- eine Steuerwelle (6), die durch den Bediengriff (7) betrieben wird,
- eine Kopplungseinrichtung (10, 16) zwischen der Steuerwelle (6) und der Kontaktträgerwelle (4), die einen Arm (16) aufweist, der an die Steuerwelle (6) gebunden ist, und
- ein Schnapporgan (17, 20, 21, 23), das der Kopplungseinrichtung (10, 16) zugeordnet ist, um für sowohl Öffnen als auch Schließen eine elastische Kraft auf die Kontaktträgerwelle auszuüben;

wobei das Schnapporgan folgende Merkmale aufweist:

- ein Element (20), das in Bezug auf die Haltestruktur (2) mobil ist,
- eine elastische Einrichtung (21), die dem mobilen Element (20) zugeordnet ist,
- eine Torsionsfeder (17) mit einem ersten Ende, das an die Kopplungseinrichtung (10, 16) gebunden ist, und einem zweiten Ende, das an das mobile Element (20) gebunden ist,
- eine Feststellvorrichtung (23), die in der Lage ist, das mobile Element (20) an einer vorbestimmten Position zu halten,
- eine Auslöseeinrichtung, die in der Lage ist, die Feststellvorrichtung (23) freizugeben,
- eine Zugeinrichtung (21, 24, 25), die in der Lage ist, in der Öffnungsrichtung der Kontakte auf die Kontaktträgerwelle (4) zu wirken, wenn die Auslöseeinrichtung die Feststellvorrichtung (23) freigibt, und
- eine Lasteinrichtung (7, 16, 30, 31), die in der Lage ist, das mobile Element (20) in der Richtung zu verschieben, die die elastische Einrichtung (21) belastet, bis dasselbe die Position erreicht, die durch die Feststellvorrichtung (23) vorbestimmt ist,

dadurch gekennzeichnet, dass

- der Arm (16) wirksam zwischen der Torsionsfeder (17) und der Kontaktträgerwelle (4) angeordnet ist; und
- die Torsionsfeder (17) wirksam zwischen dem Arm (16) und dem mobilen Element (20) angeordnet ist, wobei das erste Ende der Torsionsfeder an den Arm (16) gebunden ist.

2. Ein Schalter gemäß Anspruch 1 bei dem die elastische Einrichtung eine Druckfeder (21) aufweist.

3. Ein Schalter gemäß Anspruch 1 oder Anspruch 2, bei dem die Feststellvorrichtung (23) einen Körper aufweist, wobei der Körper schwenkbar an der Haltestruktur (2) befestigt ist und mit einem Einhakelement (33), das mit dem mobilen Element (20) in Eingriff genommen werden kann, und einem Auslösehebel (27) versehen ist.

4. Ein Schalter gemäß einem der vorherigen Ansprüche, bei dem die Auslöseeinrichtung einen Elektromagneten aufweist, der in der Lage ist, den Auslö-

sehebel (27) zu betreiben.

5. Ein Schalter gemäß einem der vorherigen Ansprüche, bei dem die Kontaktträgerwelle (4) und die Steuerwelle (6) um im Wesentlichen die gleiche Achse schwenkbar sind.

6. Ein Schalter gemäß Anspruch 5, bei dem das mobile Element eine Platte (20) aufweist, die in einer Ebene, die senkrecht zu der Achse der Steuerwelle (6) ist, gleiten kann.

7. Ein Schalter gemäß Anspruch 6, bei dem das Einhakelement eine Rolle (33) aufweist und die Platte (20) einen Ausschnitt (32) aufweist, der einen Sitz für die Rolle (33) bildet.

8. Ein Schalter gemäß Anspruch 5, 6 oder 7, bei dem der Arm (16) mit einem vorbestimmten Winkelspiel an die Steuerwelle (6) gebunden ist, und bei dem die Kopplungseinrichtung zwischen der Steuerwelle (6) und der Kontaktträgerwelle (4) ein Endteil (10) der Kontaktträgerwelle (4) aufweist, das in einer derartigen Weise geformt ist, um einen Hohlraum (19) zu bilden, der einen kreisförmigen Sektor definiert, innerhalb dessen sich der Arm (16) zwischen zwei Winkelpositionen, die durch die Wände des Hohlraums (19) begrenzt sind, bewegen kann.

