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(54) **ELECTRICAL CONNECTION DEVICE**

(57) The invention relates to an electrical connection device. The inventive device comprises a casing (5) which can receive a plurality of terminal contacts (7) therein. According to the invention, the terminal contacts (7) are intended to be joined to corresponding external conductors (1) under the action of elastic clamps (11) which can be actuated from the exterior perpendicularly to the plane of the external conductors (1). The aforementioned elastic clamps (11) take the form of a flat spring that forms a loop (12). Both sides of the clamps are equipped with legs (14) which are designed to transmit the forces generated by actuation of the elastic clamps (11) to a lower cap (18), thereby enabling both the terminal contact (7) and the external conductor (1) to be housed between the legs (14). The invention comprises several staggered elastic clamps (11) in which different external conductors (1) can be connected. Each of said elastic clamps (11) can be actuated by push buttons (19) with parallel shafts which are disposed in the same vertical plane.

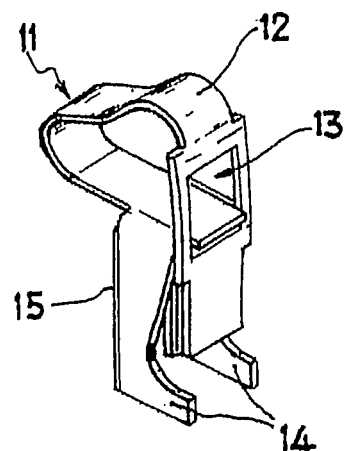


FIG. 5

Description

[0001] The present invention refers to an electrical connection device which introduces certain improvements into the management of the space available and absorption of the stresses needed to assure a proper electrical contact. Its use takes place in the field of the connecting of electrical components to external conductors, as well as in the interconnection of these to form connecting terminal strips.

Background of the invention

[0002] Electrical connectors that trap the conductor against the terminal contact by means of a clamping spring in the form of a leaf spring have been known for a long time. Thus, in 1905 patent document US 829883 was published in which a connecting terminal for electrical appliances is described, using a leaf spring that is directly accessible to the operator for immobilising the conductor. Since the spring is secured between the terminal and the housing of the electrical appliance it is subjected to a certain mechanical stress. If a number of conductors have to be connected at the same time, there is a possibility of making use of a floating spring, as described in US 2068314.

[0003] The search for a solution that does not transmit stress to the housing of the electrical appliance leads to a device in which the leaf spring is connected directly to the terminal contact, as described in US 3696229. The disadvantage of this solution is that it is especially adapted to the simultaneous connection of two external conductors. Some years later a loop-shaped leaf spring would be developed that is supported and kept in tension by the actual terminal contact. Document ES 8301067 illustrates this type of solution which determines a shape for the clamping spring that has come down to our times basically unchanged. In this document the problem is already posed of the direction of actuation on the clamping spring to release the conductor from the terminal contact, and thus its figure 3 describes a parallel actuation of the conductor by means of a wedge, while figure 2 describes a perpendicular actuation by means of a push-button.

[0004] Thereafter a succession of numerous minor modifications took place usually seeking an improvement in technical features, such as higher contact pressure in US 2003/0017754, inclusion of plug-in devices in ES 2143775, electrical bridging of various circuits in US 4171861, direct insertion of the external conductor as in US 5975940, and so on.

[0005] However, in recent times, possibly due to the fact that it is a very mature technology that has achieved a high degree of technical sophistication, attention is placed on an improvement of the economic aspects, which has led to various lines of development.

[0006] What is sought sometimes is miniaturisation; as in the above-mentioned document ES 2143775 (re-

ception of a socket inside the clamping spring) or in the later US 6010376 ("concealment" of the clamping spring loop) and US 6155890 (the clamping spring "embraces" the conductor).

