



Europäisches Patentamt
 European Patent Office
 Office européen des brevets



(11) **EP 1 003 191 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.05.2000 Bulletin 2000/21

(51) Int. Cl.⁷: **H01H 71/52**

(21) Application number: **98203874.7**

(22) Date of filing: **19.11.1998**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
 MC NL PT SE**
 Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Jacovino, Elio**
20052 Monza (MI) (IT)

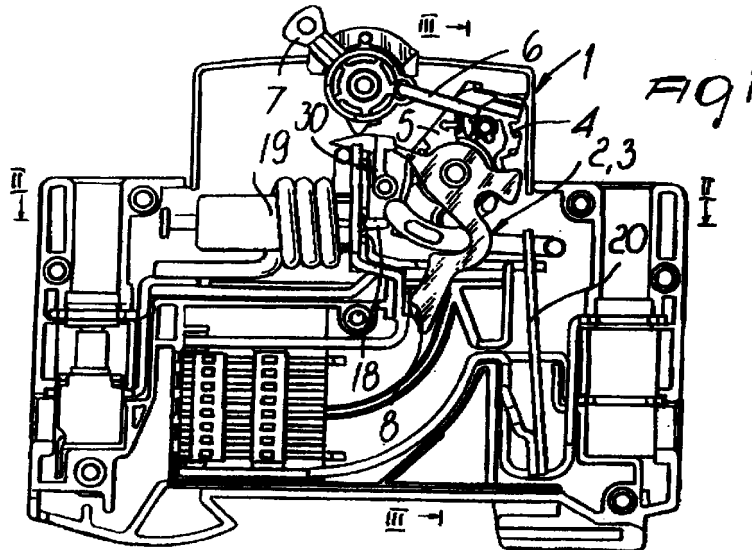
(74) Representative:
Giavarini, Francesco
ABB Ricerca S.p.A.
Viale Edison, 50
20099 Sesto San Giovanni (MI) (IT)

(71) Applicant:
ABB Elektroconduitture S.p.A.
20010 Vittuone (Mi) (IT)

(54) **Thermomagnetic circuit-breaker**

(57) The present invention relates to a thermomagnetic circuit-breaker comprising a moulded case containing a movable contact and a fixed contact, the movable contact being connected to an operating lever controlled by a trip lever and operatively associated to an operating knob, characterised by the fact that it comprises an auxiliary lever engageable with said movable

contact to hold it at a predetermined distance from said fixed contact during closing operations, said auxiliary lever being operatively coupled with the operating knob to release the movable contact allowing completion of the closing operation.



EP 1 003 191 A1

Description

[0001] The present invention relates to a thermomagnetic circuit-breaker with means for adjusting the motion of the movable contacts.

[0002] As it is known, thermomagnetic circuit-breakers may feature, in accordance with the regulations in force, a so-called dependent closing movement, which in essence means that the movement of the movable contacts depends on the movement of an operating knob or lever. In the first part of rotation, said operating knob brings the movable contact closer to the fixed contact; then, electrical coupling between contacts is achieved by means of a subsequent elastic thrust on the movable contact in order to increase the tightness of contact and generate the contact pressure.

[0003] With circuit breakers of this type, the interruption of a closing operation for any reason and at any angle of travel of the operating knob could happen when the movable contact has already reached a position close to the fixed contact or even is yet in contact with it without the necessary pressure; in this cases, damages to the contacts could occur.

[0004] Moreover, in cases of very slow operation, the contact pressure could be insufficient, inevitably creating contact wear if they are subjected to multiple electrical operations. Thermomagnetic circuit-breakers have already been launched on the market that have a dependent operation in a first part until reaching a predetermined stop distance of the movable contact in relation to the fixed contact, said distance being then exceeded with a tripping movement that performs the closing.

[0005] This solution, which is valid from a design standpoint, has been found difficult to apply in practice in that, in order to keep the movable contact at a certain distance from the fixed contact during the operating travel, a cam is used; this cam engages in special seatings in the plastic parts of the movable contacts with a configuration that is not able to guarantee the minimum stopping distance and, therefore, undue electrical discharges could occur.

