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(72) Inventor: **Fumagalli, Matteo**

24018 Villa d'Almé (Bergamo) (IT)

(74) Representative: **Maggioni, Claudio et al**

Jacobacci & Partners S.p.A.,

Via delle Quattro Fontane 15

I-00184 Roma (IT)

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(71) Applicant: **BTICINO S.p.A.**

20154 Milano (IT)

(54) **Switch-disconnector**

(57) A supporting structure (2) contains 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. These means comprise an operating handle (7), a control shaft (6) operated by the handle (7), coupling means (10, 16) between the control shaft (6) and the contact-carrier shaft (4) and a snap organ (17, 20, 21, 23) to apply an elastic force to the contact-carrier shaft for both opening and closing. To make it possible for the switch to be opened by re-

mote control, the snap organ comprises a sliding plate (20), a compression spring (21), a torsion spring (17) with one end constrained to the coupling means (10, 16) and the other end constrained to the plate (20), an arrester device (23) to maintain the plate (20) in a predetermined position and tripping means to release the arrester device, dragging means capable of acting on the contact-carrier shaft (4) in the opening direction of the contacts and loading means capable of displacing the plate (20) in the direction that loads the compression spring until it reaches the predetermined position.

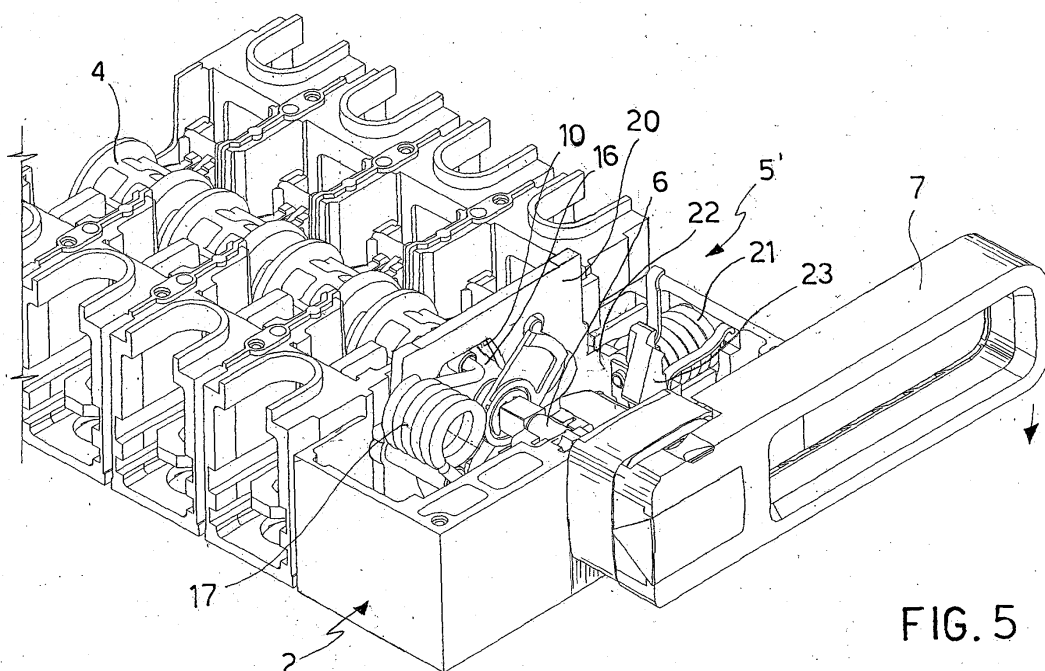


FIG. 5

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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] 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.

[0007] 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.

[0008] 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.

[0009] This aim is attained by realizing the switch described and characterized in general terms in Claim 1.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] 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).

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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 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) 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,

characterized in that the snap organ comprises

- 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 one end constrained to the coupling means (10, 16) and another 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),
- 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).

