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Trip lamina for single-pole circuit breakers

This invention relates to a trip lamina for single-pole circuit breakers.

According to the known art, in some kinds of single-pole circuit breakers employing an over center mechanism, a trip lamina effects the automatic tripping in the event of an overload and/or short circuit current, said trip lamina being subjected to a bimetallic strip, responsive to the overload current and to a magnetizable armature responsive to the short circuit current, and it is provided with a latching notch or aperture allowing the latching of a tip, or similar members, provided on one end of a latching cradle usually of arcuate shape, and having the other end pivoted on a fixed pin around which it may rotate for a determined angle.

When said latching cradle is latched to said trip lamina, it keeps steadily the stationary and the movable contacts in a closed position.

When, on the other end, an anomalous increase of the current happens, i.e. an overload or short circuit current, said trip lamina is retracted by the bimetallic strip or by the magnetizable armature, causing the tripping of the latching cradle, so that the latter, under the traction on a suitable spring, rotates thus causing the snap into the open position of the over center mechanism and therefore the sudden opening of the movable contact with respect to the stationary contact.

Even though said trip lamina is a simple member, it shows some drawbacks during the production, assembling adjustment or calibration steps.

The known trip laminae, in effect, must be produced with a thickness able to withstand the bending and compressive stress transmitted by the tip of the latching cradle, and to assure a stable latching of the tip itself, also avoiding an improper tripping if the mechanism is subjected to vibrations.

In this way the trip laminae must have a stiffness that counteracts any bending of the trip lamina, preventing or delaying the tripping in overload or short circuit current conditions.

Consequently, it is preferred as in US—A—2308401 to constrain the trip lamina so that it may rigidly rotate around one of its own ends inserted in a seat provided in a moulded case enclosing the circuit breaker.

This solution, however, requires the employment of adjustment means to adjust the angular latching position and the employment of elastic means to recall the same lamina into said latching position after every displacement caused by the bimetallic strip or by the magnetic attractions means.

Said adjustment and recalling means even if they are simply constituted by a screw or by a spring are, in any case, additional members that weigh heavily on the cost of the circuit breaker not only for their price on the market, but also

because they require additional operations for mounting and adjusting that cannot be done mechanically.

Moreover, the end of the trip lamina which is not constrained in the seat, and that can be provided with a magnetizable armature, is connected to the bimetallic strip, by a screw that functions both as a pulling member between the bimetallic strip and the trip lamina for executing the tripping, and as a calibration means to define the minimum overload current at which the tripping must take place.

Said calibration screw needs some means apt to prevent the spontaneous unscrewing.

Said means, according to the known art, are constituted by particular lacquers, by lock-nuts, or the like, that are time consuming in the assembling and calibration steps and therefore weigh heavily on the whole cost of the circuit breaker.

In another known trip lamina, see US—A—2824191 a leaf spring having one end inserted into a slot defined by two housing portions is utilised.

The present invention relates to a trip lamina that, although it has the required thickness apt to withstand the combined bending and compressive stress transmitted by the tip of the latching cradle and although assuring the necessary latching, shows a low resistance to the bending, so that it may be elastically bent under the forces exerted by the bimetallic strip and by the magnetic attraction means and does not require recalling means and adjusting means for its angular latching position.

The present invention consists in a trip lamina for single-pole circuit breakers of the kind having an elongate laminar body having one end received in a seat of a moulded case of the single-polar circuit breaker and so constrained that it may not rotate with respect to the seat and the other end connected to a bimetallic strip through a calibration screw and provided with a movable armature of magnetizable iron, and of the kind having a notch or aperture for the latching of a tip carried by a latching cradle until said trip lamina is displaced to cause the tripping of said latching cradle, and the invention is characterized by said elongate laminar body having its middle portion, of significant length with respect to the whole length, provided with shearings that extend through the whole thickness of the lamina and which are executed in the direction perpendicular to the plane of the trip lamina and extend transversely to the longitudinal direction of the same, said shearings having their respective outlets alternatively on both longitudinal edges of the trip lamina, each shearing being so finely executed that its edges meet and rest one on top of the other to render said lamina resistant to the bending and compressive stress

transmitted by the tip of the latching cradle, said shearings generating a continuous undulating strip of reduced width on the trip lamina, thus rendering said trip lamina highly flexible, so that it may be bent without remarkable resistance, by the traction exerted by the bimetallic strip or by the magnetizable armature to trip in overload or short circuit current conditions.