[0007] Special attention is also paid to simplification, both of the cases and of the clamping spring and of the terminal contact, without overlooking the installation operations. Thus, US 5975940 describes a connector to join a plurality of connectors to a set of busbars, which, besides allowing the direct insertion of the conductor without a separate actuation on the clamping spring, permits a linear installation on a housing of the clamping spring-contact assembly, which is secured in position by means of a cover which is attached to the base with interlocking means. This in-line installation philosophy of a plurality of springing clamp-contact assemblies on a common base is a radical departure from the previous technology based on immobilising the clamping spring by lateral installation on a modular housing of a single "wafer" type conductor, as described for example in US 4171861, which calls for the stacking of a large number of "wafers" to form the end device, sometimes requiring external interconnection means. The solution described in US 5975940, however, does not permit an external actuation on the clamping spring, which is necessary when we want to connect flexible conductors made up of a plurality of small diameter wires.

[0008] Simulating the previous one, document DE 19610958 addresses this last problem with a similar philosophy. The solution proposed consists of providing for an actuation of the clamping spring parallel to the external conductors, supporting the terminal contact on the base and on the cover. Accordingly, the terminal contact has to be considerably resistant to bending in order to withstand the actuation on the clamping spring in the manoeuvre of releasing the external conductors. The insertion of the clamping spring-contact assembly in the base during assembly represents an additional problem, as, if we want to have a ramp that facilitates the opening of the clamping spring, the insertion operation may prove complicated. The addition of the ramp to the cover instead of to the base facilitates coupling to the latter but interferes with the prior union between the cover and the clamping spring-contact assembly.

[0009] Lastly, document EP 136765, which constitutes the closest prior art, describes a connector very similar to the previous one wherein the problem of the ramp is resolved by reducing its width, so that it may be inserted by way of a slot provided in the clamping spring-contact assembly during the cover coupling manoeuvre. In this way, the clamping spring-contact assembly may be fitted on the base with a simple linear insertion. As in the previous case, the actuation on the clamping spring is parallel to the external conductor and the terminal contact bears the clamping spring opening stress as a beam supported at the ends.

[0010] In the case of the present invention the intention is to rationalise production in such a way that either a

conventional terminal with the conductor being tightened by a screw or an automatic connection with tightening by a clamping spring may be fitted on the same base (usually made from an injected plastic).

[0011] Another object of this invention is that the clamping spring-terminal contact assembly should be fitted by means of a linear insertion operation from the under side of the device.

[0012] Another object of this invention is the clamping spring-terminal contact assembly should be immobilised inside the base when coupling to this a lower cover common to all the external conductors.

[0013] Another object of the invention is that the actuation on the clamping spring for its opening may be effected in a direction perpendicular to the insertion of the external conductors.

[0014] It is lastly a further object of the invention that the external conductors may be disposed at various levels in order to take maximum advantage of the height of the relay or electrical device intended to be connected to the external conductors by means of the device of the invention.

Description of the invention

[0015] The solution proposed consists of endowing the loop-shaped strip that forms the clamping spring with two lower legs which withstand the bending stress of the clamping spring during its opening, while at the same time they permit the external conductor and the terminal contact to pass between them. In this way, the latter does not bear the spring bending stress and may be sized in accordance with its electrical load only.

[0016] Such a solution furthermore permits a ladder arrangement allowing various levels of external conductors. An actuation on the clamping spring perpendicular to the external conductors is envisaged, which permits maximum utilisation of the space available, both for locating external conductors and for situating the respective pushbuttons that will permit the opening of the clamping springs. These are identical to one another, irrespective of the level at which the external conductor is situated, the lower cover being supplemented by means of independent extensions or blocks.

[0017] The advantages of the device that is the object of the present invention are as follows:

It simplifies production by using a common housing (case and cover) both for the connection with conventional terminals and for connection with a clamping spring.

It dispenses with the need to use a plurality of "wafer" type modular assemblies coupled to one another, which is highly advantageous if we intend to use the device for the external connection of relays, as is the case at hand.

[0018] The clamping spring does not press on the ter-

minal contact during its opening manoeuvre.

[0019] Since the direction of the external conductors is horizontal, the perpendicular actuation on the clamping spring enables a considerable force to be developed against the normalised profile on which the device is disposed.

