



12

EUROPEAN PATENT SPECIFICATION

45 Date of publication of patent specification :
30.08.95 Bulletin 95/35

51 Int. Cl.⁶ : **H01H 73/04**

21 Application number : **90108624.9**

22 Date of filing : **08.05.90**

54 **An automatic magneto-thermal protection switch having a high breaking capacity.**

30 Priority : **25.05.89 IT 2064289**

43 Date of publication of application :
28.11.90 Bulletin 90/48

45 Publication of the grant of the patent :
30.08.95 Bulletin 95/35

84 Designated Contracting States :
BE DE ES FR GB

56 References cited :
DE-B- 2 132 738
DE-U- 8 109 136
GB-A- 2 040 573

73 Proprietor : **BTICINO S.r.l.**
Corso di Porta Vittoria 9
I-20122 Milan (IT)

72 Inventor : **Fabrizi, Fabrizio**
Via Cucchi 5
I-24100 Bergamo (IT)
Inventor : **Pianezzola, Sergio**
Via della Fratellanza,
I-21100 Calcinate del Pesce, Varese (IT)

74 Representative : **Perani, Aurelio et al**
c/o JACOBACCI & PERANI S.p.A
Via Visconti di Modrone, 7
I-20122 Milano (IT)

EP 0 399 282 B1

Note : Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Description

This invention relates to an automatic magneto-thermal protection switch according to the preamble of claim 1 and known from document DE-B-2 132 738.

As is well known, automatic switches or breakers of the above-outlined type are widely employed in the civil and tertiary sectors to perform control and protection functions for an electric system.

They are installed, for example, upstream of an electric power distribution line to which a number of consumer apparatus are connected. These switches enable the line to be sectioned off other lines in the system, while also affording magneto-thermal protection for such apparatus against overloading, fault currents, and shorts.

For that field of application, relevant regulatory bodies (CEI Standard 23-3) provide for these switches to have a breaking capacity at 220 Volts rated at 3-4.5 kiloamperes in a short situation.

When conformant with this standard, the switch will be able to adequately protect resistive loads as are usually to occur in generic domestic and civil systems.

A current demand is also that of providing modular switches of still smaller size and bulk so that an increased number of them can be accommodated within a station panel. This demand is more acutely felt where the protection for existing systems is to be enhanced and the space available for the station panel is limited.

The trend is, with most of the manufacturers, toward the provision of protection switches or breakers which are incorporated to a single standard module 17.5 mm wide. However, this brings about some serious design problems if the break mechanism and the switch protection devices are both to fit in that module. In addition, to conform with the aforesaid standard, it is necessary that on the occurrence of a short, the electric arc that is unavoidable generated across the fixed and moving contacts of the switch be effectively suppressed within the shortest possible time. But this requires de-ionization chambers of adequate size and considerable bulk, which runs contrary to the need to fit the whole assembly in a single standard module.

It will be appreciated, moreover, how these problems are aggravated where automatic switches or breakers are to be provided which are of the so-called single-pole type with neutral, and require that two ionization chambers be accommodated within said standard module, respectively for the phase contacts and the ones associated with the neutral pole.

The technical problem that underlies this invention is to provide an automatic magneto-thermal protection switch which has such structural and functional characteristics as to permit of the use of uniquely

small-size de-ionization chambers, so that the switch can comfortably fit inside a single standard module, and still retain a high breaking capacity, while overcoming the drawbacks with which the prior art is beset.

The solutive idea on which this invention stands is that of increasing the opening and separation speed of the moving contact relatively to the fixed contact, upon automatic operation of the switch, thereby the size of the de-ionization cells can be reduced.

On the basis of this idea, the technical problem is solved by an automatic switch of the type specified in claim 1.

The features and advantages of an automatic switch according to the invention will become apparent from the following detailed description of an embodiment thereof, to be taken by way of illustration and not of limitation in conjunction with the accompanying drawings.

In the drawings:

Figure 1 shows in perspective the outward appearance of an automatic switch according to the invention;

Figure 2 is a perspective view of the construction of the switch shown in Figure 1;

Figure 3 is a top plan view of the switch of Figure 2; and

Figure 4 is a perspective detail view of the switch shown in Figure 2.

With reference to the drawing views, generally indicated at 1 is an automatic magneto-thermal protection switch or breaker according to the invention.

