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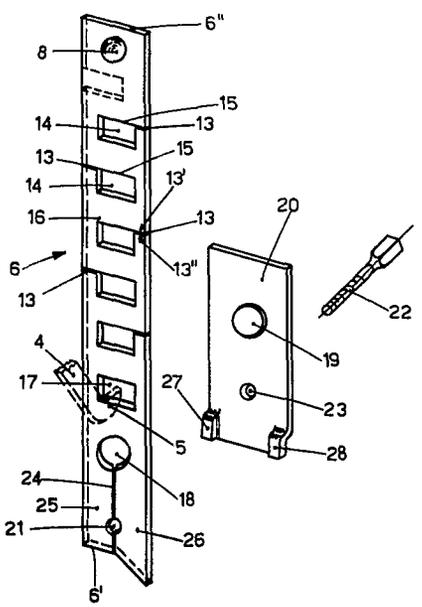
(54) Trip lamina for single-pole circuit breakers.

(57) The present invention is related to a trip lamina employable for single-pole circuit breaker.

The trip lamina (6) has an adequate thickness and is rendered very flexible because it is provided with shearings (13) interesting its whole thickness and that are transversal to the longitudinal direction of the lamina itself, said shearings having their respective outlets alternatively on both the longitudinal edges of the trip lamina, the latter being provided with successive holes (14) having at least one side (15) directed transversely to the longitudinal direction and prolonged by a respective shearing (13), said shearings being so finely executed that their 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) of the circuit breaker.



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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 is preposed to 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 steadly the stationary and the movable contacts in a close position.

When, on the other end, an anomalous increasing 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 in 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 umproper tripping if the mechanism is subjected to vibrations.

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

Consequently, it is preferred to constrain the trip lamina so that it may rigidly rotate around one of its own ends inserted in a seat provided in the moulded case.

This solution, however, requires the employment of adjustement means to adjust the angular latching position

and the employment of elastic means to recall the same lamina in said latching position after every displacement caused by the bimetallic strip or by the magnetic attractions means.

Said adjustement and recalling means even if they are simply constituted by a screw or by a spring are, in any case, additional members that weight 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 mean 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 weight heavily on the whole cost of the circuit breaker.

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 altough assuring the necessary latching, it shows a low resistance to the bending, so that it may elastically bent under the forces exerced by the bimetallic strip and by the magnetic attraction means and does not require recalling means and adjusting means for its angular latching position, nor additional means for preventing the unscrewing of the calibration screw.

The trip lamina of the present invention is characterized by an elongate laminar body having its middle portion, of relevant lenght with respect to the whole lenght, provided with shearings that interest 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 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 undulated 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 exerced by the bimetallic strip or by the magnetic traction means to trip in overload or short circuit current

conditions and it is also characterized by the fact that one end of said trip lamina is received in a seat provided by the moulded case and it is so constrained that it may not rotate with respect to said seat.

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 of said shearings and in each one of which the inner end of a respective shearing has its outlet, so that the flexibility of the undulated strip is increased and the execution of the shearings in a precise manner and without deformation of the same 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 the ending edge of the same trip lamina and traversing the threaded hole engaging said calibration screw, said longitudinal slit separating said ending portion in 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.

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, 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 fig. 1 showing the seat provided in the moulded case receiving the fixed end of the trip lamina.

Figure 4 and 5 shows, in a more enlarged scale, a side view and a 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 accomodating a snap mechanism that will not be specified in details.

In effect said snap mechanism, may be every 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 for the displacement of the manual operating member 3 or for 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 fig. 1, however, constitutes the object of a separated patent application, filed simultaneously to 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 relief 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 the projection 8, preventing said upper end 6" from every rotatable movement. Furthermore said seat 9 is provided with a peripheral slot 12 directed inwardly 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 lenght of the same trip lamina, is provided with transversal shearings 13 that have their outlets alternatively on both the 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 13and the eventual disposition of apertures 14 generates on the trip lamina 6 an undulated continuous strip 16, having particularly, square ondulation, each side of the ondulation 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 shoulding between the edges 13' and 13" of each shearing 13 prevents the trip lamina 6 from being bent under the benting and compressive stress exerced by the tip 5 of the latching cradle 4.

This advantage could not be obtained when a very thin flexible trip lamina was 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 shoulding 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 presented by 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 exerced in correspondence of the slit 24 by means of a suitable fixture, said projecting bearing 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 exerced 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 exerce 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 intended by the appended claims.