[0020] The use of various parallel levels, both for the external conductors and for the actuation on the clamping spring pushbuttons maximises the utilisation of the space around the electrical appliance which has to be connected to the external conductors.

Short description of the drawings

[0021] To complete the foregoing description and in order to assist in a clearer understanding of the features of the invention, in accordance with a preferred practical embodiment of same, a set of drawings is adjoined as an integral part of said description, wherein there is represented on an informative and non-restrictive basis the following:

Figure 1 shows a plug-in relay and base assembly where the device of the invention is used, the latter being disposed on a normalised mounting profile.

Figure 2 shows a diagrammatic section of the base and the arrangement of the plug-in relay on same.

Figure 3 shows an exploded view of the case and bottom cover forming the base and the contact-clamping spring assembly during the fitting operation by means of linear insertion.

Figure 4 shows a perspective view of a partial section of the items represented in figure 3, once installation has been carried out.

Figure 5 shows a perspective view of the clamping spring in the rest position.

Figure 6 shows a perspective view of the clamping spring after being deformed to enable the external conductor to be inserted.

Figure 7 shows the development of the steel strip forming the clamping spring, prior to the different folding operations that lead to its end configuration.

Figure 8 shows the actuation with a screwdriver on the pushbutton that causes the deformation of the clamping spring.

Figure 9 shows the end layout of the assembly when the external conductor has been connected to the terminal contact.

[0022] In the aforesaid figures the numerical references refer to the following parts and components:

- 1.- External conductor
- 2.- Electrical relay
- 3.- Base
- 4.- Normalised profile
- 5.- Case
- 6.- Cavities

- 7.- Terminal contacts
- 8.- Connection areas
- 9.- Connectors
- 10.- Plug-in contacts
- 11.- Clamping spring
- 12.- Spring loop
- 13.- Spring window
- 14.- Spring legs
- 15.- Longitudinal spring leg folds
- 16.- Perpendicular holes
- 17.- Parallel holes
- 18.- Bottom cover
- 19.- Pushbuttons
- 20.- Centre hole
- 21.- Bottom cover extensions
- 22.- Blocks
- 23.- Screwdriver
- 24.- Lever

Detailed description of a preferred embodiment

[0023] In a particular application of the connection device that is the object of the invention, this is used to establish the continuity of the circuit from a plurality of external conductors (1) to a plug-in electrical relay (2) on a base disposed on a normalised profile (4), as is shown in figure 1. A lever (24) enables the electrical relay (2) to be locked or withdrawn, as will be more than familiar to an expert on the matter.

[0024] The interior arrangement of the different items may be seen in figures 2 and 4, where we observe that the base (3) is made up of a housing formed of a bottom cover (18) and a case (5), the latter being provided with cavities (6) insulated from one another, each intended to receive a terminal contact (7) with flat connection areas (8) at one end, while terminating at the other end in forms (9) that enable the plug-in contacts (10) of the electrical relay (2) to be received.

[0025] A clamping spring (11) intended to assure the contact pressure between the external conductors (1) and the connection area (8) of the terminal contact (7) is made up of a steel strip, as shown in figures 5, 6 and 7. The steel strip is bent on itself to form a loop (12), which terminates in a flaring provided with a window (13) for receiving both the connecting area (8) of the terminal contact (7) and the external conductor (1). The opposite end of the clamping spring also passes through the window (13), where it is retained. This end presents two legs (14), which protrude laterally from either side and head parallelly towards the lower portion, and they each have longitudinal folds (15) for enhancing their strength.

[0026] Referring now to figure 4, we will observe that the different cavities (6) in the case (5) present perpendicular holes (16) and parallel holes (17) in respect of a lower cover (18) which closes the case (5). Freely sliding pushbuttons (19) for exerting pressure on the clamping spring (11) and to enable the external conductor (1) to be inserted in the parallel hole (17) can actuate in the

perpendicular holes. The pushbuttons (19) have a centre hole (20), which may be traversed by the testing tip of a measuring appliance as far as the loop (12) of the clamping spring (11). For their part, the parallel holes (17) are in alignment with the window (13) in the clamping springs (11) when these are actuated by the pushbuttons (19).