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 coupling means between the control shaft (6) and the contact-carrier shaft (4) comprise an arm (16) constrained to the control shaft (6) with a predetermined angular play and 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). 5 10 15
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). 20
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). 25

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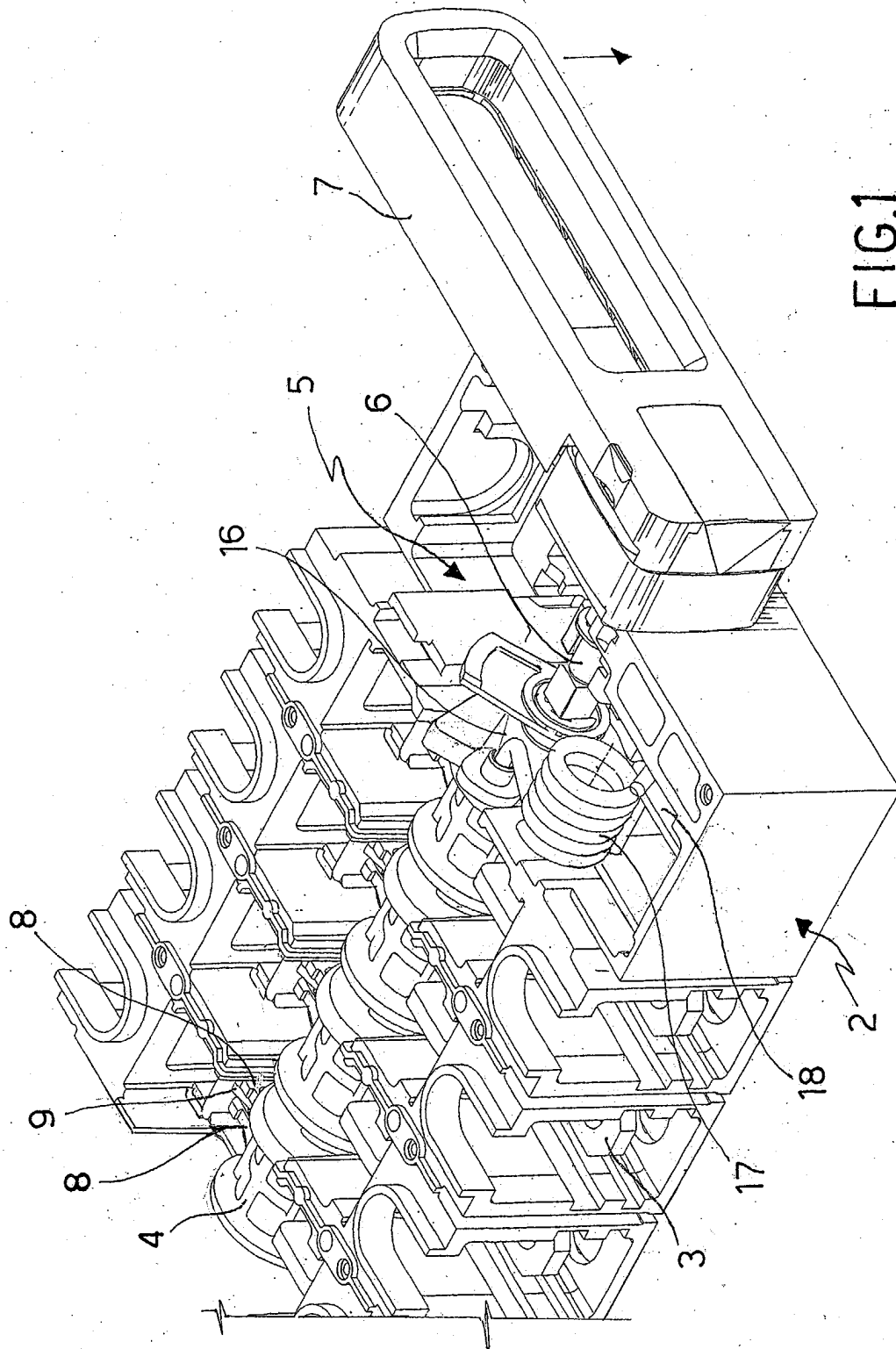


