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(54) A shutter device for socket openings

(57) A shutter device for electrical socket openings, in particular sockets having offset openings, in which a rigid shutter element is housed between a front plate and a rear plate of the device, free to rotate about a first axis parallel to the axes of the two live openings in the socket, equidistant from and in the same plane as these, and free to oscillate about a second axis perpendicular to the said plane and intersecting the first axis.

The shutter element, biased to an obstruction position by a spring, is provided with shutter arms each having an inclined plane facing one of the two "live" socket openings, and is displaced from the obstruction position by an action exerted on the inclined plane of each arm only if the action is exerted on both arms together and the shutter is in a predetermined angular position about the second axis.

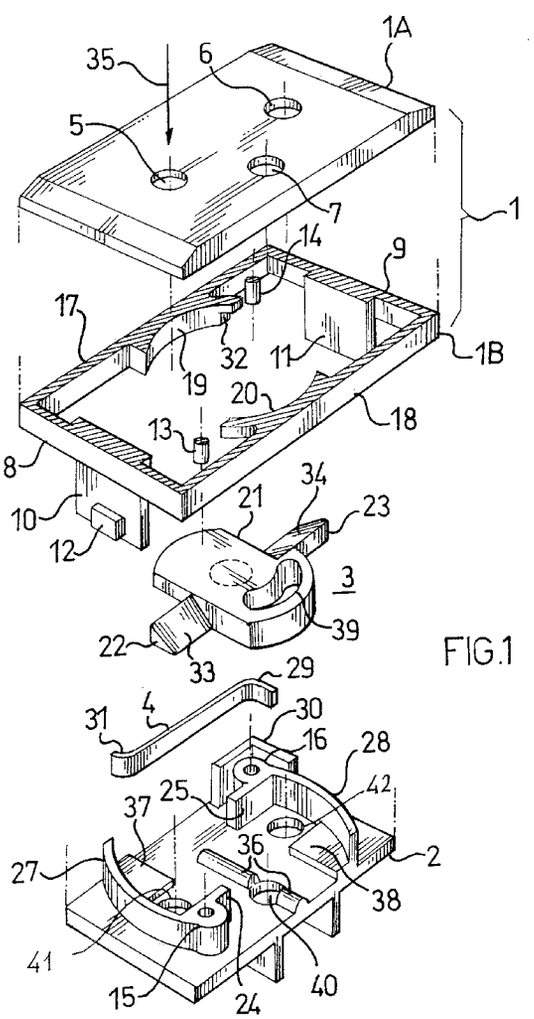

FIG.1

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Description

The present invention relates to a shutter device for socket openings in sockets having an offset earth pin opening.

Electrical sockets are known having three openings in line, with the earth opening being the intermediate or central one, provided with shutters for the outer or live openings.

The openings are formed in a front plate of an insulating body, generally constituted by two connected half shells which form a housing for the metal electrical contacts and for the shutter.

The shutter is made of insulating material and is provided to prevent access to the electrical contacts through the socket openings by either a single electrical pin or, more generally, of any improper element, and should allow access to the sockets only if two pins are jointly introduced into the openings of the "live" socket openings.

This ensures the correct insertion of the plug and eliminates the risk of accidental contact with live electrical parts due to an improper insertion of an electrical pin or other element into the socket.

Shutter devices which allow this result consist of an element having two radially opposite resilient arms on either side of a central aperture of the element.

The shutter element is housed in the insulating body of the socket behind the front plate in which the holes are formed, and its middle region is provided with helical teeth (or equivalent means) which pass around a helical support which surrounds the central or earth opening, formed in the insulating body behind the front wall.

The shutter is biased into a closure position, obstructing the live openings, by a compression spring which urges it axially of the openings towards the front plate from the inside thereof.

In this position the shutter is turned on the helical support to an angular position such that its radial arms are aligned with the live socket openings, obstructing them, and are moreover housed with their ends in two cavities formed on the inside of the front plate which prevent the rotation of the shutter.

To release the shutter from this position it is necessary to act jointly on the ends of both arms through the live socket openings and resiliently deform them in such a way as to disengage them from the housing cavities.

At this point a further thrust exerted on the arms causes rotation of the shutter with consequent free access to the live socket openings.

On the other hand a force exerted on the end of only one of the arms through one of the socket openings causes resilient deformation thereof but does not allow disengagement of the other end of the arm from the respective cavities, and therefore rotation of the shutter is prevented.