The switch 1 comprises a box-type case 2 of parallelepipedic shape, known per se, which measures 17.5 mm in width.

The case 2 is formed of two superimposed half-shells 4 and 5 having mating shapes.

The switch 1 also comprises a control key 3, of the bistable kind, which is accessible frontally on the case 2 and journaled on a pin 6 fast with the half-shell 5.

Connected to the key 3 is a break mechanism, generally denoted by 15, comprising a toggle mechanism 16 for driving a moving contact to rock toward and away from a corresponding fixed contact.

The switch 1 is of the so-called single-pole type with neutral, and input and output fixed-cage terminals 7 and 8 are provided therefor to enable connection to neutral and phase conductors, respectively.

To the phase input terminal 8, there is connected one end of an amperometric coil 9 intended for automatic magnetic protection operation and wound around a stationary core 10.

The coil 9 is carried in a U-shaped cage 11 having sheet-like walls and, pivoted to its top, a small moving armature 12 bent at right angles to define a first leg extending over the core 10 and a second leg 12a hav-

ing an end arranged to interfere with and act upon, with the interposition of a small lever 46, the breaking mechanism 15. The end of the first leg of the armature 12 has a breaker arm-like lug 35 serving a function to be explained.

The armature 12 is apt to be pulled toward the core 10 by the electromagnetic force induced by a fault or short current such that the end active on the mechanism 15 can automatically trip off the switch 1 on the occurrence of a fault situation.

Respectively associated with the neutral input terminal 7 and the phase output terminal 8 are fixed contacts 14 and 18, toward and away from which, corresponding moving contacts 17 and 19 are guided movably by the mechanism 15.

A moving contact holder assembly 20 is provided for the purpose which comprises a drum 21 journalled on a pin 22 fast with the half-shell 5.

The drum 21 is connected peripherally to one end of the toggle mechanism 16 and displaceable angularly against the bias force of a spring means 24.

Mounted resiliently on said drum 21, to opposed faces thereof, are the aforesaid moving contacts 17 and 19. More particularly, with reference to Figure 4, each contact, 17 or 19, comprises an annular sheet-like portion 25 fitting around the pin 22 in a mating seat 26 formed in the drum 21 and being held therein against the bias of a spring 27.

Formed integrally with the portion 25 is an arm 28 carrying the moving contact and jutting out toward the corresponding fixed contact opposite to a de-ionization chamber 30 and respective cell 29.

The cells 29 are provided on opposed sides of the switch 1 near the fixed contacts 14 and 18; they are arranged substantially along a slightly inclined direction to the major axis of the switch.

Each cell 29 consists of a set of laminations 36 thickly arranged parallel and attached to one another by small opposed cross-bars 37. These laminations 36 have a V-shaped cutout 38 formed in their side facing the moving contact, whereby a corresponding V-like notch is defined which provides an invitation for the electric arc to be suppressed.

The spring 27 controls the contact force between the corresponding fixed and moving contacts, while taking up any backlash generated by the contact wear.

The respective arms 28 of the contacts 17 and 19 extend substantially from opposed ends of the drum 21, and are aligned along the same direction but opposite verses. They are displaceable angularly together with the drum 21 in the same direction of rotation.

A cord lead 43 connects the portion 25 of the moving contact 17 to the output terminal 7, and a similar cord lead 44 connects the portion 25 of the other moving contact 19 to the end of a bimetallic plate 45. This plate 45 has the opposite end connected to the

other end of the coil 9, being thus connected in series between that coil and the moving contact 19 to provide thermal protection for the switch 1.

A small, three-arm lever 46 is journalled for the purpose on a pin 48 rigid with the half-shell 5 and displaceable angularly against the bias force of a spring 47. That lever 46 has a first arm acting as feeler on the bimetallic plate 45, a second arm inserted in the path of travel of the section 12a of the armature 12, and a third arm connected detachably to the breaking mechanism 15.

Advantageously, a rocking striker 32 is also provided which is journalled on the pin 22 above the drum 21 and has opposite ends 31 and 33 respectively located close against each arm 28, thereby the rocking striker 32 will form with the arms 28 a cross-over X-shaped configuration.

The rocking striker 32 has its end 33 inserted in the path of travel of the breaker arm-like lug 35 on said armature 12 and the opposite end 31 active on the arm 28 of the moving contact 19 in abutment relationship.