Claims

1. Trip lamina for single-pole circuit breakers of the kind having a band shape (6) having one end (6") received in a seat (9) of the moulded case (1) of the single-pole circuit breaker 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) said trip lamina (6) being 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 relevant lenght with respect to the whole lenght, provided with shearings (13) interesting 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 both 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 generating on the trip lamina a continuous undulated 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 exerced by the bimetallic strip (7) or by the magnetic traction means (20), to trip in the event of an overload or short circuit

current and further characterized by the fact that one end (6") of said trip lamina is received in a seat (9) provided by the moulded case and so constrained that it may not rotate with respect to said seat.

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 of 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 undulated strip (16) is increased and the execution of the shearings in a precise manner is allowed and without the deformation of the same trip lamina.

3. Trip lamina according to claims 1 and 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 the edge(6') of the same trip lamina and trasversing the threaded hole (21) engaging said calibration screw, said longitudinal slit separating said ending portion in 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 claims 1 and 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 is 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, 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).

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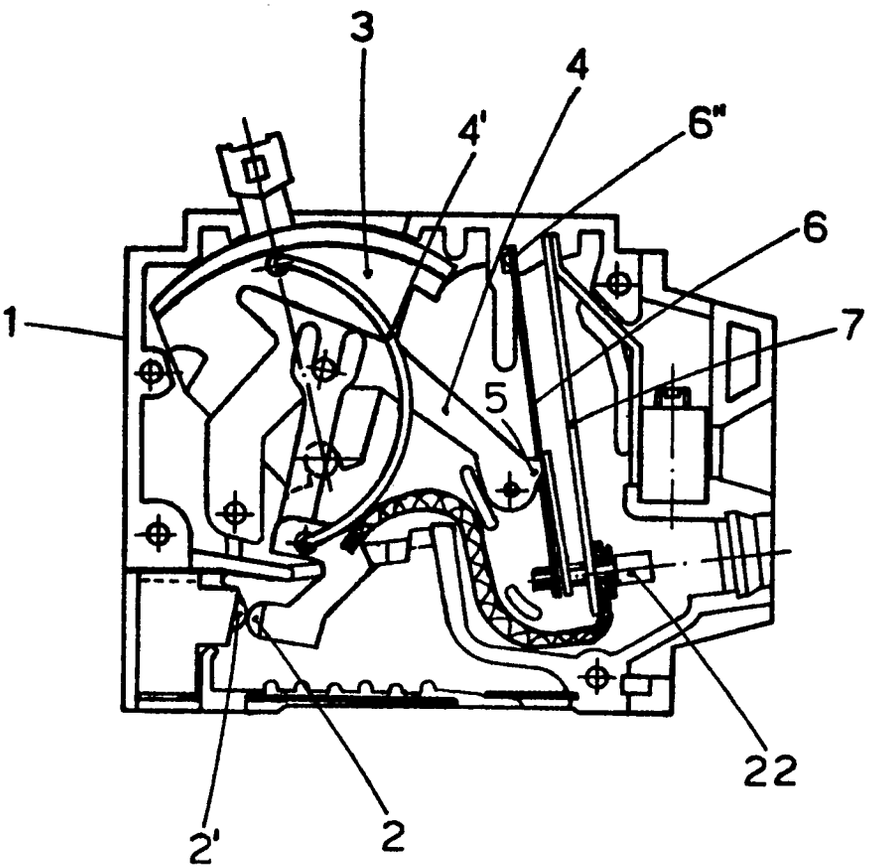