This type of shutter has a number of disadvantages:

- the shutter arms must be flexible in a direction perpendicular to the front plate and relatively rigid in the other directions, which requirements are difficult to reconcile with one another;
- the arms are stressed and become fatigued by the effect of repeated insertions and have a limited useful life
- the size of the shutter device in the axial direction of the socket openings, that is to say perpendicular to the front plate of the socket, is relatively large because the rotation of the shutter on its axis is associated with an axial displacement of the shutter.
- it cannot be used in the case of sockets having offset socket openings, for example of the type defined in regulation IEC 906-1 because the offset of the earth opening does not allow a helical support to be formed for rotation of the shutter around the offset socket opening and at the same time having its axis aligned with the live socket openings, nor can a support for the rotation be disposed laterally of the earth opening without interfering with it.

To overcome the disadvantage of the limited useful life of the shutter arms devices have been proposed in which the shutter arms are rigid and the helical support which surrounds the central socket opening engages with the helical teeth of the shutter only if the shutter is conveniently displaced, with axial sliding motion along the helical support away from the front wall by the effect of a symmetrical thrust exerted through the two socket openings.

In another arrangement a helical spring engaged on the support acts as a yieldable mounting which allows the shutter to move to an inclined position in relation to the front wall with the end of one arm which remains engaged in one of the two cavities preventing the rotation of the shutter. Even this arrangement does not, however, remedy the other disadvantages and limitations mentioned.

These disadvantages are completely eliminated by the shutter device for electrical socket openings, in particular of the offset socket opening type, which forms the subject of the present invention, which device is constructionally simple, compact and reliable.

These results are achieved, according to the invention, by a shutter device in which a shutter having rigid arms is mounted in a housing free to rotate through a predetermined angle about a first axis of rotation parallel to and coplanar with the axis of the two live socket openings and equidistant from these, and at the same time free to rotate transversely of the first axis of rotation about a second axis of rotation defined by a supporting wedge perpendicular to the plane defined by the axis of the two live openings.

A leaf spring biases the shutter to the closed position.

The ends of the shutter arms facing the socket openings are shaped to have inclined planes with orien-

tations, relative to the first axis of rotation, along a generally helical surface in such a way that a thrust exerted on the inclined planes through the socket openings develops a couple for rotation of the shutter.

If the action exerted on the arms is balanced and the shutter is in a predetermined angular position with respect to the second axis, this couple, by overcoming the action of the biasing spring, displaces the arms to a position in which the socket openings are unobstructed.

The shutter housing is provided with projecting teeth which interfere in a mutually exclusive manner with one or the other end of the arms when, by the effect of an unbalanced action applied through the socket openings, the shutter assumes, in relation to the second axis, an angular position different from the predetermined position. The interference with the projecting teeth prevents the shutter arm from rotating to clear the socket openings.

The shutter is provided at a transverse median portion with a slot which is eccentric with respect to the first axis of rotation and which, in any position assumed by the arm, faces the earth opening in such a way as not to obstruct the introduction of an earth pin into this opening.

The characteristics and advantages of the invention will become clearer from the following description of a preferred embodiment and from the attached drawings in which:

Figure 1 is an exploded perspective view of a preferred embodiment of the shutter device for electrical sockets with offset socket openings in accordance with the present invention and;

Figure 2 is an exploded perspective view of some constructional variants of components of the device of Figure 1.

With reference to Figure 1, a preferred embodiment of shutter device comprises a front plate 1 coupled to a rear plate 2 to form a housing for a shutter 3 and a biasing spring 4.

For greater clarity the front plate 1 is represented as "exploded" and sectioned along a plane parallel to the front surface.

The front plate 1 includes a rectangular substantially flat element 1A in which are formed three openings 5, 6, 7 for access to the socket pits one of which, the opening 7 is offset relative to the other two, and a rectangular frame 1B with two opposite sides 8, 9 provided with resilient tongues 10, 11 extending perpendicularly of the plane of the element 1A and terminating in an engagement tooth 12 for snap-engaging irreversibly with an insulating body of the electrical socket, not illustrated and otherwise conventional.

Within the frame 1B are formed two registration and fixing pins 13, 14 integral with the flat element 1A for insertion and fixing by adhesive or thermoplastic welding in corresponding seats formed in turrets 15, 16 of the rear plate 2.