[0006] In addition, with this embodiment it is necessary to have the movable contacts made in two parts, namely a metal part and a plastic part.

[0007] A further drawback is in addition constituted by the fact that the operating lever or knob and the operating lever need to have opposing directions of rotation, thus creating considerable manufacturing complications and significant limitations regarding the dimensions and positioning.

[0008] The main task of the invention is precisely that of eliminating the above mentioned drawbacks providing a thermomagnetic circuit-breaker with means for adjusting the motion of the movable contacts in which it is possible to predetermine a stop distance for the movable contacts in relation to the fixed contacts that is always constant and defined by the design geometry so

that one always has a safety condition.

[0009] As part of the aforesaid task, a particular object of the invention is to provide a thermomagnetic circuit-breaker in which it is possible to guarantee a minimum insulation distance between the contacts when interrupting the closing operation for any reason at any angle of travel of the knob.

[0010] Another object of the present invention is to provide a thermomagnetic circuit-breaker in which the minimum contact pressure is practically the same as the nominal pressure even with a slow closing operation, thus ensuring lower contact wear.

[0011] A further object of the present invention is to provide a thermomagnetic circuit-breaker which can be used, in its general constructional lines, as a circuit-breaker with dependent operation if desired, offering the possibility, with the addition of an easily-installed part, of increasing the functionality of the circuit-breaker with the introduction of the predetermined stopping distance of the contacts before the closing tripping movement.

[0012] A further but not last object of the present invention is to provide a thermomagnetic circuit-breaker with means for adjusting the motion of the movable contacts that can be easily obtained using common commercially-available elements and materials and that is, furthermore, competitive from a purely economic standpoint.

[0013] This task, as well as the aforementioned objects and others that shall emerge more clearly hereinafter are achieved by a thermomagnetic circuit-breaker comprising a moulded case containing a movable contact and a fixed contact, the movable contact being connected to an operating lever controlled by a trip lever and operatively associated to an operating knob, characterised by the fact that it comprises an auxiliary lever engageable with said movable contact to hold it at a predetermined distance from said fixed contact during closing operations, said auxiliary lever being operatively coupled with the operating knob to release the movable contact allowing completion of the closing operation.

[0014] Further characteristics and advantages shall emerge more clearly from the description of a preferred but not exclusive embodiment of a thermomagnetic circuit-breaker with means for adjusting the motion of the movable contacts illustrated purely by way of example and without limitation with the aid of the attached drawings in which:

Figure 1 is a diagrammatic side view of the thermomagnetic circuit-breaker as in the invention;

Figure 2 shows a section along the line II-II of Figure 1;

Figure 3 shows a section along line III-III of Figure 1;

Figure 4 shows a detail of the movable contact in the open position;

Figure 5 shows a detail of the movable contact dur-

ing the closing phase, stopped at a predetermined distance from the fixed contact;

Figure 6 shows the movable contact during the initial closing tripping movement phase;

Figure 7 shows the movable contact in the closing position;

Figure 8 shows a detail of the release lever and operating lever from the front;

Figure 9 shows a section along line IX-IX of Figure 8.

[0015] With reference to the aforesaid figures, the thermomagnetic circuit-breaker according to the invention includes a moulded case overall indicated by reference number 1 which substantially has a standardised conformation typical of thermomagnetic circuit-breakers for connection to omega-shaped bars.

[0016] Movable electric contacts, indicated by 2 for the phase contact and 3 for the neutral contact, are provided inside the moulded case 1.

[0017] The movable contacts are connected to an operating lever 4 that is controlled by a trip lever 5 and associated with an operating knob or lever 7 by means of a U bolt 6.

[0018] The movable contacts 2 and 3 are available for contact with corresponding fixed contacts 8 defined inside the moulded case.