That same end 33 of the rocking striker 32 is active, on account of the thrust force applied to it by the lug 35 on operation of the coil 9, on the arm 28 of the moving contact 17.

This concurrent striking effect on the moving contacts 17 and 19 allows the opening of the contacts to be speeded up upon automatic operation of the switch 1.

The switch 1 is also provided with an indicator device 40 indicating the operational state of the switch. This device comprises a rod 39 pivoted between the drum 20 and the toggle mechanism 16 and extending to the key 3.

To the end of said rod 39, there is attached a small indicator plate 42 in two colors which can be viewed through a window 41 provided in the case 2 front above the key 3.

Thus, automatic operation of the protection switch according to the invention is made easier by the peculiar construction of the moving contact holder assembly arranged to co-operate with the rocking striker 32. The latter can strike the opposed arms 28 of the respective moving contacts 17 and 19 simultaneously and impart a higher angular acceleration to the drum 20 on the occurrence of an automatic switch operation.

The striking effect adds to the elastic pull from the spring 24, with the result that the speed of relative movement of the fixed and moving contacts away from each other can be higher than that afforded by switches made in accordance with the prior art.

This enables de-ionization chambers and their cells to be provided in uniquely small sizes, such that the remaining parts can find room within the DIN standard module of the switch in a proper structural layout effective to facilitate assembly procedures.

Claims

1. An automatic magneto-thermal protection switch (1) having a high breaking capacity and being of a type which comprises a control key (3), a toggle mechanism (16) associated with the key, at least one moving contact (19) supported on an arm (28) operated through said mechanism to rock toward and away from a fixed contact (18) facing a de-ionization chamber (30) and respective cell (29), an amperometric protection solenoid (9) having its moving armature (12) arranged to act on said mechanism, a rocking striker (32) having one side portion in the path of movement of a lug (35) on said armature and another side portion arranged to abut on said moving contact arm (28), to thereby speed up the contact opening movement by the time of automatic operation,
characterized in that it comprises a pair of moving contacts (17,19) in a single-pole configuration with neutral, being mounted on a contact holder assembly (20) consisting of a drum (21) journaled on a pin (22) and peripherally connected to one end of said toggle mechanism (16), said moving contacts (17,19) having their supporting arms (28) jutting out from diametrically opposite sides of said drum (20), and in that said rocking striker (32) is formed and arranged to rotate around said pin (22) and has two opposite ends (31,33) movable around the drum (21) and located each close to a respective one of said moving contact arms (28), said one side portion being a side portion of one of said opposite ends (31,33) and said another side portion being a side portion of each of said opposite ends (31,33).
2. A switch according to Claim 1, characterized in that each moving contact (17,19) includes a sheet-like annular portion (25) fitting around said pin (22) in a mating seat (26) formed in one face of the drum (21) and being held therein by a spring (27), and an arm portion (28) formed integrally with said annular portion and supporting the corresponding moving contact.
3. A switch according to Claim 1 or 2, characterized in that it comprises an indicator device (40) for indicating the operational state of said switch and being provided with a rod (39) journaled between said drum (20) and the toggle mechanism (16) and extending to said key (3), to the end of said rod there being attached a small indicator plate (42) in two colors which can be viewed through a window (41) provided on the front of the switch case.