FIG.1

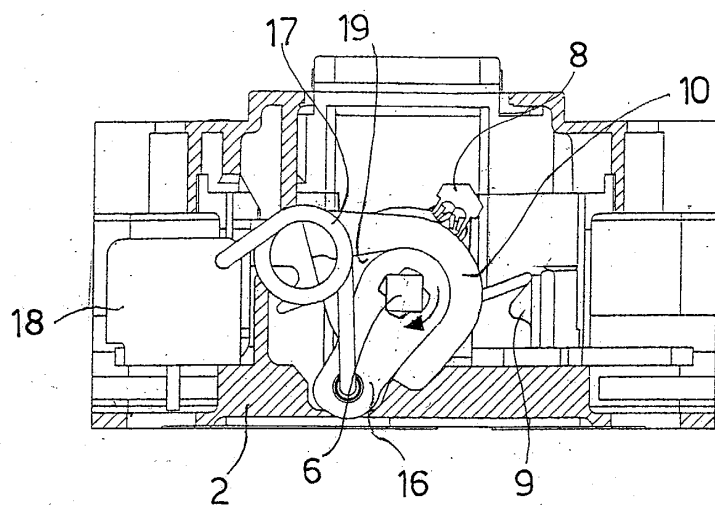


FIG. 2

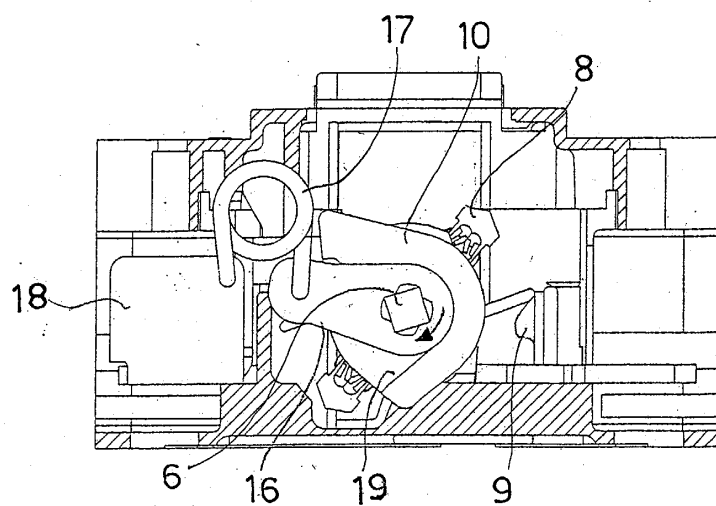


FIG. 3

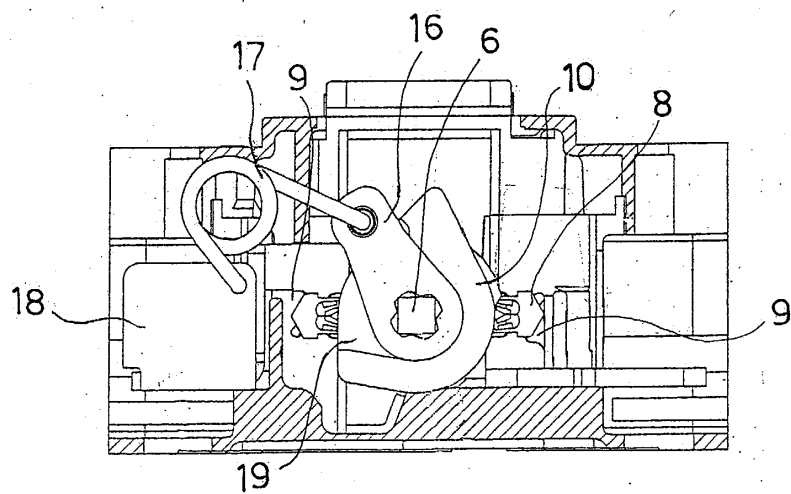


FIG. 4

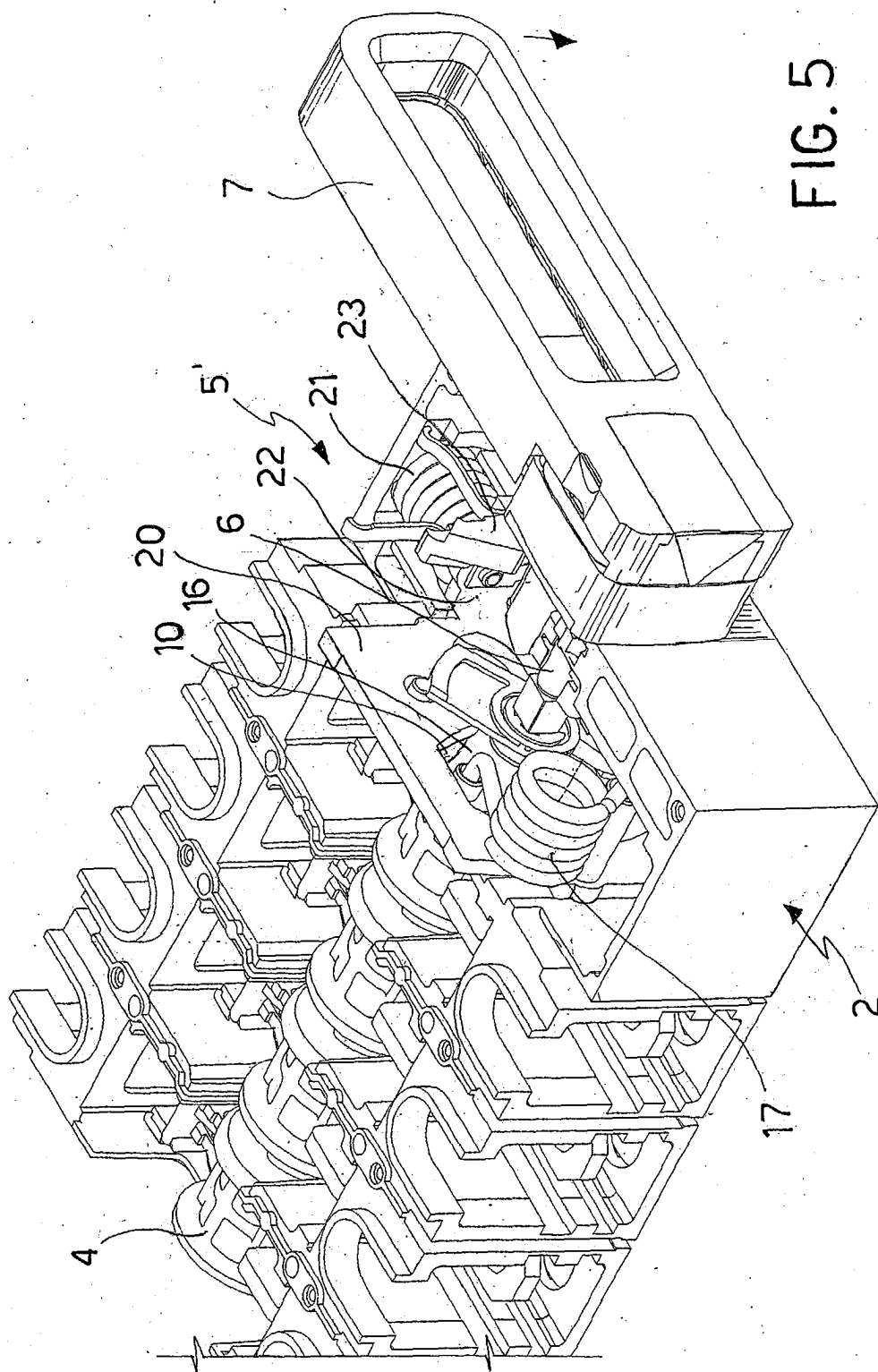


FIG. 5

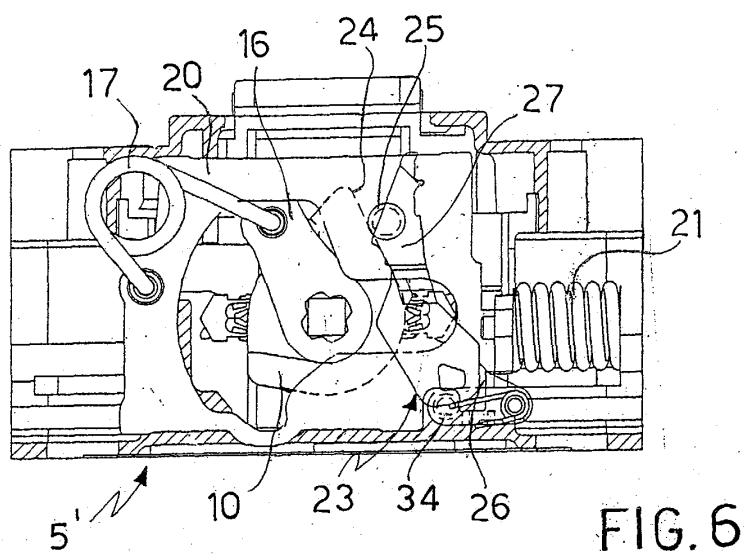


FIG. 6