In a preferred embodiment of the invention, the trip lamina, along said middle portion, is provided with substantially equal apertures successively spaced in the same way as said shearings and in each one of which the inner end of a respective shearing has its outlet, so that the flexibility of the undulating strip is increased and the execution of the shearings in a precise manner and without deformation of the trip lamina is allowed.

In a further preferred embodiment of the invention, each one of said apertures is provided with a rectilinear side at least, directed as said shearings, each respective shearing being disposed on the prolongement of such a side.

In a further important embodiment of the invention, the end portion of the trip lamina connected to the bimetallic strip through the calibration screw, is provided with a longitudinal slit having its outlet on said other edge of the trip lamina and traversing the threaded hole engaging said calibration screw, said longitudinal slit separating said ending portion into two parallel tongues able to assume a respective inclination having contrary slopes with respect to the plane of said trip lamina, so that the edges of said threaded hole engaging the calibration screw are obliquely pressed against the threads of said calibration screw preventing the spontaneous unscrewing of the latter.

Due to this construction, additional means for preventing the unscrewing of the calibration screw are not necessary.

According to a last embodiment of the invention, said ending portion of the trip lamina is provided with a retaining hole, from which said longitudinal slit initiates a magnetizable movable armature, in the form of a plate, being provided with a projection able to be forced with snapping insertion through said retaining hole. Said magnetizable movable armature is provided, at its lower corners, with two respective projecting bearings, designed to rest on said tongues, near the outer edges of the latter, so as to oblige said tongues to assume the due inclination with respect to the plane of the trip lamina, when said projection of the magnetizable movable armature is forced through said retaining hole.

An embodiment of the invention, by way of example, will be hereinafter disclosed referring to the accompanying drawings, wherein:

Figure 1 is a view of a single-pole circuit breaker, having a shell of the moulded case removed and to which the trip lamina of the invention is applied.

Figure 2 is an exploded view, in enlarged scale, of the trip lamina, of the magnetizable armature and of the calibration screw.

Figure 3 is a view in enlarged scale of a portion of Figure 1 showing the seat provided in the moulded case receiving the fixed end of the trip lamina.

Figures 4 and 5 show, in a more enlarged scale, a side view and bottom view respectively, of the assembling of the trip lamina, the magnetizable movable armature and the calibration screw.

Figure 1 refers to a single-pole circuit breaker comprising a moulded case 1, composed by two meeting shells one of which has been removed in the drawing, said moulded case accommodating a snap mechanism that will not be specified in detail.

In effect said snap mechanism, may be any known one provided for moving a movable contact 2 from a closed position to an open position, with respect to a stationary contact 2', either by the displacement of the manual operating member 3 or by the tripping of a latching cradle 4, provided with a tip 5 that latches in a notch or hole carried by a trip lamina 6, the latter being connected to a bimetallic strip 7 by means of a calibration screw 22.

The particular snap mechanism shown in Figure 1, however, constitutes the subject of a separate European patent application 80830032 (publication number 0020312), filed simultaneously with this application.

From said snap mechanism one may note that the tip 5 transmits to the trip lamina 6 a force generated by a spring 4' and that constitutes a bending and compressive stress for the trip lamina itself.

The trip lamina 6, according to the present invention, is shown in Figures from 2 to 5.

Said trip lamina 6 is preferably obtained from steel band having a suitable thickness.

At the upper end 6", said trip lamina 6 is provided with a projection 8, preferably shaped as a spherical segment, obtained by forming the steel band, so that said upper end 6" can be received in a seat 9, where two opposed walls 10 and 11 contain therebetween, almost exactly, the thickness of the blade and projection 8, preventing said upper end 6" from every rotatable movement. Furthermore said seat 9 is provided with a peripheral slot 12 directed inwardly of the moulded case, having a width a bit greater than the thickness of the trip lamina 6 and through which said trip lamina may pass, so that the upper end 6" is trapped in the seat 9 and so that the possibility of a rotation does not exist with respect to said seat 9.

A middle longitudinal portion of the trip lamina, extending along a great part of the whole length of the same trip lamina, is provided with transversal shearings 13 that have their outlets alternately on the opposed longitudinal edges of the trip lamina.

Preferably, along said middle portion, apertures 14 are provided, having at least one side 15 directed transversely to the longitudinal direction of the trip lamina 6, so that for every hole 14, a respective shearing 13 is disposed on the prolongement of said side 15.