9. Ein Schalter gemäß Anspruch 6, 7 oder 8, bei dem die Zugeinrichtung eine Nockenoberfläche (24), die einstückig mit der Kontaktträgerwelle (4) ist, und einen Stift (25), der einstückig mit dem Arm (16) ist, aufweist.

10. Ein Schalter gemäß Anspruch 8 oder Anspruch 9, bei dem die Lasteinrichtung eine geneigte Oberfläche (30), die einstückig mit der Platte (20) ist, und ein Schubelement (31), das einstückig mit dem Arm (16) ist, aufweist.

11. Ein Schalter gemäß Anspruch 2 und 6, bei dem die Platte (20) angepasst ist, um entlang einer Druck-/Entladungsrichtung der Druckfeder (21) zu gleiten.

12. Ein Schalter gemäß einem der vorherigen Ansprüche, bei dem das mobile Element (20) wirksam zwischen der Torsionsfeder (17) und der elastischen Einrichtung (21) angeordnet ist.

Revendications

1. Interrupteur-sectionneur comprenant :

- une structure de support (2) ;
- un arbre portant des contacts (4) pouvant pivoter entre une position d'ouverture et une position de fermeture des contacts ; et
- des moyens (5') destinés à actionner l'arbre portant des contacts (4) comprenant :
- une poignée de commande (7) ;
- un arbre de commande (6) actionné par la poignée de commande (7) ;
- des moyens de couplage (10, 16) entre l'arbre de commande (6) et l'arbre portant des contacts (4), comprenant un bras (16) contraint par l'arbre de commande (6) ; et
- un organe à action brusque (17, 20, 21, 23) associé aux moyens de couplage (10, 16) de manière à appliquer une force élastique à l'arbre portant des contacts autant pour l'ouverture que pour la fermeture ;

l'organe à action brusque comprenant :
- un élément (20) qui est mobile par rapport à la structure de support (2) ;
- des moyens élastiques (21) associés à l'élément mobile (20) ;
- un ressort de torsion (17) qui présente une première extrémité contrainte par les moyens de couplage (10, 16) et une seconde extrémité contrainte par l'élément mobile (20) ;
- un dispositif d'arrêt (23) capable de maintenir l'élément mobile (20) dans une position prédéterminée ;
- des moyens de déclenchement pour libérer le dispositif d'arrêt (23) ;
- des moyens de tirage (21, 24, 25) capables d'agir sur l'arbre portant des contacts (4) dans la direction de l'ouverture des contacts lorsque les moyens de déclenchement libèrent le dispositif d'arrêt (23) ; et
- des moyens de charge (7, 16, 30, 31) capables de déplacer l'élément mobile (20) dans la direction qui charge les moyens élastiques (21) jusqu'à ce qu'il atteigne la position prédéterminée par le dispositif d'arrêt (23) ;

caractérisé en ce que :
- ledit bras (16) est interposé de manière fonctionnelle entre ledit ressort de torsion (17) et ledit arbre portant des contacts (4) ; et
- ledit ressort de torsion (17) est interposé de manière fonctionnelle entre ledit bras (16) et ledit élément mobile (20), ladite première extrémité du ressort de torsion étant contrainte par ledit bras (16).

2. Interrupteur selon la revendication 1, dans lequel les moyens élastiques comprennent un ressort de compression (21).

3. Interrupteur selon la revendication 1 ou la revendication 2, dans lequel le dispositif d'arrêt (23) comprend un corps, ledit corps étant monté en pivotement sur la structure de support (2) et étant doté d'un élément d'accrochage (33) capable de venir en prise

avec l'élément mobile (20), et d'un levier de déclenchement (27).

4. Interrupteur selon l'une quelconque des revendications précédentes, dans lequel les moyens de déclenchement comprennent un électroaimant capable d'actionner le levier de déclenchement (27).

5. Interrupteur selon l'une quelconque des revendications précédentes, dans lequel l'arbre portant des contacts (4) et l'arbre de commande (6) peuvent pivoter sensiblement autour du même axe.

6. Interrupteur selon la revendication 5, dans lequel l'élément mobile comprend une plaque (20) qui peut glisser dans un plan perpendiculaire à l'axe de l'arbre de commande (6).

7. Interrupteur selon la revendication 6, dans lequel l'élément d'accrochage comprend un rouleau (33) et la plaque (20) comprend une échancrure (32) qui constitue un logement pour le rouleau (33).