Two opposite sides 17, 18 of the frame 1B are provided with internal arcuate portions 19, 20 which together with the flat element 1A define a cylindrical housing for a central body 21 of the shutter 3.

The axis of the cylindrical housing is parallel to, coplanar with and equidistant from the axes of the pits underlying the socket openings 5, 6.

The central body 21 of the shutter 3 is in the form of a cylindrical segment with a diameter substantially equal to that of the cylindrical housing so that it can be freely fitted into this with suitable clearance, and has two opposite radial arms 22, 23 extending therefrom.

The central body 21 is free to rotate within the cylindrical housing about the axis of the housing through a predetermined angle between an obstruction end position and a non-obstruction end position.

The obstruction end position is defined by the contact of the arms 22, 23 with respective abutment shoulders 24, 25 projecting from the rear plate 2 in radially opposite positions with respect to the axis of the cylindrical housing.

Advantageously the shoulders 24, 25 constitute parts of the turrets 15, 16 and are integrally formed with these for greater robustness.

Advantageously, as well as the shoulders 24, 25 there are two cylindrical arcuate wall portions 27, 28 formed so as to project from the rear plate 2, for radially confining the arms 22, 23.

The shutter arm is urged towards its obstruction end position by a leaf spring 4 one end 29 of which fits into an L-shaped channel formed between the turrets 16 and an L-shape shoulder projection 30 extending from the inner plate 2.

The free end 31 of the spring 4 acts on one side of the arm 22 and tends to cause the shutter 3 to rotate in an anticlockwise sense as viewed in Figure 1.

To facilitate mounting of the spring 4 on the rear plate 2 this is inserted with clearance into the L-shape channel and its working position is defined by an intermediate abutment shoulder 32 for the spring formed at one end of the arcuate portion 19.

To allow the spring 4 to act on the arm 22 without interference with the central body 21 of the shutter the spring 4 has a vertical dimension, with reference to Figure 1, less than the height of the housing and the thickness of the central body 21, which latter is conveniently cut away in its lower part.

The non-obstructing end position of the shutter 3 is defined by contact of the arms 22 and 23 respectively with the sides 17 and 18 of the frame 1B.

As is clearly visible in Figure 1 the upper faces 33 and 34 of the arms 22 and 23 respectively are inclined with respect to the plane of the front plate 1 along a generally helical surface which turns anticlockwise (with reference to the orientation shown in the drawing).

In this way a thrust exerted on the upper face 33 of the arm 22 through the socket opening 5, in the direction

of the arrow 35 and neglecting friction, acts on the arm 22 with a component perpendicular to the face 33 and a component perpendicular to and offset from the axis of rotation of the central body 21 which, upon overcoming the action of the spring 4, tends to make the shutter arm turn in a clockwise sense.

This action on only one arm 22, however, is not sufficient and it is necessary to exert an action of equal effect on the arm 23 as well.

In fact, as shown in Figure 1, the rear plate 2 is provided with a projecting support wedge 36 the vertex of which is disposed diametrically in relation to the cylindrical housing and perpendicular to the plane defined by the axis of the socket openings 5 and 6.

In this way the shutter 3 formed by the central body 21 of the arms 22 and 23 is not only free to rotate through a predetermined angle around the axis of the associated cylindrical housing, but can become inclined, like a rocker, by rotating on the fulcrum defined by the edge of the supporting wedge 36 which defines a second axis of rotation.

The amplitude of this oscillation is defined by the difference between the thickness of the central body 21 and that of the arms 22, 23 (conveniently, but not necessarily, the same as one another) and the height of the housing between the front plate 1 and the rear plate 2 less the height of the supporting wedge 36.

In addition to the supporting wedge 32 the plate 2 is formed with two projecting teeth 37, 38 the height of which is equal to or slightly less than that of the wedge 36, which form with the opposite shoulders 24 and 25 two grooves for partially housing the teeth 22 and 23.

In this way, if the shutter arm 3 is disposed parallel to the plane of the rear plate 2, in turn parallel to the front plate 1, the shutter arm is free to turn from the obstruction position to the non-obstruction position.