Moreover, each one of the shearings 13 is so finely executed that its edges 13' and 13" couple so that the edge of the first constitutes a shoulder for the other one.

The disposition of the shearings 13 and the possible disposition of apertures 14 causes the trip lamina 6 to have the form of an undulating continuous strip 16, having particularly, square undulation, each side of the undulation constituting a flexible element that furnishes a great elastic flexibility to the trip lamina, greatly reducing its resistance to the bending, while having a relatively great thickness.

Moreover the disposition of apertures 14 allows the production of shearings 13 in a precise manner, without deforming the trip lamina 6 and it also allows to size the width of the undulated strip 16 for establishing the required flexibility of the trip lamina 6.

Moreover, the mutual shouldering between the edges 13' and 13" of each shearing 13 prevents the trip lamina 6 from being bent under the bending of compressive stress exerted by the tip 5 of the latching cradle 4.

This advantage could not be obtained if a very thin flexible trip lamina were to be employed.

The shearings 13 are produced by blanking in a direction perpendicular to the plane of the trip lamina 6, to assure the maximum mutual shouldering between the edges 13' and 13".

Below the middle portion occupied by the shearings 13, a first hole 17 is provided designed to be latched by the tip 5 of the latching cradle 4. A second hole 18 is provided below the first hole 17 for receiving a projection 19 carried by a movable armature 2 of magnetizable iron, designed to be mounted on the trip lamina 6.

A third hole 21 is provided for the engagement of a calibration screw 22 passing through a hole 23 located in the movable armature 20.

The first, the second and the third hole respectively 17, 18 and 21 are disposed along the central line of the trip lamina 6 and along said central line a slit 24 is provided, extending from the lower edge of the second hole 18 up to the lower edge 6' of the trip lamina 6 and traversing the third hole 21.

Said slit 24 separates a lower portion of the trip lamina in two juxtaposed tongues 25 and 26 that may be bent to assume a deflection contrary with respect to the plane of the trip lamina, as shown in Figures 2 and 5.

Two projecting bearings 27 and 28 are provided on the lower corners of the movable armature 20, having the aim to cause the tongues 25 and 26 to assume said inclined position, so that when the movable armature is

mounted on the trip lamina and a pressure is exerted on the slit 24 by means of a suitable fixture, said projecting bearings 27 and 28 act on the outer edges of the tongues 25 and 26 causing the latter to assume the desired deflection that will be kept by the traction exerted through the calibration screw 22.

The assembly of the movable armature 20 is accomplished quickly by introducing the projection 19 through the hole 18, the introduction taking place with a snap movement, because of the elastic enlargement of the hole 18 permitted by the slit 24.

After the calibration screw has been screwed, the pressure on the slit 24 is arrested, so that the tongues 25 and 26 have the tendency to elastically return to the plane of the trip lamina, but they are prevented from doing so by the threads of the same calibration screw.

As a consequence, the edges of the third hole 21 exert a pressure on the threads of the calibration screw generating a relevant friction that prevents the unscrewing of the calibration screw 22. In this way, the calibration screw 22, once it has been calibrated, is permanently locked in its position without requiring additive members or operations.

This description is made only by way of example and not as a limitation to the scope of the invention, many variations and modifications may be made and will become apparent to those skilled in the art. Said modifications fall within the invention as defined by the appended claims.

Claims

1. Trip lamina for single-pole circuit breakers of the kind having an elongate laminar body (6) having one end (6") received in a seat (9) of a moulded case (1) of the single-pole circuit breaker and so constrained that it may not rotate with respect to the seat and the other end (6') connected to a bimetallic strip (7) through a calibration screw (22) and provided with a movable armature (20) of magnetizable iron, and of the kind having a notch or aperture (17) for the latching of a tip (5) carried by a latching cradle (4) until said trip lamina (6) is displaced to cause the tripping of said latching cradle, characterized in that the body of said trip lamina (6) has its middle portion, which has significant length with respect to the whole length, provided with shearings (13) extending through the whole thickness of the lamina and executed in the direction perpendicular to the plane of the trip lamina and extending transversely to the longitudinal direction of the same, said shearings having their respective outlets alternatively on opposed longitudinal edges of the trip lamina, each shearing being so finely executed that its edges (13'—13") meet and rest one on top of the other to render said trip lamina resistant to the bending and compressive stress transmitted by the tip (5) of the

latching cradle (4) said shearings causing the trip lamina to take the form of a continuous undulating strip (16) of reduced width so that said trip lamina is rendered highly flexible and it may be bent, without remarkable resistance, by the traction exerted by the bimetallic strip (7) or by the moveable armature (20), to trip in the event or an overload or short circuit current.