8. Interrupteur selon l'une quelconque des revendications 5 à 7, dans lequel le bras (16) est contraint par l'arbre de commande (6) avec un jeu angulaire prédéterminé et dans lequel lesdits moyens de couplage entre l'arbre de commande (6) et l'arbre portant des contacts (4) comprennent une partie d'extrémité (10) de l'arbre portant des contacts (4) modelée de manière à former une cavité (19) qui définit un secteur circulaire à l'intérieur duquel le bras (16) peut se déplacer entre deux positions angulaires délimitées par les parois de la cavité (19).

9. Interrupteur selon l'une quelconque des revendications 6 à 8, dans lequel les moyens de tirage comprennent une surface de came (24) formée d'une seule pièce avec l'arbre portant des contacts (4) et une broche (25) formée d'une seule pièce avec le bras (16).

10. Interrupteur selon la revendication 8 ou la revendication 9, dans lequel les moyens de charge comprennent une surface inclinée (30) formée d'une seule pièce avec la plaque (20) et un élément de poussée (31) formé d'une seule pièce avec le bras (16).

11. Interrupteur selon les revendications 2 et 6, dans lequel ladite plaque (20) est adaptée de manière à glisser le long d'une direction de compression / décharge dudit ressort de compression (21).

12. Interrupteur selon l'une quelconque des revendications précédentes, dans lequel ledit élément mobile (20) est interposé de manière fonctionnelle entre ledit ressort de torsion (17) et lesdits moyens élastiques (21).