Patentansprüche

1. Ein automatischer magnetothermischer Schutzschalter (1) mit einer hohen Unterbrechungsschaltleistung und von einer Art, die eine Steuerungstaste (3), einen Kniehebelmechanismus (16), der der Taste zugeordnet ist, zumindest einen beweglichen Kontakt (19), der auf einem Arm (28) getragen ist, der durch den Mechanismus betrieben wird, um in Richtung eines festen Kontakts (18), der einer Deionisationskammer (30) und einer jeweiligen Zelle (29) gegenüberliegt, und von diesem weggeschwenkt zu werden, einem Strommeßschutzsolenoid (9), dessen beweglicher Läufer (12) angeordnet ist, um auf den Mechanismus einzuwirken, einen schwenkbaren Anschlag (32), der einen Seitenabschnitt im dem Bewegungsweg einer Nase (35) auf dem Läufer und der einen anderen Seitenabschnitt aufweist, der angeordnet ist, um an den beweglichen Kontaktarm (28) anzuliegen, umfaßt, um dadurch die Kontaktöffnungsbewegung durch die Zeit des automatischen Betriebes zu beschleunigen, dadurch gekennzeichnet, daß
er ein Paar von beweglichen Kontakten (17, 19) in einer einpoligen Konfiguration mit einem neutralen Pol umfaßt, die auf einer Kontakthalteranordnung (20) befestigt sind, die aus einer Trommel (21) besteht, die auf einem Stift (22) gelagert ist und peripher mit einem Ende des Kniehebelmechanismus (16) verbunden ist, besteht, wobei die Tragearme (28) der beweglichen Kontakte (17, 19) von diametral gegenüberliegenden Seiten der Trommel (20) hervorstehen, und daß der schwenkbare Anschlag (32) gebildet und angeordnet ist, um sich um den Stift (22) zu drehen, und zwei entgegengesetzte Enden (31, 33) aufweist, die um die Trommel (21) bewegbar sind und jeweils nahe an den jeweiligen Enden der beweglichen Kontaktarme (28) angeordnet sind, wobei ein Seitenabschnitt ein Seitenabschnitt eines der entgegengesetzten Enden (31, 33) ist, und der andere Seitenabschnitt ein Seitenabschnitt jedes der entgegengesetzten Enden (31, 33) ist.
2. Ein Schalter gemäß Anspruch 1, dadurch gekennzeichnet,
daß jeder bewegliche Kontakt (17, 19) einen plattenartigen kreisförmigen Abschnitt (25), der um den Stift (22) in einem Gegenlager (26), das in einer Fläche der Trommel (21) gebildet ist, angepaßt ist und darin durch eine Feder (27) gehalten ist, und einen Armabschnitt (28), der einstückig mit dem kreisförmigen Abschnitt gebildet ist und den entsprechenden beweglichen Kontakt trägt, einschließt.

3. Ein Schalter gemäß Anspruch 1 oder 2, dadurch gekennzeichnet, daß er ein Anzeigergerät (40) umfaßt, um den Betriebszustand des Schalters anzuzeigen, und der mit einer Stange (39) versehen ist, die zwischen der Trommel (20) und dem Kniehebelmechanismus (16) gelagert ist und sich zu der Taste (3) erstreckt, wobei an dem Ende der Stange eine kleine Anzeigerplatte (42) in zwei Farben befestigt ist, die durch ein Fenster (41) gesehen werden kann, das an der Vorderseite des Schaltergehäuses vorgesehen ist.

Revendications

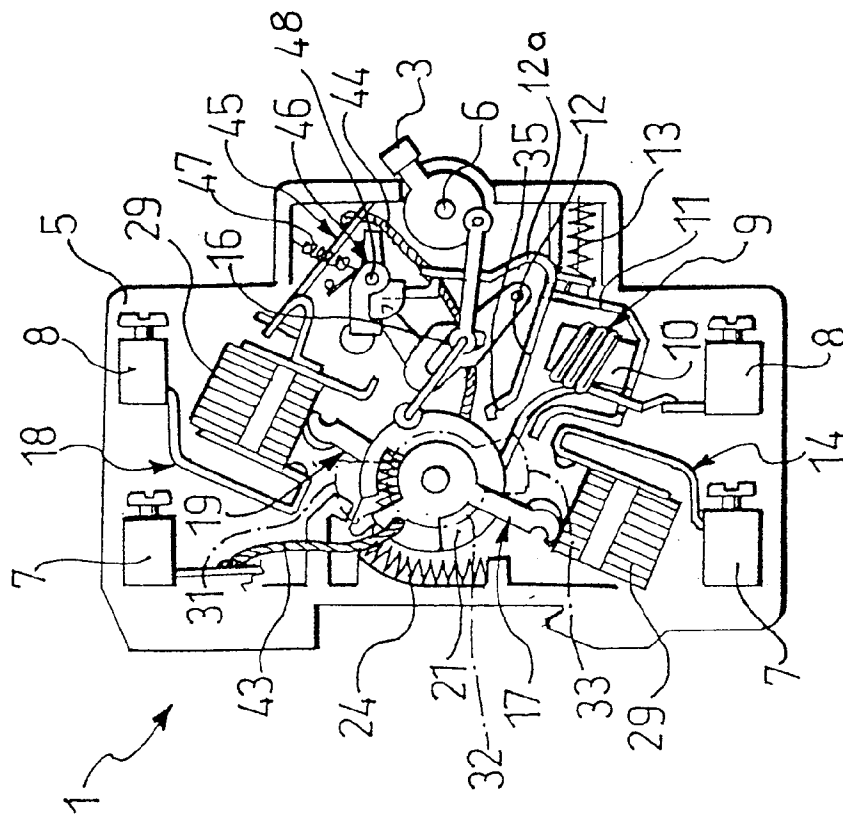
1. Disjoncteur magnéto-thermique automatique (1) ayant une capacité de coupure élevée et d'un type qui comprend une manette (3) de commande, un mécanisme (16) de basculement associé à la manette, au moins un contact (19) mobile supporté par un bras (28) actionné par ledit mécanisme pour basculer vers et s'écarter d'un contact (18) fixe faisant face à une chambre (30) de désionisation et une cellule (29) respective, un solénoïde (9) de protection ampèrométrique dont l'armature (12) mobile est agencée de façon à agir sur ledit mécanisme, un percuteur (32) basculant dont une partie latérale se trouve sur la trajectoire de mouvement d'une cosse (35) sur ladite armature et dont une autre partie latérale est disposée de façon à buter sur ledit bras (28) de contact mobile, afin d'accélérer le mouvement d'ouverture du contact lors d'un actionnement automatique,