[0019] A spring associated to the trip lever 5 indicated overall by 10 acts between the operating lever 4 and the trip lever 5; said spring 10 has the distinctive feature of being of the hairpin type with an axial appendix 10a held in a corresponding seat of the trip lever 5 and a radial appendix 10b that engages with a catch projection 11. The projection 11 is defined on the operating lever 4 at the moment of assembly of the lever 5 and the operating lever 4 itself.

[0020] The movable contacts 2 and 3 have contact springs, indicated by 15, also of the hairpin type, that interact with a catch projection 16 located on the operating lever and with an appendix 17 defined by the movable contact.

[0021] The thermomagnetic circuit-breaker, as it is usual in the practice, features an opening release that operates by means of the relative rotation of the operating lever in relation to the trip lever 5; the operation can occur by means of the action of a thrust pin 18 connected to a relay 19 that acts on the trip lever, for example in case of a high fault current (short circuit). In addition a bimetallic strip 20 is provided that acts on a thermal trip lever 21 in the event of an overload; this strip 20 transmits the movement to the trip lever.

[0022] It is also possible to provide external accessories that engage in recesses 22 in the trip lever, obtaining an action directly on the trip lever by means of slots located in the two sides of the circuit-breaker.

[0023] The distinctive feature of the invention is constituted by the fact that an auxiliary lever 30 is provided that pivots alongside the axis of the operating

lever and has the function of movably stopping the movable electric contacts during closing operations at a predetermined distance from the fixed contact 8.

[0024] The auxiliary lever has a body 31 that terminates in a head 32 and defines, on the part facing the movable contacts, a recess 33 in which a prominence 34 of the movable contacts engages.

[0025] The head 32 features a protuberance 35 that extends from the opposite side in relation to said recess 33 and is designed to interact with a cam 36 that is connected to the operating knob 7.

[0026] In open circuit-breaker conditions, as illustrated in Figure 4, the movable contacts are positioned at a distance from the fixed contact, and the prominence 34 is engaged with the auxiliary lever close to the pivoting zone; as illustrated, the lever 30, pushed by a spring 40, associated to the lever 30 itself, is held against the prominence 34 in a lower area of the recess 33.

[0027] Acting on the knob 7 to execute closing, the rotation of the knob causes the operating lever to rotate at a speed dependent on that of the knob 7 by means of a U bolt 6, bringing the movable contacts close to the fixed contact 8 until stopping at a predetermined distance due to the engagement of the prominence 34 with a catch projection defined by the head 32 at the end of the recess 33.

[0028] From the above conditions on the movement of the mobile contacts becomes independent of the motion of the knob 7; in fact, the subsequent rotation of the operating knob 7, as illustrated in fig.6, leads the cam 36 to engage the protuberance 35, causing a rotation of the auxiliary lever contrasting with the spring 40, with consequent starting of disengagement between protuberance 34 and recess 33.

[0029] The end of rotation of the operating knob 7, as illustrated in Figure 7, disengages the protuberance 34 and the head 32, consequently making it possible to obtain the closing trip movement of the movable contacts towards the fixed contacts at a speed that is dependent solely on the loading of the spring 15 (independent motion).

[0030] The pressure action applied is therefore substantially constant and, even in cases where slow operation is executed, the pressure applied is still substantially the same as the nominal pressure.

[0031] A further aspect worthy of emphasis is constituted by the fact that the operating knob and the operating lever rotate in the same direction, thus significantly simplifying the structure of the device.

[0032] From that which has been set out above it is possible therefore to see that the invention achieves the objectives set and in particular it is to be emphasised that the closing operation, which is dependent for a part and then substantially independent, makes it possible to obtain a predetermined and constant closing speed and force.

[0033] Moreover, it should be noted that the additional functionality is obtained simply by the presence of

the auxiliary lever and related spring, which are elements that can be added to a thermomagnetic circuit-breaker that would behave like a traditional device without the presence of such a lever.

[0034] Furthermore, in the event of tripping in opening of the device, the design and implementation of the cams together with the operating knob and auxiliary lever ensure that the movable contacts do not encounter obstacles in their opening travel that could be the cause of jamming or loss of performance in the event of a short circuit. 5 10

[0035] A further important aspect is in addition constituted by the fact that the spring of the trip lever acts between the trip lever and the operating lever, thus having greater speed of response in use. 15

[0036] The invention as conceived is capable of numerous modifications and variants that are all within the inventive concept.