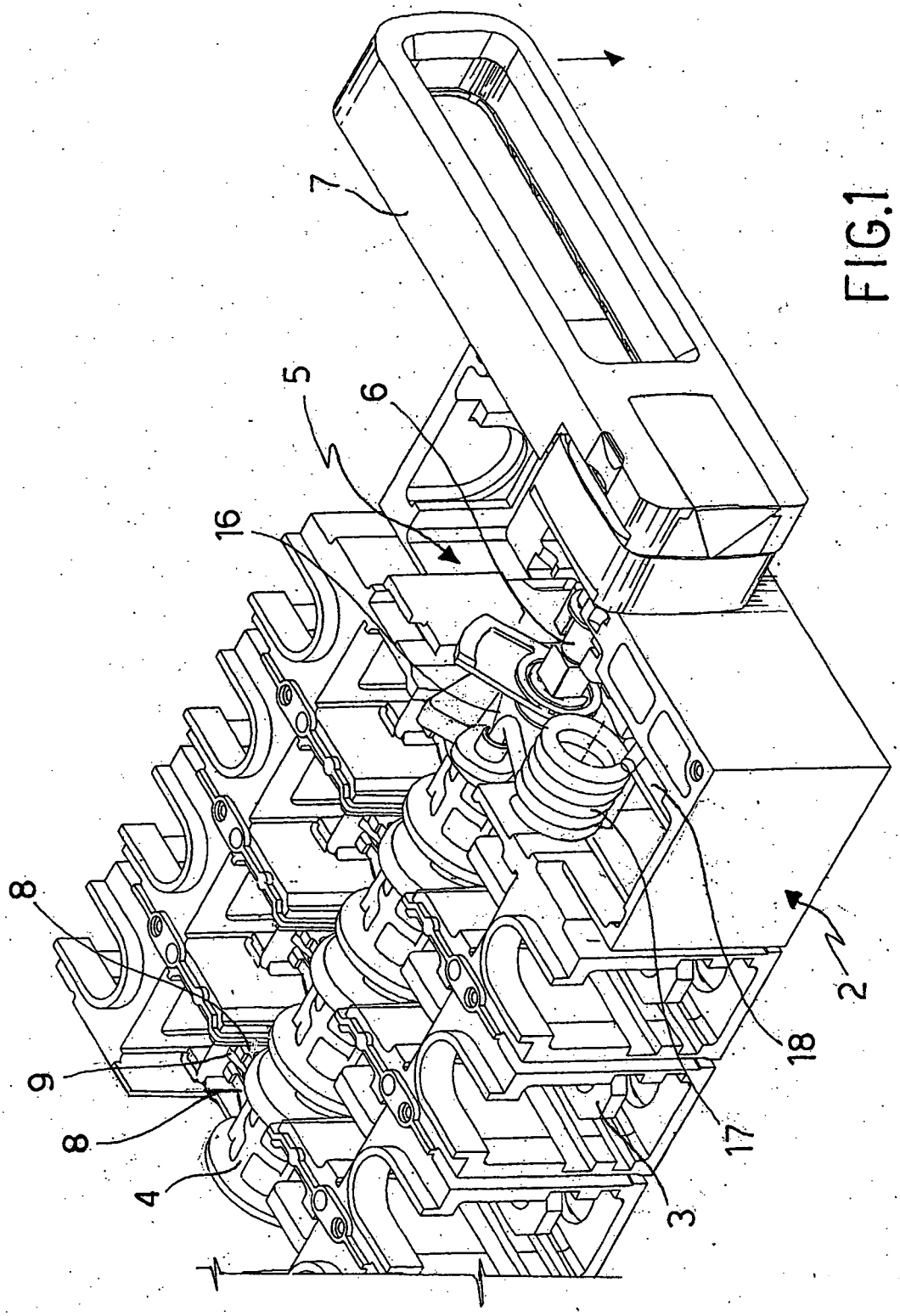


FIG.1

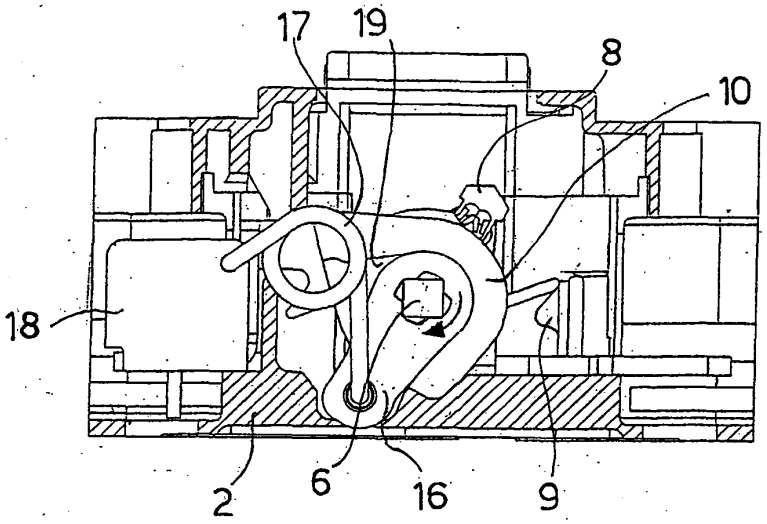


FIG. 2

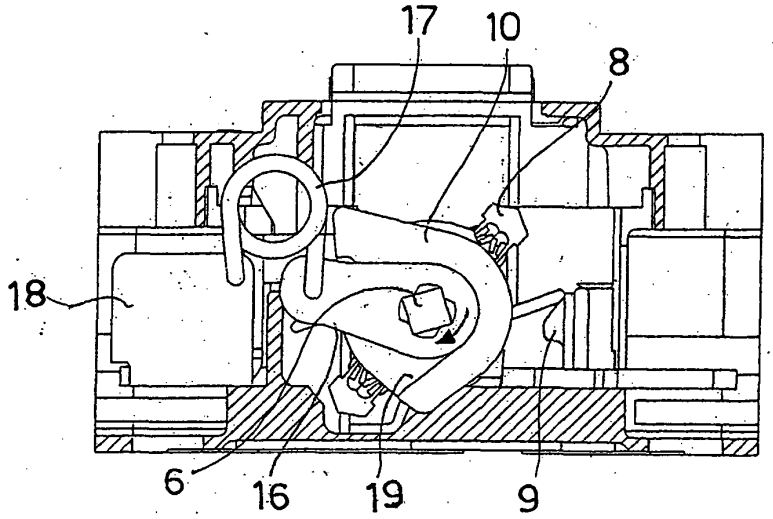


FIG. 3