caractérisé en ce qu'il comprend une paire de contacts (17, 19) mobiles dans une configuration monopolaire ayant un neutre, qui sont montés sur un ensemble (20) de support de contacts constitué d'un tambour (21) monté sur un axe (22) et connecté à sa périphérie à une extrémité dudit mécanisme (16) de basculement, lesdits contacts (17, 19) mobiles ayant leurs bras (28) de support faisant saillie sur des côtés diamétralement opposés dudit tambour (20), et en ce que ledit percuteur (32) basculant est formé et conçu pour tourner autour dudit axe (22) et présente deux extrémités (31, 33) opposées mobiles autour du tambour (21), chacune située à proximité de l'un respectif des bras (28) de contacts mobiles, ladite partie latérale étant une partie latérale de l'une desdites extrémités (31, 33) opposées et l'autre desdites parties latérales étant une partie latérale de chacune desdites extrémités (31, 33) opposées.

2. Disjoncteur selon la revendication 1, caractérisé en ce que chaque contact (17, 19) mobile

comporte une partie (25) annulaire en forme de feuille ajustée autour dudit axe (22) dans un siège (26) de réception formé dans une face du tambour (21) et y étant maintenue par un ressort (27) et une partie (28) de bras formée solidaire de ladite partie annulaire et supportant le contact mobile correspondant.

3. Disjoncteur selon la revendication 1 ou 2, caractérisé en ce qu'il comporte un dispositif (40) indicateur pour indiquer l'état de fonctionnement dudit disjoncteur et étant muni d'une tige (39) montée entre ledit tambour (20) et le mécanisme (16) de basculement et se prolongeant jusqu'à ladite manette (3), une plaquette (42) indicatrice bicolore étant fixée à l'extrémité de ladite tige, celle-ci pouvant être vue à travers une fenêtre (41) disposée sur la face avant du boîtier du disjoncteur.