2. Trip lamina according to claim 1 characterized in that, along said middle portion there are provided substantially equal apertures (14) successively spaced in the same way as said shearings (13) and in each one of which the inner end of a respective shearing (13) has its outlet, so that the flexibility of the undulating strip (16) is increased and the execution of the shearings in a precise manner is allowed without the deformation of the said trip lamina.

3. Trip lamina according to claim 2 characterized in that said apertures (14) are provided with at least a rectilinear side (15) directed as the shearings, each shearing being disposed on the prolongement of such a side (15).

4. Trip lamina according to claim 1 characterized in that the ending portion of the trip lamina, connected to the bimetallic strip through the calibration screw (22), is provided with a longitudinal slit (24) having its outlet on said other edge (6') of said trip lamina and traversing a threaded hole (21) engaging said calibration screw, said longitudinal slit separating said ending portion into two parallel tongues (25—26) able to assume respective inclinations having contrary slopes with respect to the plane of said trip lamina, so that the edges of said threaded hole engaging the calibration screw are obliquely pressed against the threads of said calibration screw preventing the spontaneous unscrewing of the latter.

5. Trip lamina according to claim 4 characterized in that said ending portion of the trip lamina is provided with a retaining hole (18) from which said longitudinal slit (24) initiates, a magnetizable movable armature (20) in the form of a plate, being provided with a projection (19) able to be forced with snapping insertion through said retaining hole (18), said magnetizable movable armature also being provided at its lower corners with two respective bearings (27 and 28), designed to rest on said tongues (25 and 26), near the outer edges of the latter, so as to oblige said tongues to keep the due inclination with respect to the plane of the trip lamina, when said projection (19) of the magnetizable movable armature is forced through said retaining hole (18).

Revendications

1. Lampe de déclenchement pour disjoncteurs unipolaires du type comprenant un corps plat allongé (6) dont l'une des extrémités (6'') est reçue dans un siège (9) d'un boîtier moulé (1) du disjoncteur unipolaire et est retenue de façon à ne pas pouvoir tourner par rapport au siège,

tandis que l'autre extrémité (6') est relié à un bilame (7) par une vis de réglage (22) et qui comporte une armature mobile (20) en fer doux et du type ayant une encoche ou une ouverture (17) pour l'accrochage d'une pointe (5) portée par une bascule de verrouillage (4) jusqu'à ce que ladite lame de déclenchement (6) ait été déplacée de façon à provoquer le décrochage de ladite bascule de verrouillage, caractérisée en ce que le corps de ladite lame de déclenchement (6) comporte une partie centrale, ayant une longueur appréciable par rapport à sa longueur totale, qui présente des incisions (13) traversant toute son épaisseur et qui sont orientées suivant une direction perpendiculaire au plan de ladite lame de déclenchement et qui s'étendent perpendiculairement à l'axe longitudinal de celle-ci, lesdites incisions (13) débouchant alternativement à l'un et à l'autre des deux bords longitudinaux opposés de la lame de déclenchement, chaque incision (13) étant si étroite que ses bords se touchent et reposent l'un sur l'autre de sorte que ladite lame du déclenchement est capable de résister aux efforts de flexion et de compression transmis par la pointe (5) de la bascule de déclenchement (4), lesdites incisions (13) donnant à la lame de déclenchement la forme d'une bande ondulée continue (16) de largeur réduite, ce qui a pour effet de rendre ladite lame de déclenchement extrêmement flexible de sorte qu'elle peut, sans opposer une résistance considérable, être fléchie par la traction exercée par la bilame (7) ou par l'armature magnétique mobile (20), en provoquant un déclenchement dans le cas d'un courant de surcharge ou de court-circuit.

2. Lampe de déclenchement, selon la revendication 1, caractérisée en ce qu'elle présente, le long de ladite partie centrale, un certain nombre d'ouvertures pratiquement identiques (14) espacées de la même façon que lesdites incisions (13) et dans chacune desquelles débouche l'extrémité intérieure de l'une desdites incisions (13), ce qui a pour effet d'augmenter la flexibilité de la bande ondulée résultante (16) et de permettre d'exécuter lesdites incisions d'une manière précise et sans déformer ladite lame de déclenchement.