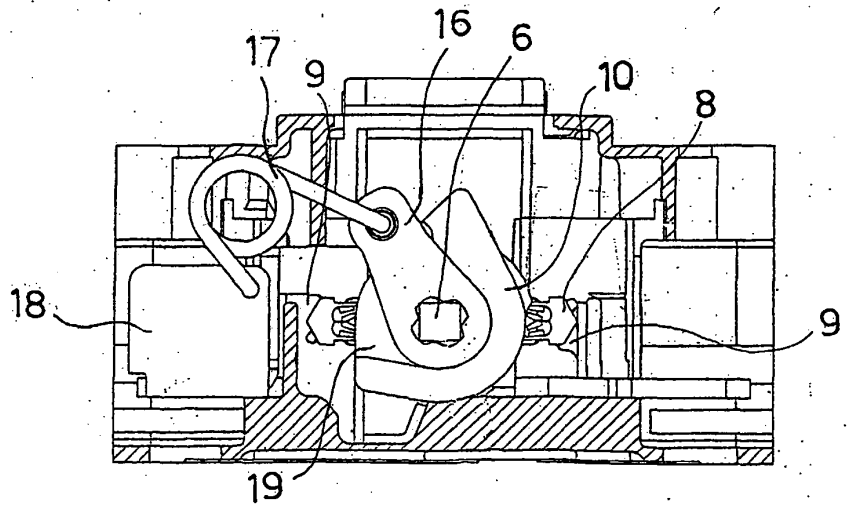


FIG. 4

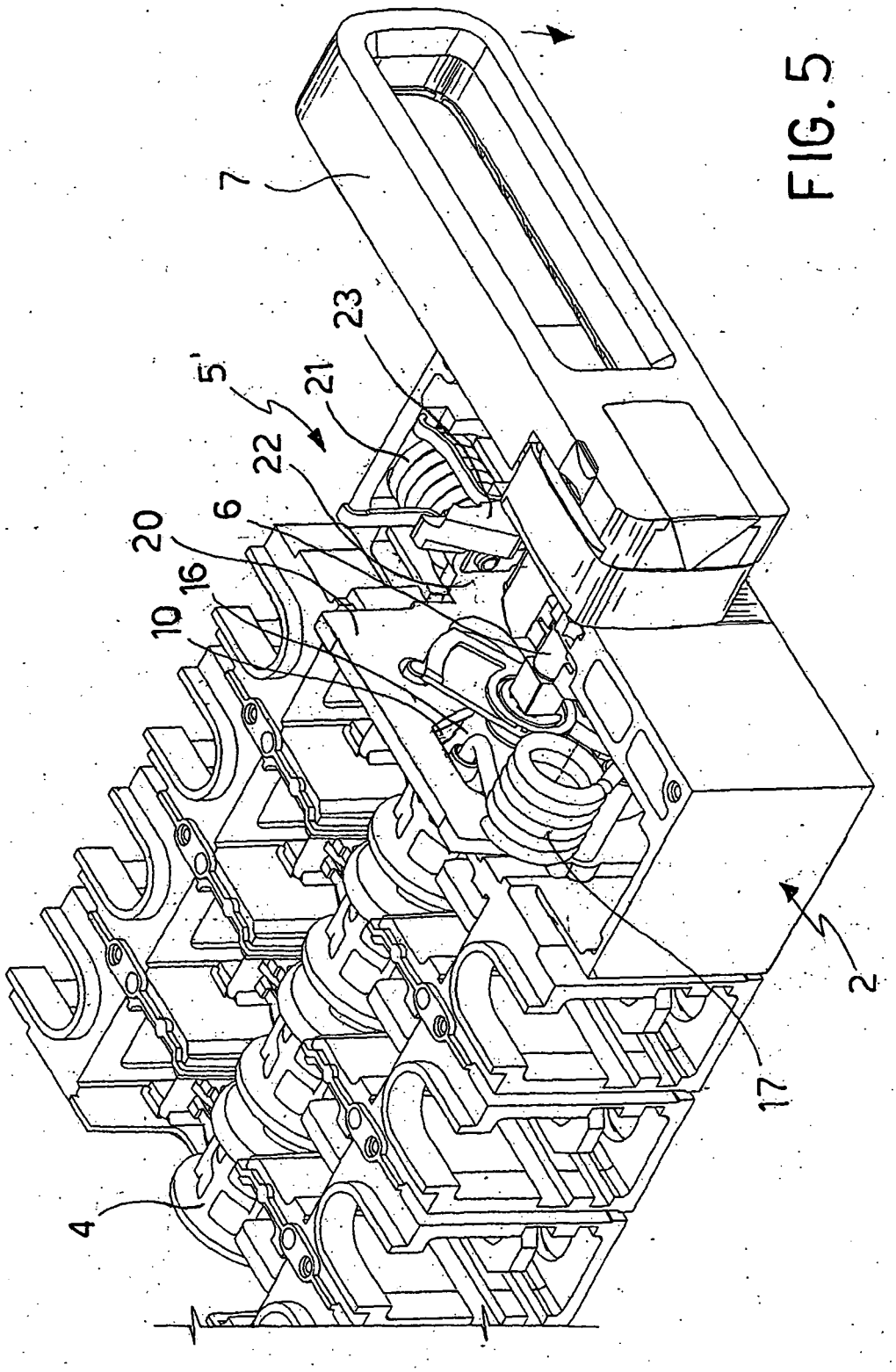


FIG. 5

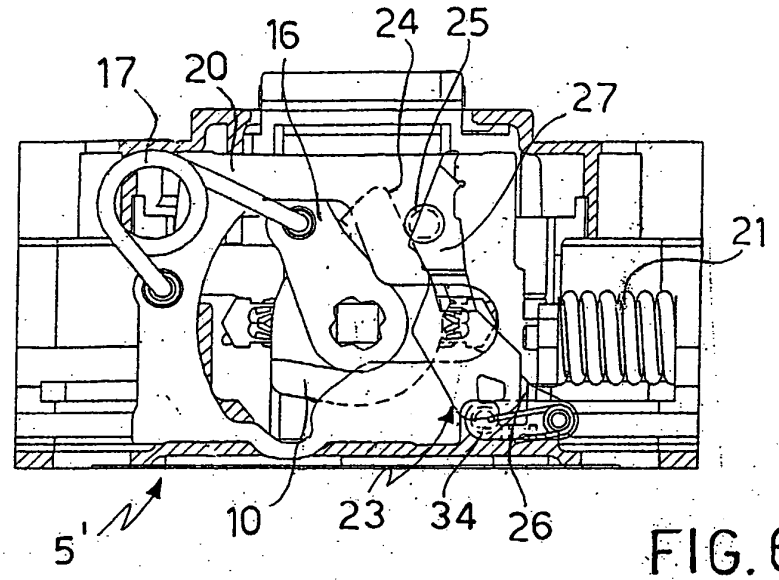


FIG. 6