[0037] Moreover, all the details may be substituted by other technically equivalent elements. In practice, the materials used as well as the contingent dimensions and shapes can be varied without limitation to suit requirements. 20

Claims 25

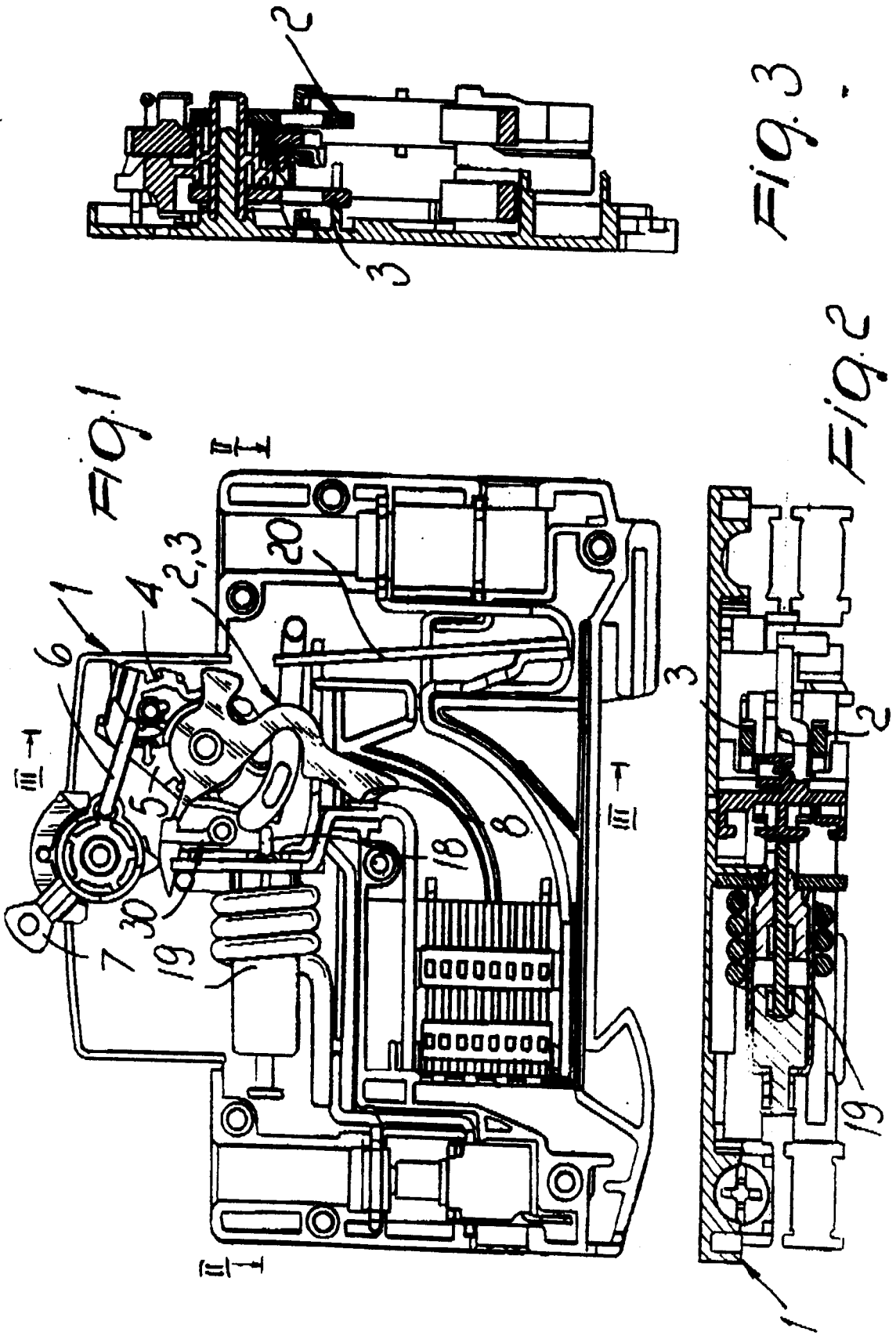
1. Thermomagnetic circuit-breaker comprising a moulded case containing a movable contact and a fixed contact, the movable contact being connected to an operating lever controlled by a trip lever and operatively associated to an operating knob, characterised by the fact that it comprises an auxiliary lever engageable with said movable contact to hold it at a predetermined distance from said fixed contact during closing operations, said auxiliary lever being operatively coupled with the operating knob to release the movable contact allowing completion of the closing operation. 30 35
2. Thermomagnetic circuit-breaker as in claim 1 characterised by the fact that said auxiliary lever has a body terminating in a head that defines, in the part facing towards said movable contact, a recess for engaging with a prominence of the movable contact itself. 40 45
3. Thermomagnetic circuit-breaker as in claim 2 characterised by the fact that said head has a protuberance that extends from the opposite side in relation to said recess, said protuberance being designed to interact with a cam connected to the operating knob. 50
4. Thermomagnetic circuit-breaker as in one or more of the previous claims characterised by the fact that it includes a spring associated to the auxiliary lever designed to press the auxiliary lever towards the movable contact. 55