On the other hand, if due to the effect of external forces applied to the faces 33 and 34 through the socket openings 5 and 6 the shutter arm should become inclined with respect to the position parallel to the plates, at least one of the arms 22, 23 will be engaged in the grooves formed between the teeth 37, 38 and the shoulders 24, 25 and prevents rotation of the shutter arm about the axis of the cylindrical housing within which the central body 21 is located.

In conclusion, the operation of the shutter device described is based on the combination of several essential aspects:

- the shutter 3, obviously of insulating material, is rigid and capable of rotating about a first axis parallel to the direction of insertion of a pin into the socket openings of the device,
- the shutter arm 3 is capable of inclination upon rotation about a second axis perpendicular to the first and to the plane defined by the axis of the two live openings in the socket, which must be obstructed,
- the ends of the shutter arm have a surface facing the socket openings which is inclined helically with the axis of the helix coinciding with the first axis of rotation,
- blocking teeth prevent rotation of the shutter arm about the first axis if the arm is inclined due to the effect of external forces, relative to a front plane in which the socket openings are formed.

Although the shutter device described can find application in electrical sockets having aligned socket openings it is particularly advantageous in the case of sockets having offset socket openings.

To this end, as shown in Figure 1, the central body 21 is provided eccentrically with an ovoidal aperture 39 which faces the socket opening 7 in any angular position assumed by the body 21.

The internal plate is provided with an aperture 40 axially aligned with the socket opening 7 and through which can be introduced into the socket a connection pin or earth connector, and apertures 41, 42 axially aligned with the socket openings 5 and 6.

The preceding description relates only to a preferred embodiment which is susceptible of many variations.

For example, as shown in Figure 2 (where functionally equivalent elements to those of Figure 1 are identified with the same reference numerals) the wedge 36 supporting the shutter arm can have a rounded barrel-like section for greater resistance to wear.

Moreover the position of the central body 21 of the shutter arm in its housing can be obtained, rather than by coupling the outer cylindrical surface of the central body 21 with annular elements of the front plate, instead by means of a centring pin 50 which supports it for rotation and is formed on the rear plate 2 and is a clearance fit in a corresponding, preferably conical, aperture 51 in the central body 21.

It is clear that the pin 50 can be formed on the front plate 1 rather than on the rear plate 2.

The use of a pin such as 50 makes the arcuate guides 19, 20 and 27, 28 entirely superfluous although these can be provided purely for additional robustness.

Since the pin 50 must have the single function of supporting the shutter for rotation without the screw function for giving the shutter any rotation, and since no compression coil spring is necessary on the pin 50, the pin can have an adequate diameter for its robustness and at the same time be sufficiently small so as not to interfere with the ovoidal access aperture for the offset earth opening of the socket.

Finally the housing for the spring 4, the shoulders 24, 25, the turrets 15, 16 and the teeth 37, 38 can be equally well formed integrally with the rear plate or the front plate.

Claims

1. A shutter device for the socket openings of an electrical socket, having at least two live socket openings in a front plate defining a plane, comprising:

   - a rear plate parallel to the said front plate and coupled to the said front plate to form a housing underlying the said front plate,
   - a rigid shutter element housed in the said housing and free to rotate through a predetermined angle between first and second angular positions about a first axis perpendicular to the plane of the said front plate, aligned between the said two apertures and equidistant from these, the said shutter element having a central body and two shutter arms radially opposite one another across the said first axis;
   - a support fulcrum for the said shutter element extending from the said rear plate to allow a limited rotation of the said shutter element within the said housing about a second axis intersecting the said first axis and perpendicular to a plane defined by the said first axis and the centres of the said two socket openings;
   - biasing means for biasing the said shutter element to the first angular position in which the said shutter arms are in juxtaposition with the said two apertures, and present towards the said apertures a helically inclined surface relative to the said first axis in such a way that the thrust exerted on the said inclined surfaces through the said two apertures develops a couple which displaces the said shutter towards the said second angular position, and
   - means for locking the said shutter element in the said first angular position for angular positions of rotation about the said second axis different from a predetermined angular position.

2. A device as in Claim 1, including a third socket opening in the said front plate offset with respect to the said two socket openings and an ovoidal aperture in the said central shutter body facing the said third socket opening for any angular position of the said shutter element between the said first and second angular positions thereof.

3. A device as in Claim 1 or Claim 2, in which the said biasing means comprises a leaf spring held fixedly at one end with its free end acting on one of the said shutter arms.