3. Lampe de déclenchement, selon la revendication 2, caractérisée en ce que lesdites ouvertures (14) présentent, au moins, un côté rectiligne (15) orienté dans la même direction que les incisions, chaque incision étant disposée sur le prolongement d'un tel côté (15).

4. Lampe de déclenchement, selon la revendication 1, caractérisée en ce que la partie terminale de la lame de déclenchement, reliée au bilame par la vis de réglage (22), présente une fente longitudinale (24) qui débouche auxdits autres bords (6') de ladite lame de déclenchement et qui est percée d'un trou taraudé (21) dans lequel est vissée ladite vis de réglage, ladite fente longitudinale séparant ladite partie terminale en deux languette parallèles (25, 26) pouvant assumer des inclinaisons opposées par

rapport au plan de ladite lame de déclenchement, ce qui fait que les bords dudit trou taraudé dans lequel est engagée ladite vis de réglage sont pressés obliquement contre le filetage, de ladite vis, en empêchant ainsi celle-ci de se dévisser spontanément.

5. Lame de déclenchement, selon la revendication 4, caractérisée en ce que la partie terminale de ladite lame de déclenchement présente un trou de retenue (18) à partir duquel ladite fente longitudinale (24) commence, une armature magnétique mobile (20), ayant la forme d'une plaquette, étant pourvue d'un élément saillant (19) pouvant être introduit par un mouvement brusque dans ledit trou (18), cette armature magnétique étant également pourvue, à ses coins inférieurs, de deux ergots d'appui (27 et 28) conçus pour reposer sur lesdites languettes (25 et 26), près des bords extérieurs de ces dernières de façon à obliger lesdites languettes à prendre une attitude inclinée par rapport au plan de la lame de déclenchement quand ledit élément saillant (19) de l'armature magnétique mobile a été introduit dans ledit trou (18).

Patentansprüche

1. Auslösungsblättchen für einpolige Stromunterbrecher der Bauart, welche einen langgestreckten blättchenartigen Körper (6) besitzen, wobei das eine Ende (6'') im Sitz (9) eines Gußgehäuses (1) des einpoligen Stromunterbrechers eingesetzt und so eingeklemmt ist, daß er sich nicht in Bezug zum Sitz drehen kann, wogegen das andere Ende (6') durch eine Feineinstellschraube (22) mit einem Bimetallstreifen (7) verbunden und mit einem beweglichen Anker (20) aus magnetisierbarem Eisen versehen ist und von der Bauart mit Kerbe oder Öffnung (17) für das Einrasten einer Spitze (5), die von einem Einrastegestell (4) getragen wird, bis das besagte Auslösungsblättchen (6) verschoben wird, um die Auslösung des besagten Einrastegestells hervorzurufen, dadurch gekennzeichnet, daß der Körper des Auslösungsblättchens (6) einen Mittelteil von erheblicher Länge in bezug auf die Gesamtlänge besitzt, versehen mit Einschnitten (13), die sich durch die gesamte Dicke des Blättchens erstrecken und in einer Richtung senkrecht zur Ebene des Auslösungsblättchens angebracht sind und sich quer zu Längsrichtung desselben erstrecken, wobei sich die Öffnungen der Einschnitte abwechselnd an den gegenüberliegenden Längsrändern des Auslösungsblättchens befinden und jeder Einschnitt so genau ausgeführt ist, daß seine Schenkel (13'—13'') zusammentreffen und einer auf dem anderen aufsitzt, um das besagte Auslösungsblättchen widerstandsfähig gegen die Biege- und Druckbeanspruchung zu machen, welche von der Spitze (5) des Einrastegestells (4) übertragen wird, wobei die besagten

Einschnitte dem Auslösungsblättchen die Form eines fortlaufenden gewellten Streifens (16) von verminderter Breite verleihen, sodaß das besagte Auslösungsblättchen sehr biegsam wird und ohne erheblichen Widerstand durch den Zug gebogen werden kann, der vom Bimetallstreifen (7) oder dem beweglichen Anker (20) ausgeübt wird, um im Falle von Überlast- oder Kurzschlußstrom die Auslösung zu bewirken.