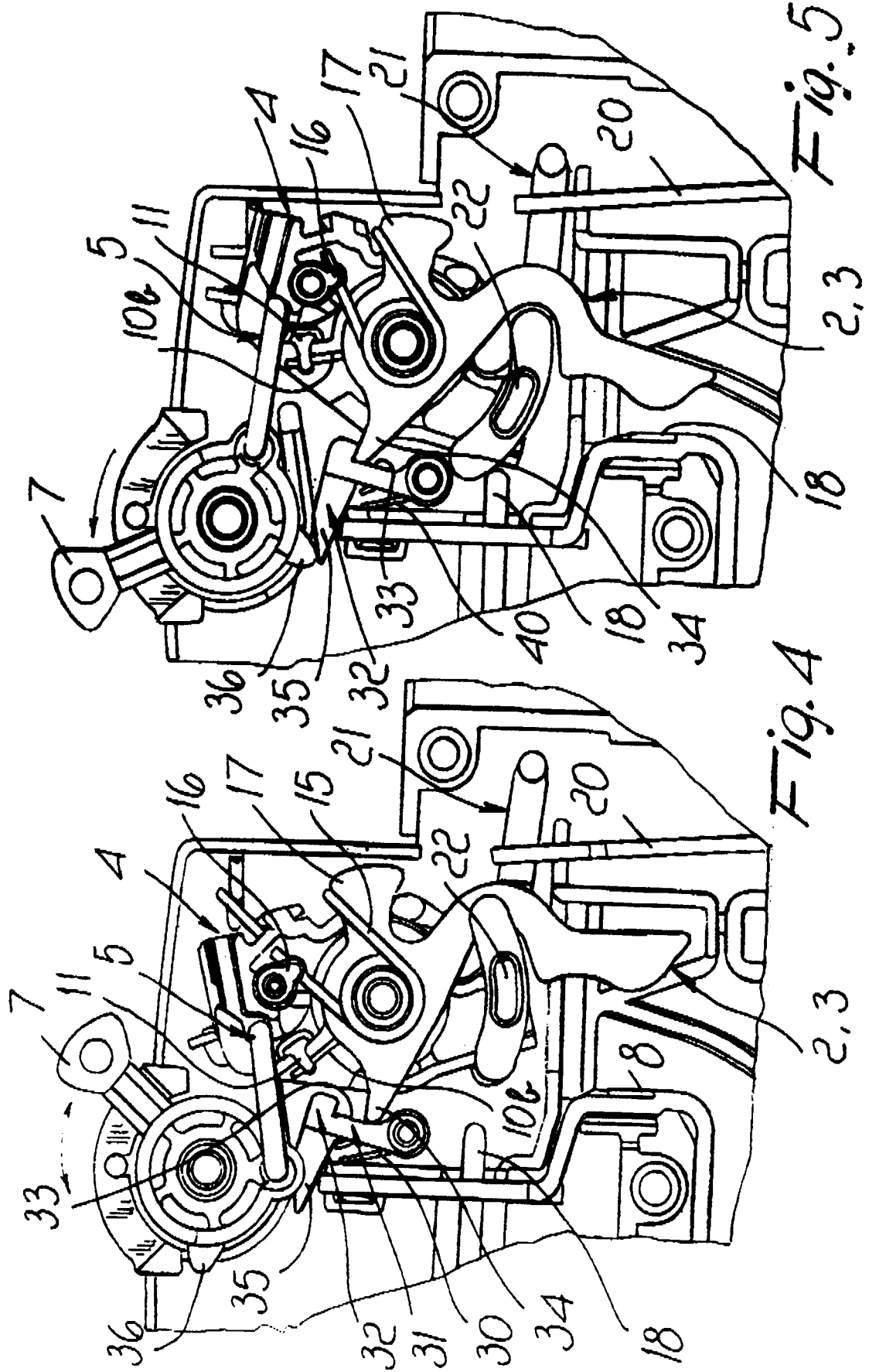
5. Thermomagnetic circuit-breaker as in one or more of the previous claims characterised by the fact that said auxiliary lever is pivoted alongside the axis of said operating lever.