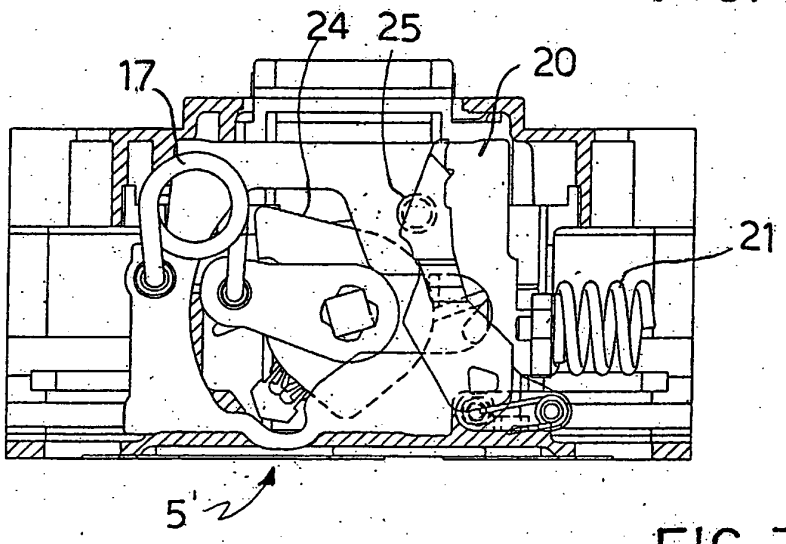


FIG. 7

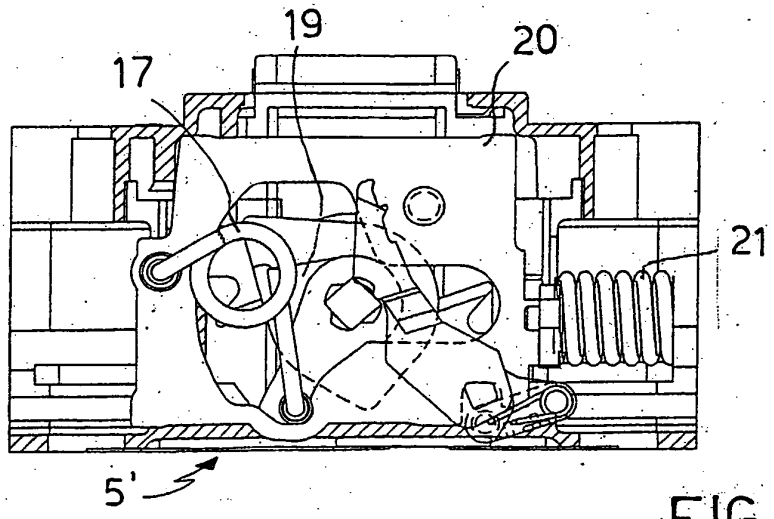


FIG. 8

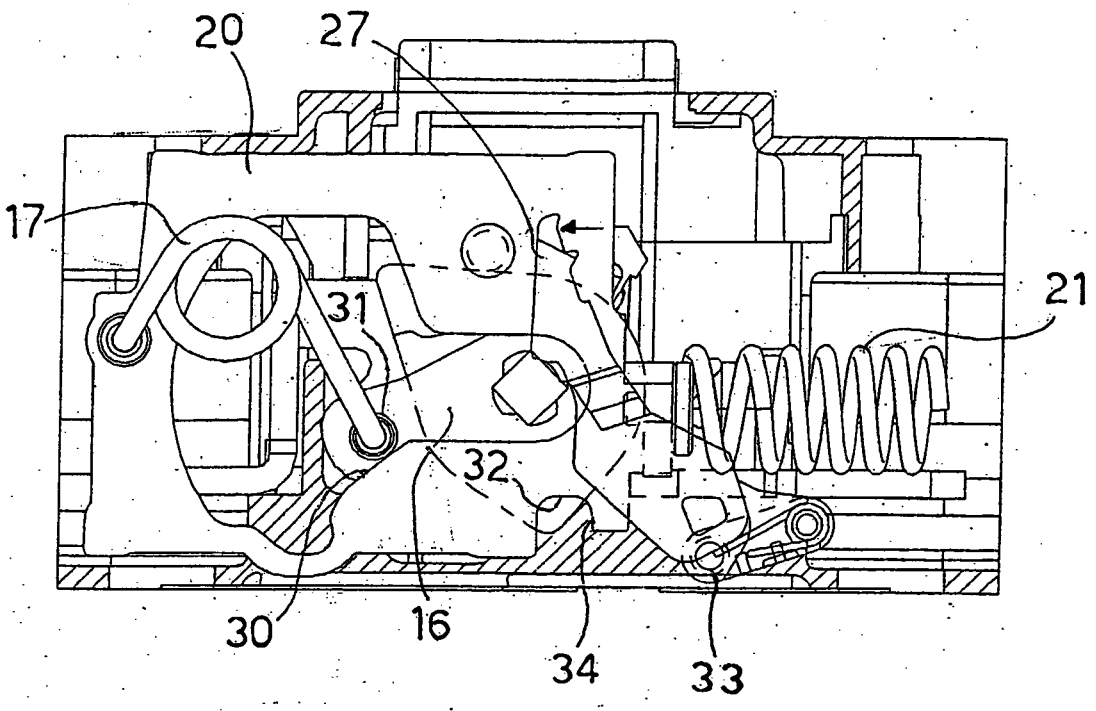


FIG. 9

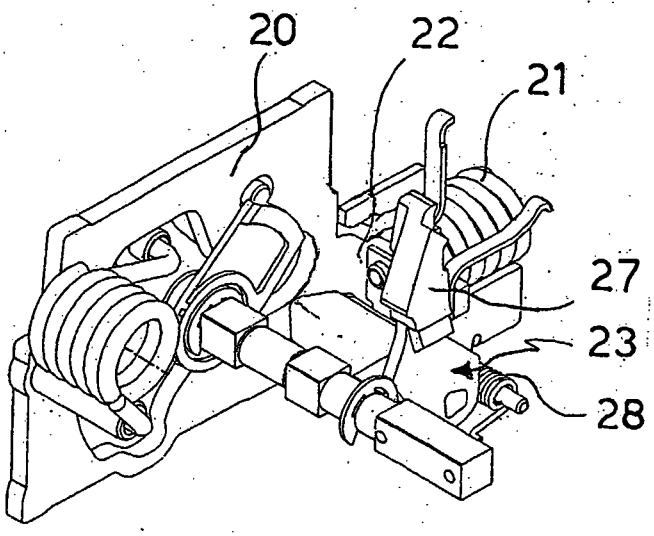


FIG. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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