2. Auslösungsblättchen nach Anspruch 1, dadurch gekennzeichnet, daß entlang dem besagten Mittelteil annähernd gleiche Öffnungen (14) aufeinanderfolgend ebenso wie die besagten Einschnitte (13) angebracht sind, und daß in jeder dieser Öffnungen das innere Ende des entsprechenden Einschnittes (13) einmündet, sodaß die Biegsamkeit des gewellten Streifens (16) erhöht wird und die genaue Ausführung der Einschnitte ohne Verformung des besagten Auslösungsblättchens ermöglicht wird.

3. Auslösungsblättchen nach Anspruch 2, dadurch gekennzeichnet, daß in den besagten Öffnungen (14) wenigstens eine gerade Seite (15) in Richtung der Einschnitte vorgesehen ist, wobei jeder Einschnitt in der Verlängerung einer solchen Seite (15) angebracht ist.

4. Auslösungsblättchen nach Anspruch 1, dadurch gekennzeichnet, daß der Endteil des Auslösungsblättchens, der durch die Feineinstellschraube (22) mit dem Bimetallstreifen verbunden ist, einen länglichen Schlitz (24) besitzt, welcher seine Öffnung auf dem anderen Rand (6') des Auslösungsblättchens aufweist und eine Gewindebohrung (21) überquert, in welches die besagte Feineinstellschraube eingreift, wobei der besagte Schlitz in der Längsrichtung den besagten Endteil in zwei parallele Zungen (25—26) trennt, die in der Lage sind, eine gegenläufige Neigung zur Ebene des besagten Auslösungsblättchens einzunehmen, sodaß die Ränder der Gewindebohrung, in welche die Feineinstellschraube eingesetzt ist, schräg gegen die Windungen der besagten Feineinstellschraube gedrückt werden, um ihre spontane Lockerung zu verhindern.

5. Auslösungsblättchen nach Anspruch 4, dadurch gekennzeichnet, daß der Endteil des Auslösungsblättchens ein Halte Loch (18) besitzt, von dem der Längsschlitz (24) ausgeht, einen magnetisierbaren beweglichen Anker (20) in Form einer Platte, die einen Fortsatz (19) besitzt, welcher mit Einrastung durch das Halte Loch (18) gedrückt werden kann, wobei der magnetisierbare bewegliche Anker an seinen unteren Ecken auch zwei entsprechende Lager (27 und 28) besitzt, die ausgebildet sind, um auf den Zungen (25 und 26) nahe ihrem äußeren Rand aufzusitzen, um die Zungen in der richtigen Neigung zur Ebene des Auslösungsblättchens zu halten, der Fortsatz (19) des magnetisierbaren beweglichen Ankers durch das Halte Loch (18) gedrückt wird.