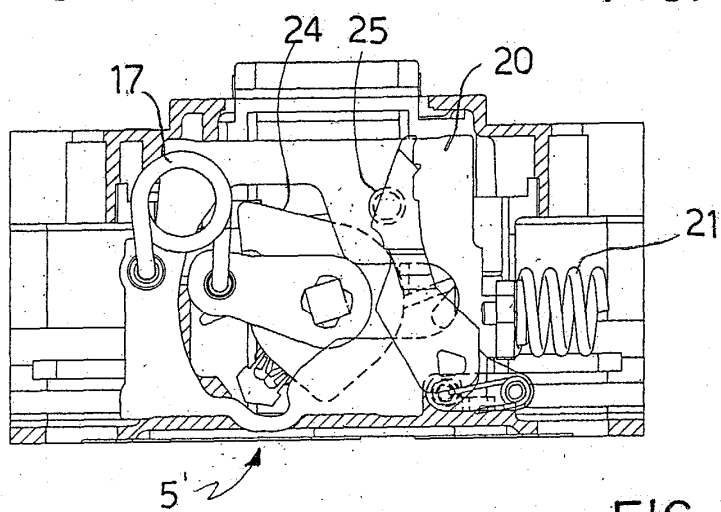


FIG. 7

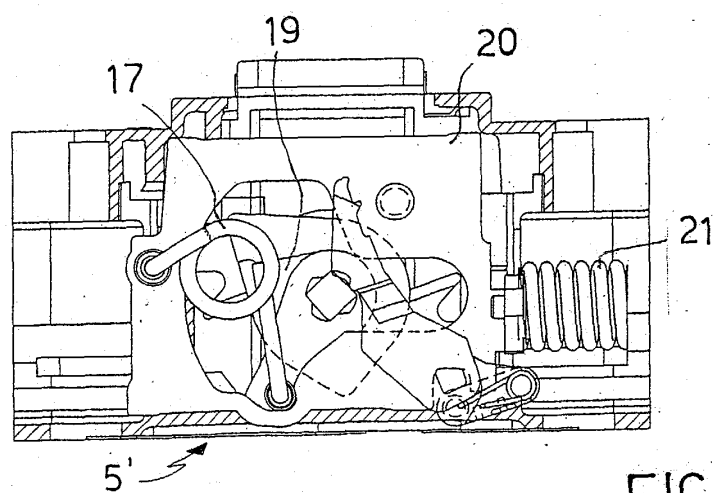


FIG. 8

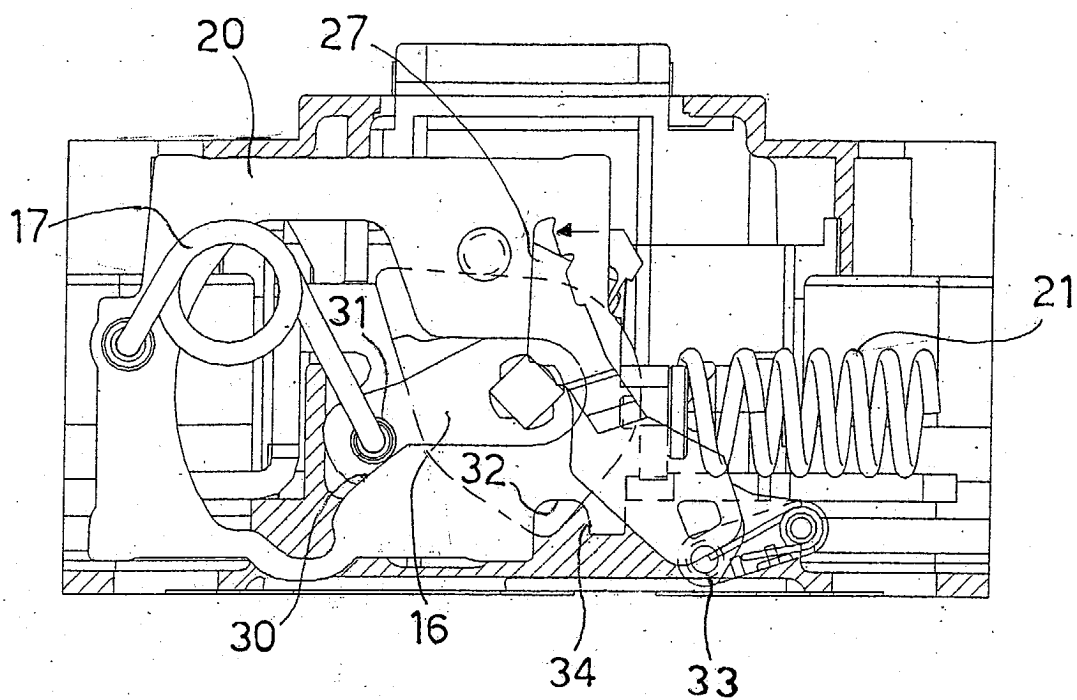


FIG. 9

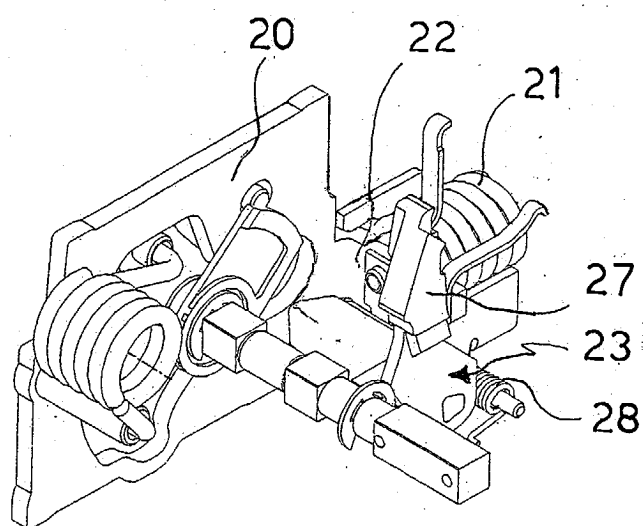


FIG. 10



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5122

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	FR 2 628 261 A (LEGRAND SA) 8 September 1989 (1989-09-08)	1	H01H5/16
Y	* page 4, line 2 - line 25; figures * * page 7, line 25 - page 9, line 34 *	2-4	
Y	EP 0 708 461 A (BTICINO SPA) 24 April 1996 (1996-04-24) * figure 2 *	2-4	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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Place of search		Date of completion of the search	Examiner
Munich		14 April 2004	Findeli, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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