4. A device as in Claim 1, 2 or 3, in which the said central body of the shutter is in the form of a cylindrical segment housed between two cylindrical arcuate guides formed by two opposite sides of a frame of the said front plate.

5. A device as in Claim 1, 2 or 3, in which at least one of the said front and rear plates includes a support pin for supporting the said shutter element for rotation with its axis coincident with the said first axis, the said pin being engaged with clearance in a corresponding opening in the said central body.

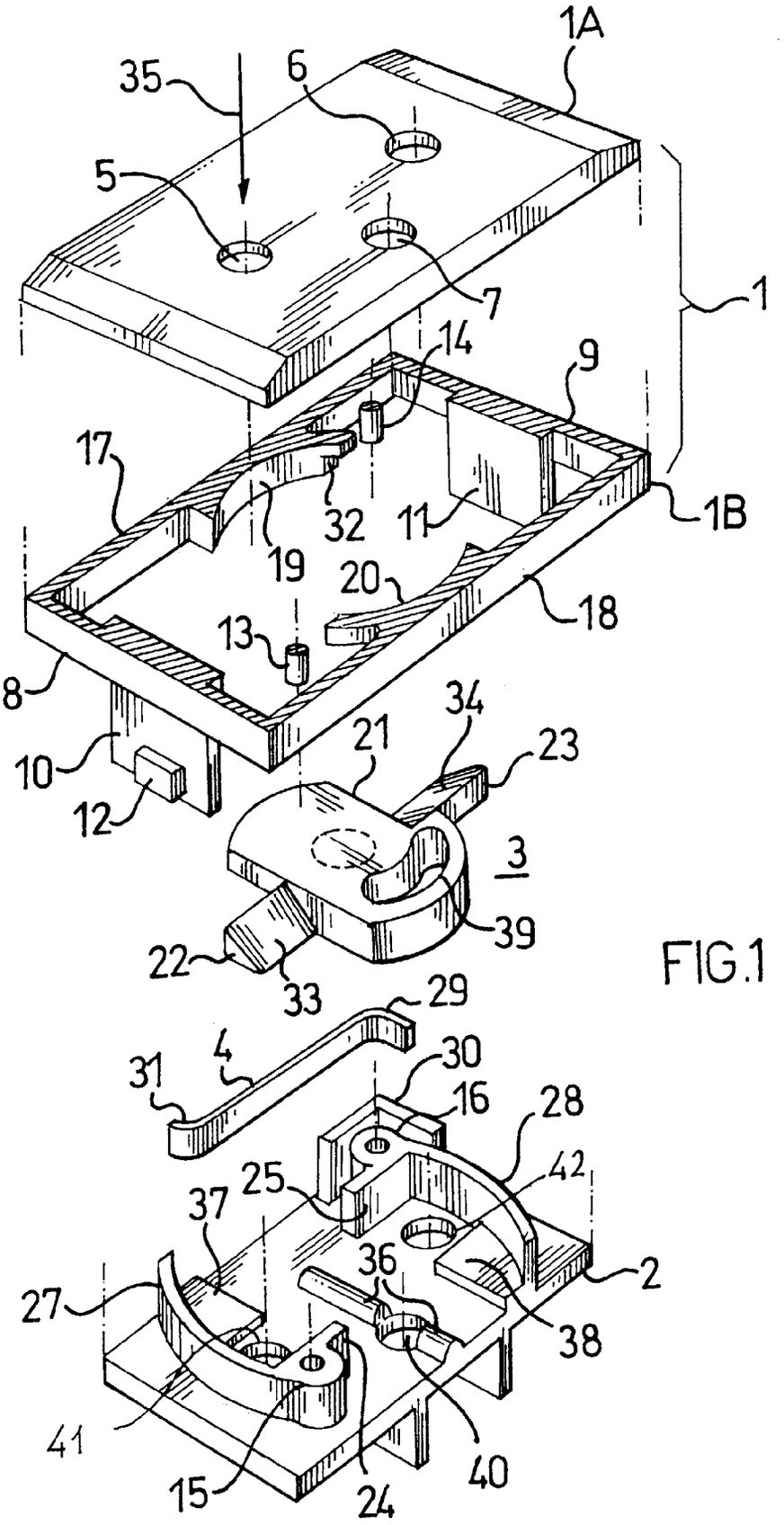
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FIG.1