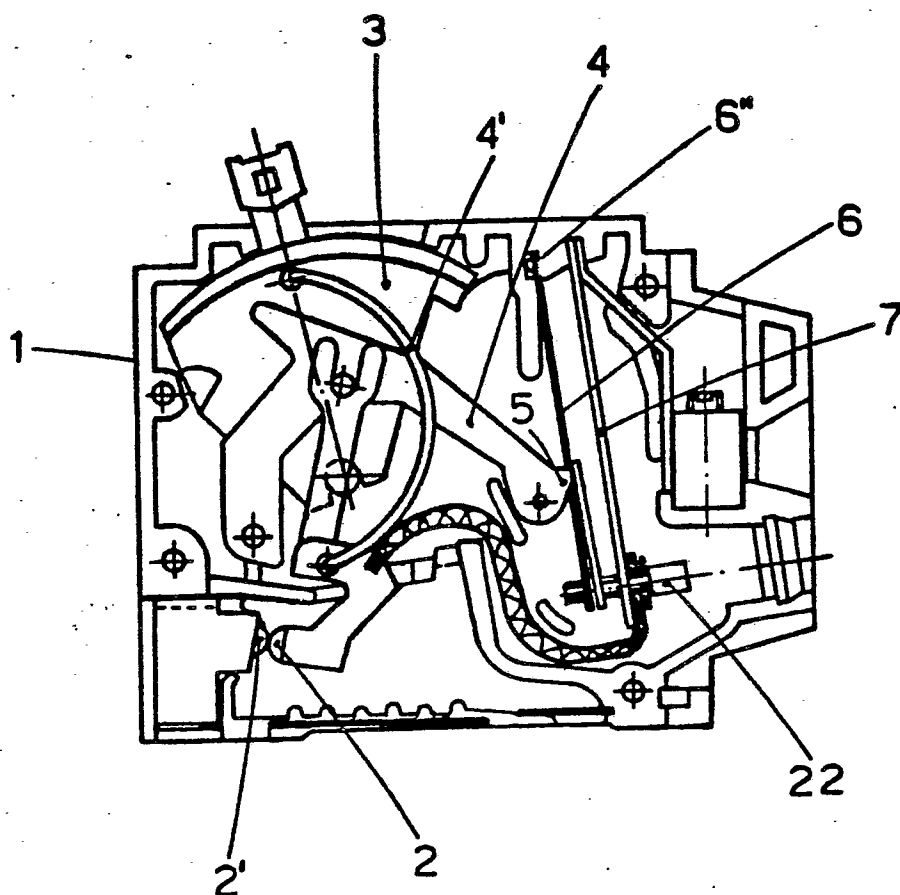
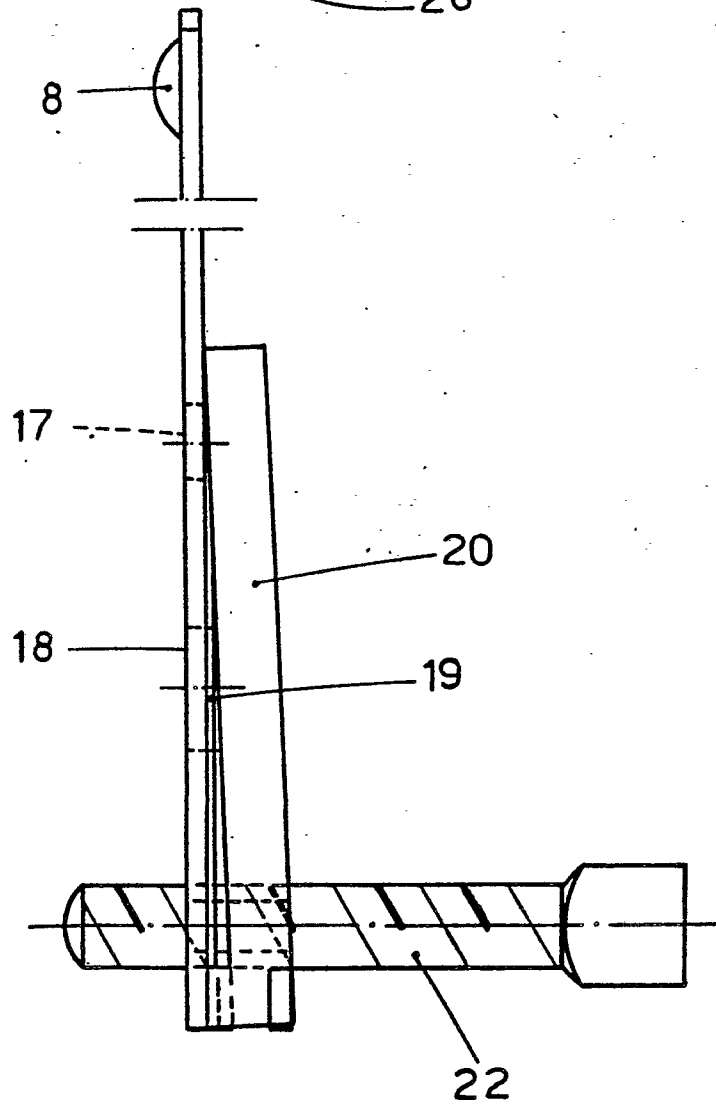
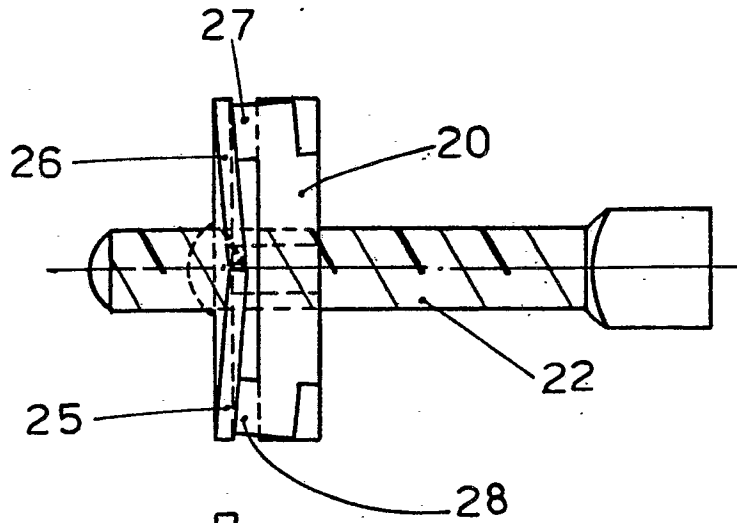