6. Thermomagnetic circuit-breaker as in one or more of the previous claims characterised by the fact that said operating knob and said operating lever rotate in the same direction.

7. Thermomagnetic circuit-breaker as in one or more of the previous claims characterised by the fact that it includes a spring associated to the trip lever that interacts with said trip lever and said operating lever.

8. Thermomagnetic circuit-breaker as claim 7 characterised by the fact that said spring associated to the trip lever is a hairpin spring having an axial appendix that can be lodged in a seat defined by said trip lever and a radial appendix that can engage in a catch projection defined on said operating lever.





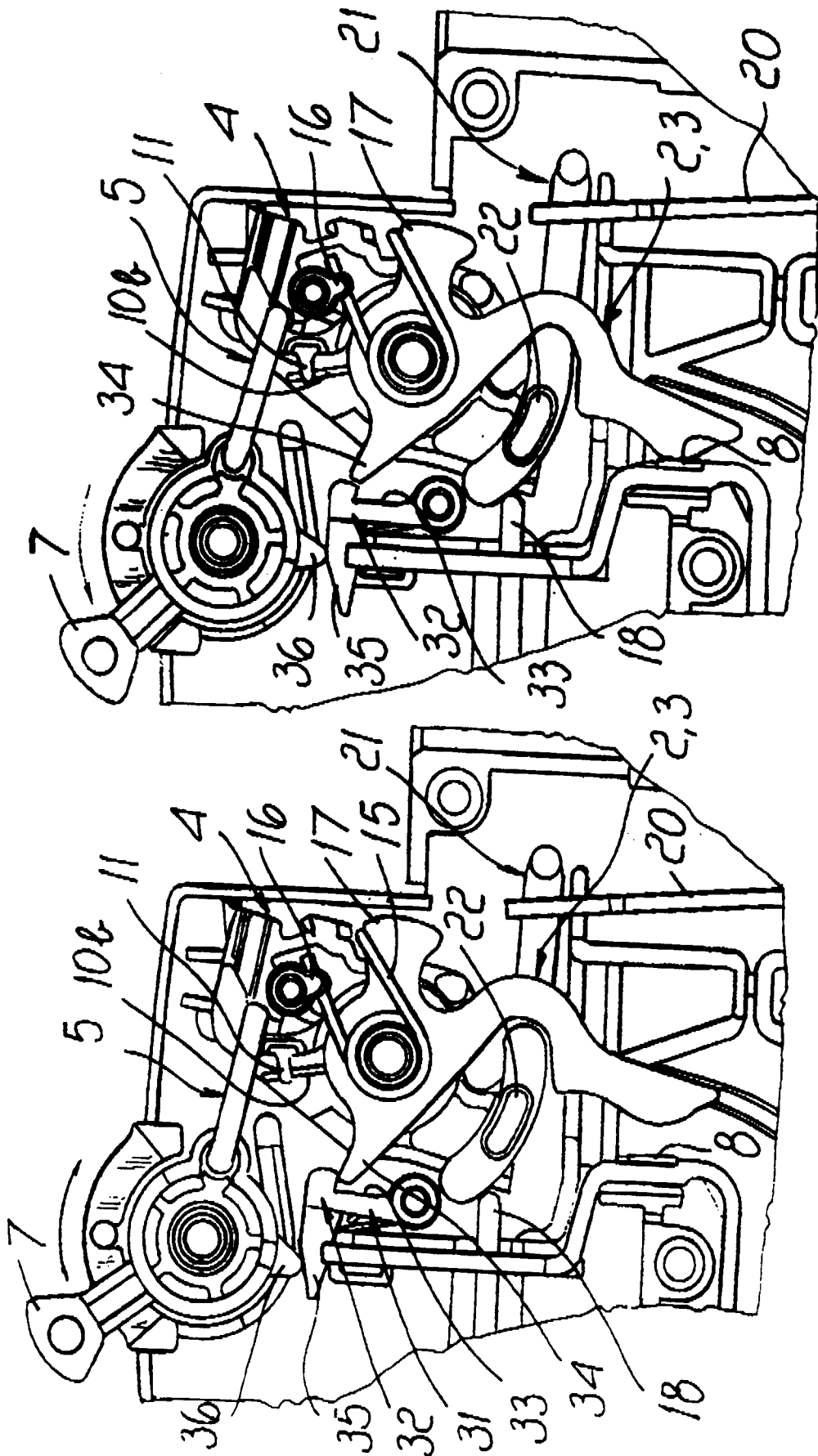
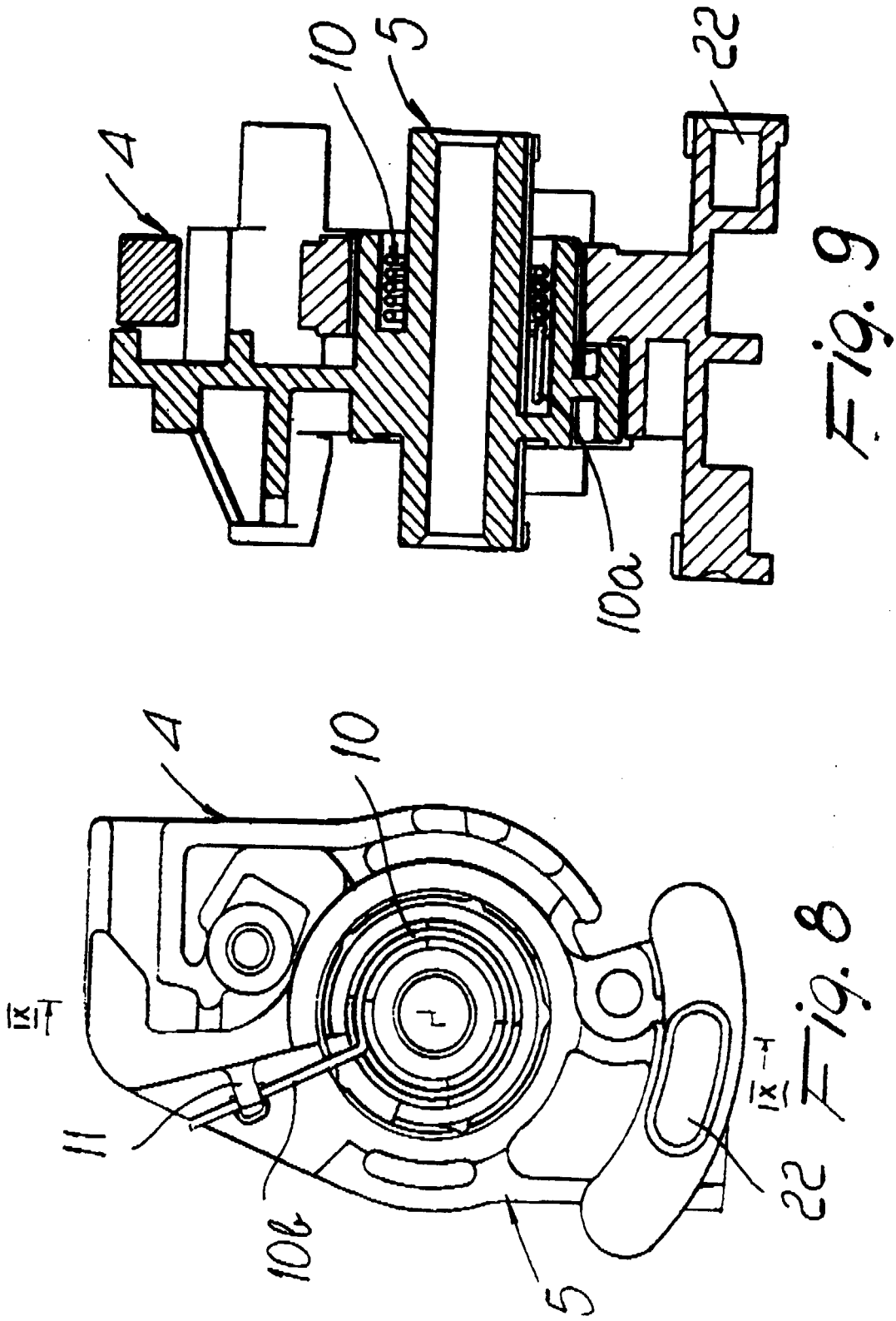