3.
G
F

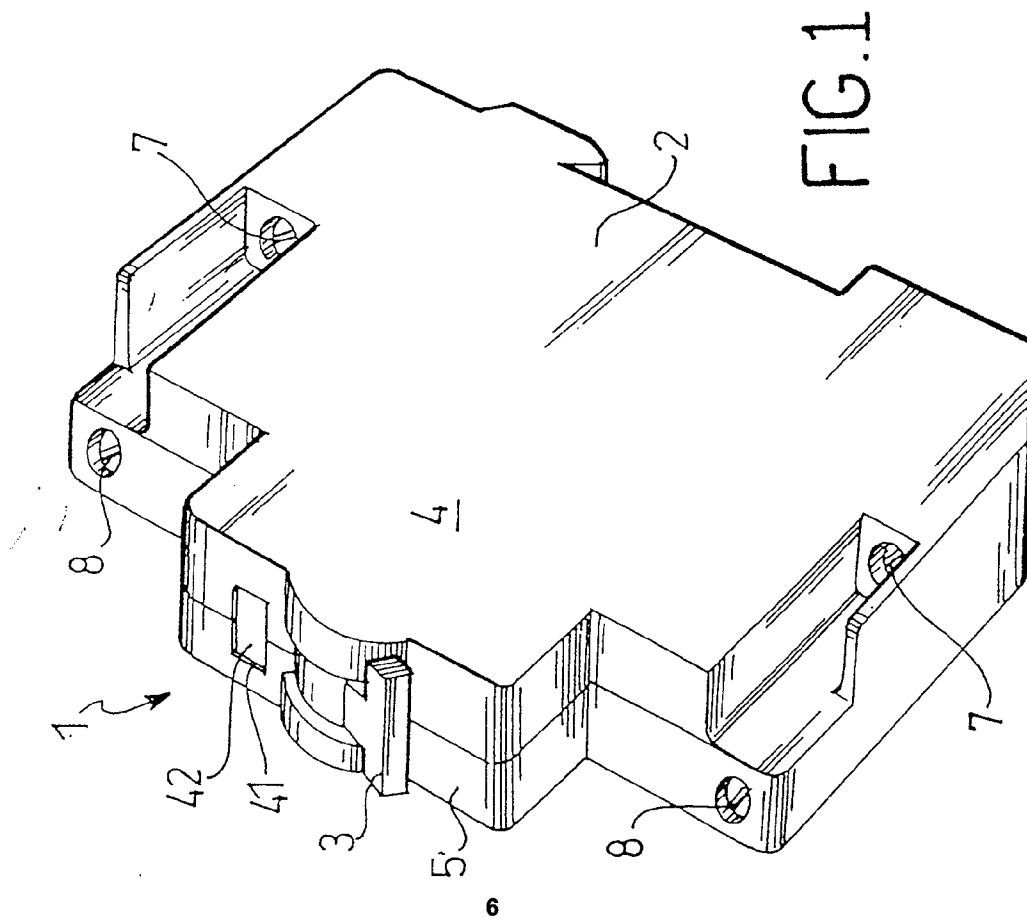


FIG. 1

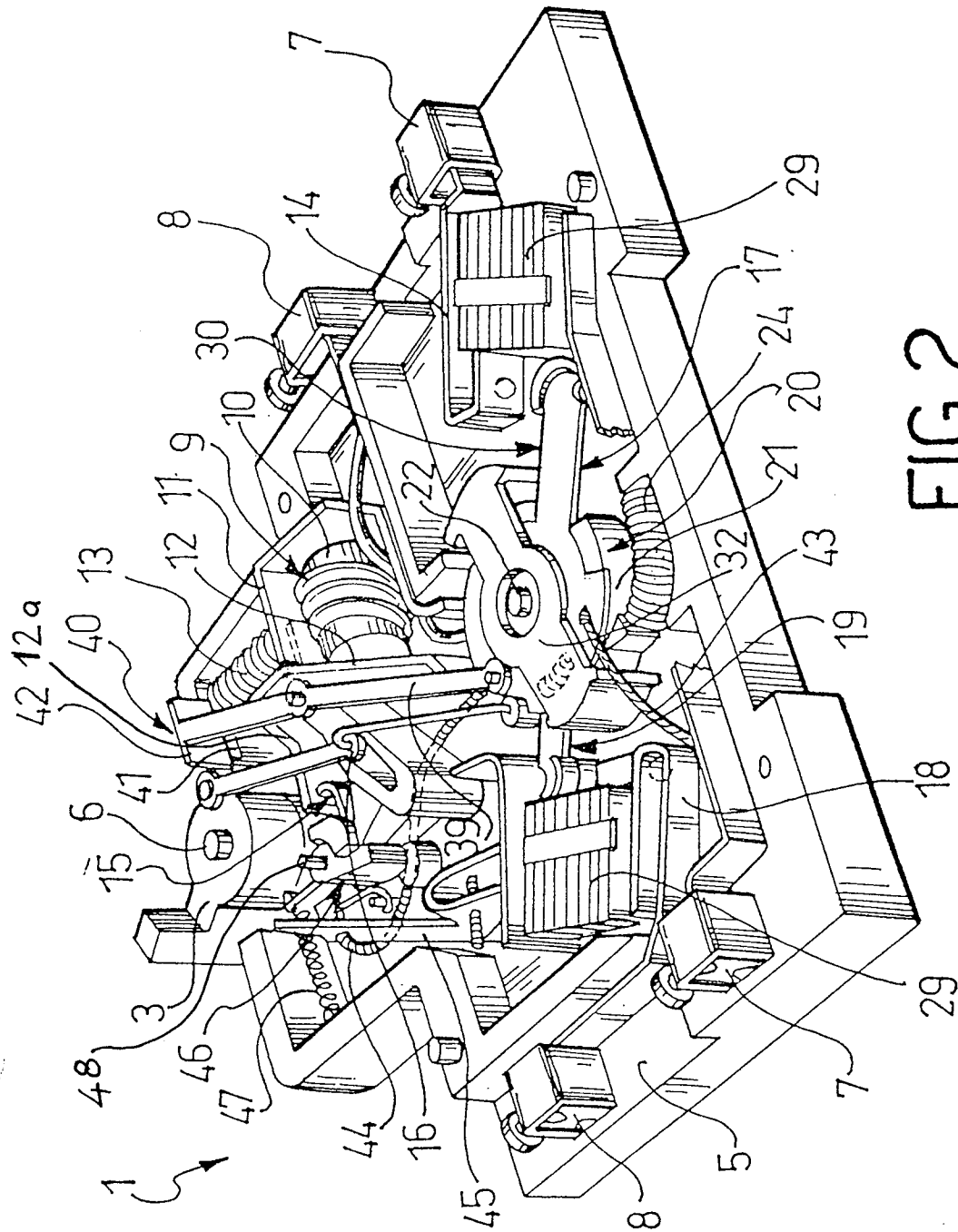