Fig. 1



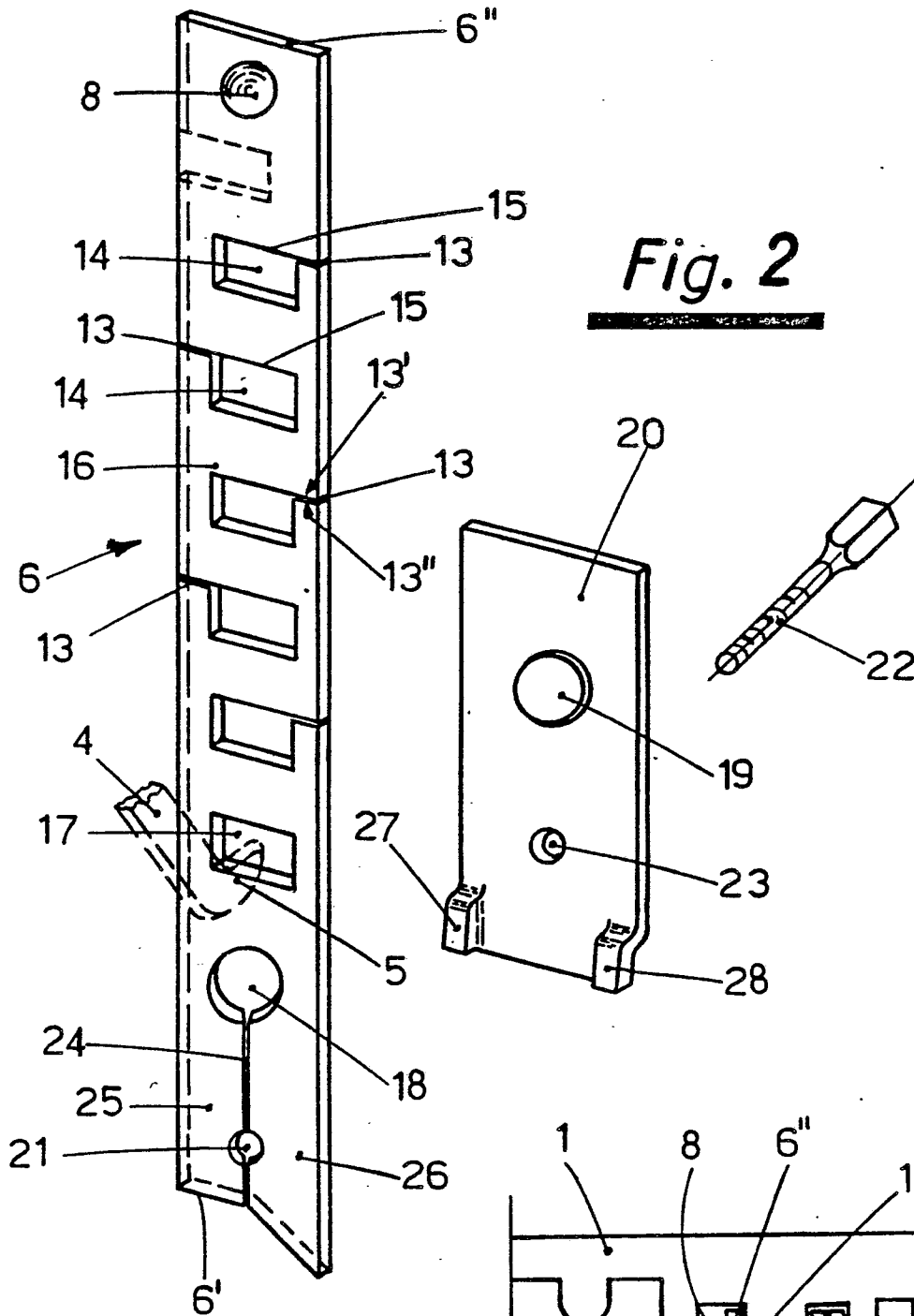


Fig. 2

Fig. 3