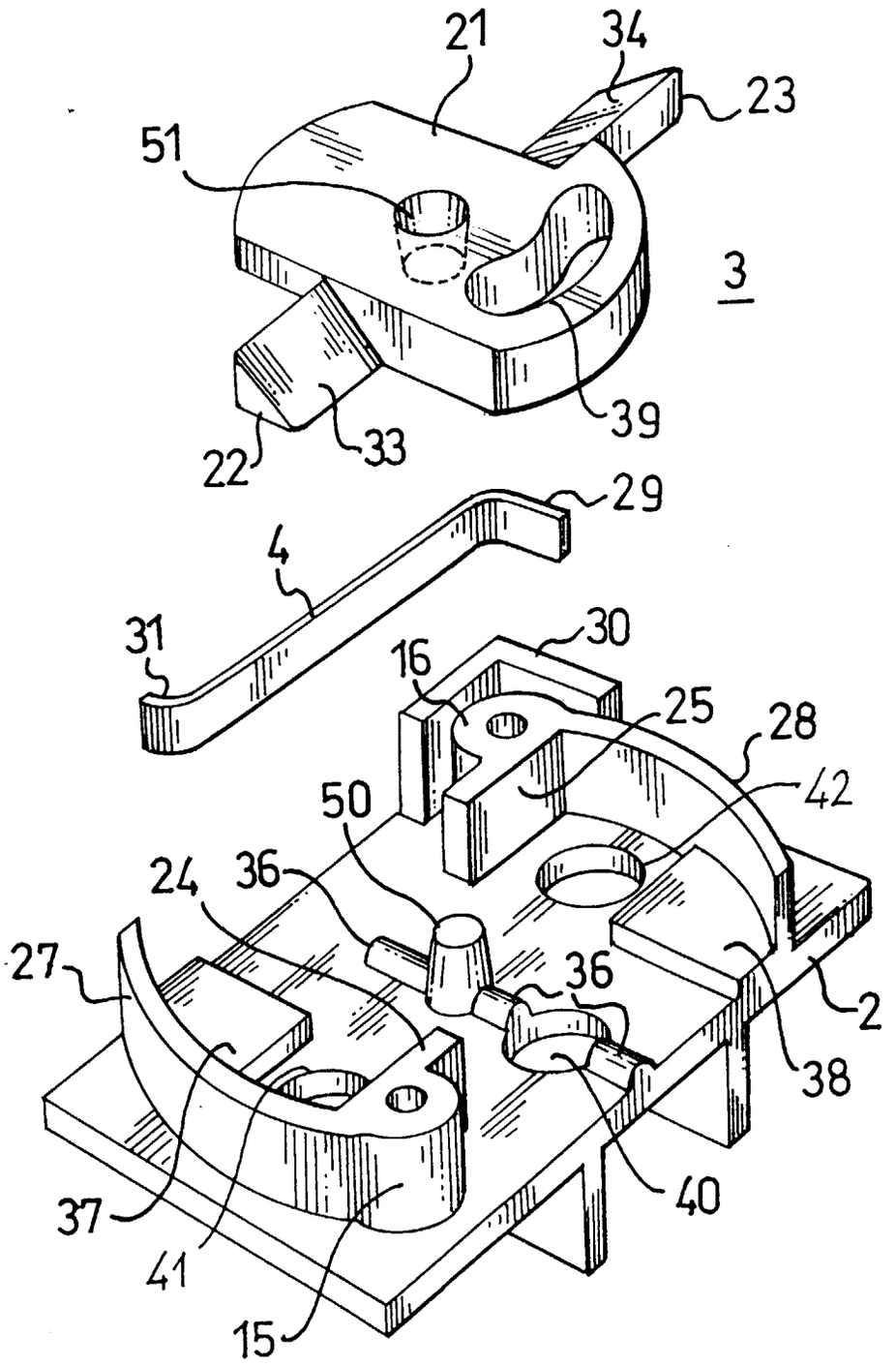
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FIG.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1438

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-B-12 18 035 (JOSEF SCHÖNER) * the whole document * ---	1,3	H01R13/453
A	DE-A-14 40 822 (GEBR. BERKER) 21 November 1968 * page 4; figures 1-8 * ---	1,4	
A	FR-A-2 619 966 (GARRIGOU JOEL) 3 March 1989 * page 1 - page 2; figures 1-3 * -----	2,5	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 July 1996	Tappeiner, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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