FIG. 2

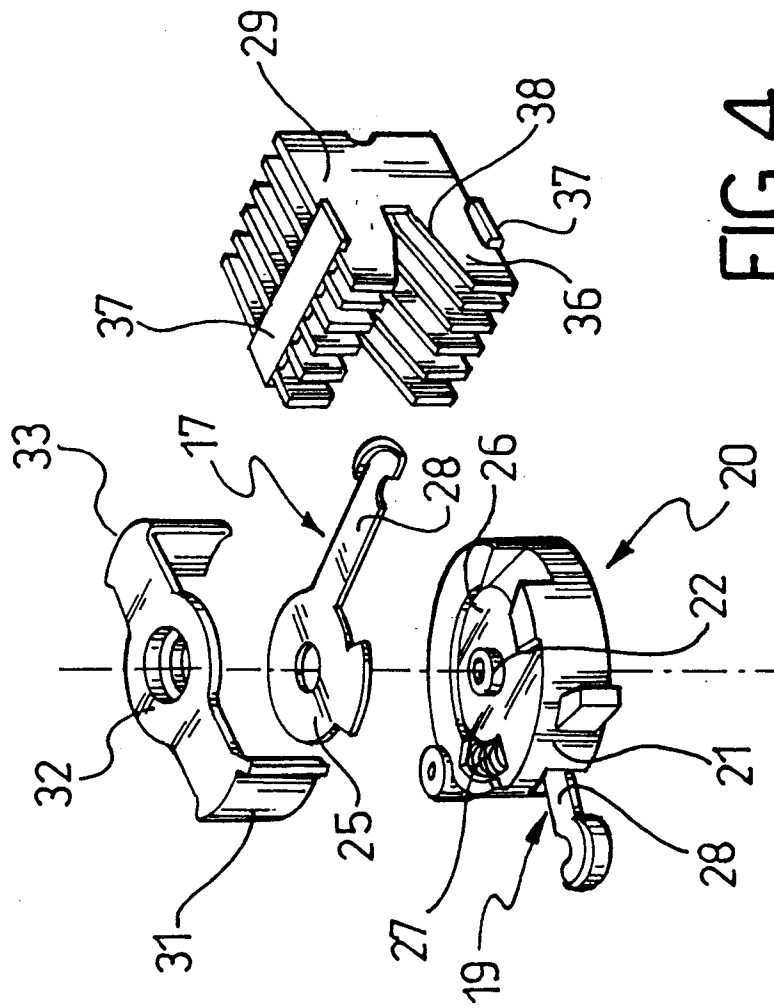


FIG. 4