Fig. 1

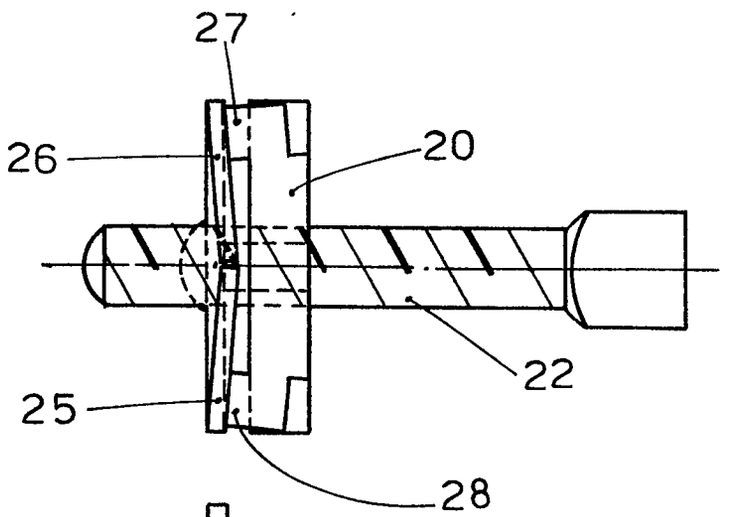

Fig. 5

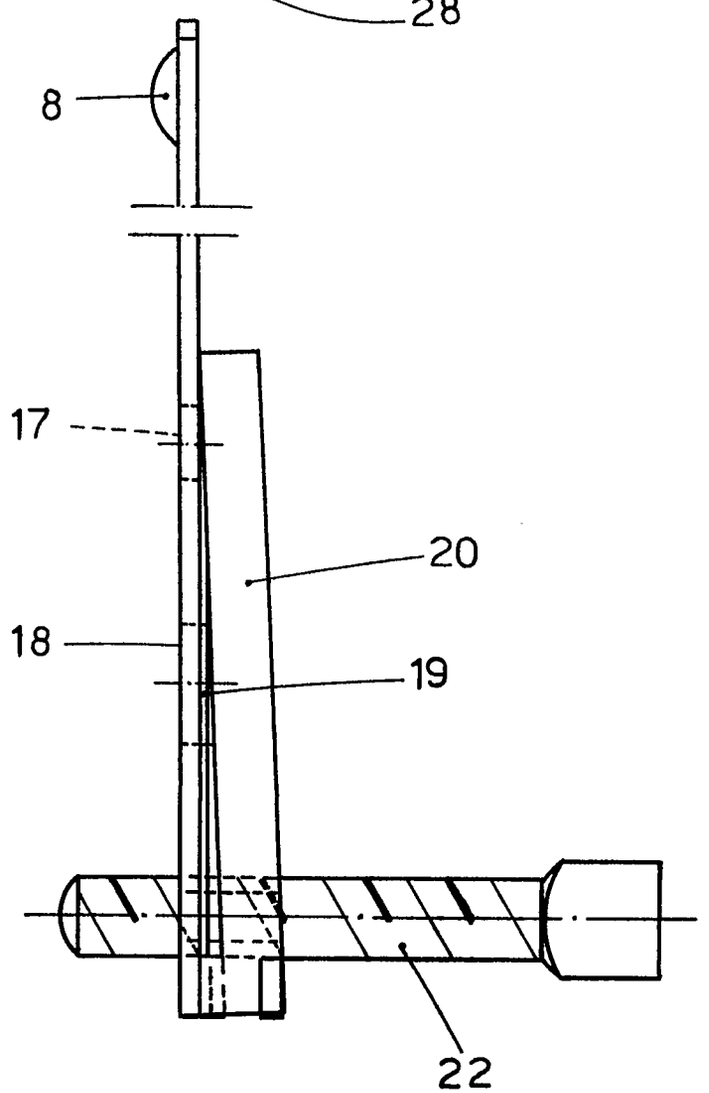

Fig. 4

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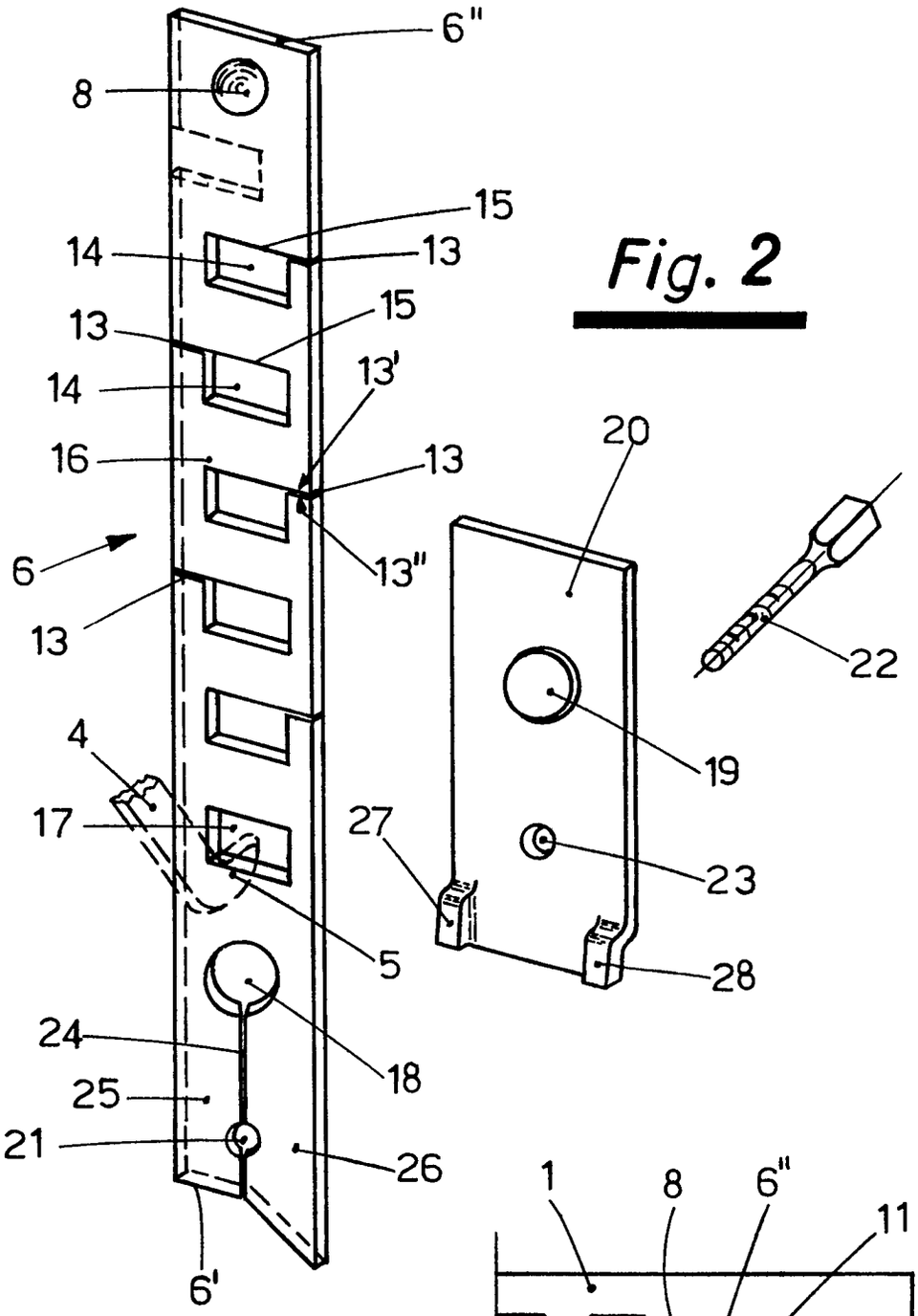

Fig. 2

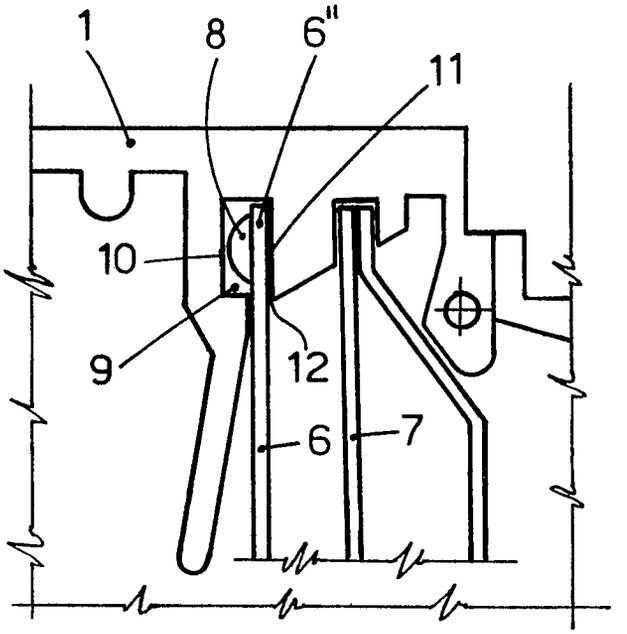

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application number
0020311
EP 80 83 0031

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US - A - 2 308 401 (E.H. TAYLOR) * Page 1, left-hand column, lines 31-73 *	1
A	US - A - 2 824 191 (P.M. CHRISTENSEN) * Column 5, lines 20-35 *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

H 01 H 71/50

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

H 01 H 71/50
71/40
3/46
73/50
73/24
71/74
71/16

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29-08-1980	LIBBERECHT

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