Fig. 7

Fig. 6





European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 3874

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.6)
X	DE 37 21 069 A (SERD SOC ET REALISA DISJONCT) 18 August 1988	1,4,5,7	H01H71/52
Y	* column 3, line 67 - column 4, line 13; figures 2-4 *	2,8	
Y	--- US 4 740 770 A (LAZARETH MICHEL ET AL) 26 April 1988 * column 6, line 29-55; figure 8 *	2,8	
A	--- US 4 687 891 A (BARTOLO WILLIAM ET AL) 18 August 1987 * column 3, line 56 - column 4, line 26; figures 1-4 *	1-8	
A	--- EP 0 046 841 A (LICENTIA GMBH) 10 March 1982 * abstract; figure 4 *	1-8	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		22 April 1999	Overdijk, J
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone		T : theory or principle underlying the invention	
Y : particularly relevant if combined with another document of the same category		E : earlier patent document, but published on, or after the filing date	
A : technological background		D : document cited in the application	
O : non-written disclosure		L : document cited for other reasons	
P : intermediate document		& : member of the same patent family, corresponding document	

EPO FORM 1503 03 82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 98 20 3874

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-04-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3721069 A	18-08-1988	FR 2610760 A	12-08-1988
US 4740770 A	26-04-1988	FR 2589627 A	07-05-1987
		AT 64234 T	15-06-1991
		AU 589856 B	19-10-1989
		AU 6449786 A	07-05-1987
		CA 1279356 A	22-01-1991
		CN 1013816 B	04-09-1991
		EP 0224396 A	03-06-1987
		IN 168773 A	01-06-1991
		JP 2637081 B	06-08-1997
		JP 62105333 A	15-05-1987
		PT 83627 A,B	01-11-1986
US 4687891 A	18-08-1987	FR 2581791 A	14-11-1986
		AT 50084 T	15-02-1990
		AU 581396 B	16-02-1989
		AU 5734086 A	20-11-1986
		CA 1275139 A	09-10-1990
		EP 0205361 A	17-12-1986
		JP 2510514 B	26-06-1996
		JP 61260525 A	18-11-1986
		PT 82563 A,B	01-06-1986
EP 0046841 A	10-03-1982	DE 3031482 A	01-04-1982
		AT 9422 T	15-09-1984