[0027] Figure 3 shows the operation for installing an assembly made up of a terminal contact (7) and a clamping spring (11) inside a cavity (6) in the case (5). As may be observed, the insertion is effected in a simple linear upward movement. When the assembly is inserted in the case (5), it is immobilised in its working position by the lower cover (18). If the case (5) has to house various terminal contact (7) and clamping spring (11) assemblies on different horizontal planes, the lowermost one will be secured directly by the bottom cover (18), while, in order to immobilise the middle ones, the bottom cover (18) presents extensions (21). The upper assemblies are immobilised by the action of blocks, which form a piece separate from the bottom cover (18) in order to simplify the latter's manufacture.

[0028] As may be seen in figure 6, so as to be able to insert the external conductor (1) in the horizontal hole (17), the pushbutton (19) is depressed with a screwdriver (23) or some other tool, thus bringing about the closure of the loop (12) of the clamping spring (11) and the opening of the window (13), which is thereby aligned with the external conductor (1). Once this is inserted, the pushbutton (19) is released, so that upon moving upwards the edge of the window (13) traps the external conductor (1) against the connecting area (8) of the terminal contact (7), as may be seen in figure 9, and ensures that the electrical connection between the two parts is made securely.

Claims

1. Electrical connection device of the type in which a housing made up of a case (5) and a bottom cover (18) may receive in its interior a plurality of terminal contacts (7) for being joined to respective external conductors (1) by means of the action of clamping springs (11) susceptible of being actuated from the exterior perpendicularly to the plane of the external conductors (1), **characterised in that** the case (5) presents interior cavities (6) for receiving from below both the terminal contacts (7) and the clamping springs (11), both being retained in their working position by the bottom cover (18), and **in that** the clamping springs (11), executed as a loop-shaped leaf spring (12), are provided on either side with a leg (14), each intended to transmit to the bottom cover (18) the stresses produced during actuation on the clamping spring (11), while permitting at the same time that both the terminal contact (7) and the external conductor (1) may be housed between said legs (14).

2. Electrical connection device in accordance with claim 1 **characterised in that** the terminal contacts (7) present a flat connecting area (8) parallel to the bottom cover (18).
5
3. Electrical connection device in accordance with claim 1 **characterised in that** the clamping springs (11) are executed in steel strip, provided adjacent to one end with a window (13), which is traversed by the second flat end parallel to the bottom cover (18).
10
4. Electrical connection device in accordance with claim 3 **characterised in that** the aforesaid legs present longitudinal folds (15) in order to enhance their strength.
15
5. Electrical connection device in accordance with claim 1 **characterised in that** the case (5) presents perpendicular holes (16) and parallel holes (17) in respect of the bottom cover (18) which communicate the exterior with the cavities (8), in such a way that the perpendicular holes (16) are disposed on the loop (12) of the clamping spring (11) and the parallel holes (17) are in alignment with the window (13) in the clamping spring (11), permitting the passage through same of the external conductors (1), which may in this way be attached to the connecting areas (8) of the terminal contacts.
20
25
6. Electrical connection device in accordance with claim 5 **characterised in that** freely sliding push-buttons (19), susceptible of acting on the loop (12) of the clamping springs, are disposed in the perpendicular holes (16).
30
35
7. Electrical connection device in accordance with claim 6 **characterised in that** the pushbuttons present a centre hole (20) for enabling the testing tip of a measuring appliance to pass through it.
40
8. Electrical connection device in accordance with claim 1 **characterised in that** various stepped clamping springs (11) are disposed on the same vertical plane in such a way that different parallel external conductors (1) may be connected on each one of them and each of the clamping springs (11) may be actuated by pushbuttons (19) with parallel axes disposed on the same vertical plane.
45
9. Electrical connection device in accordance with claim 8 **characterised in that** the legs (14) of the clamping springs (11) rest on blocks (22) disposed against the bottom cover (18).
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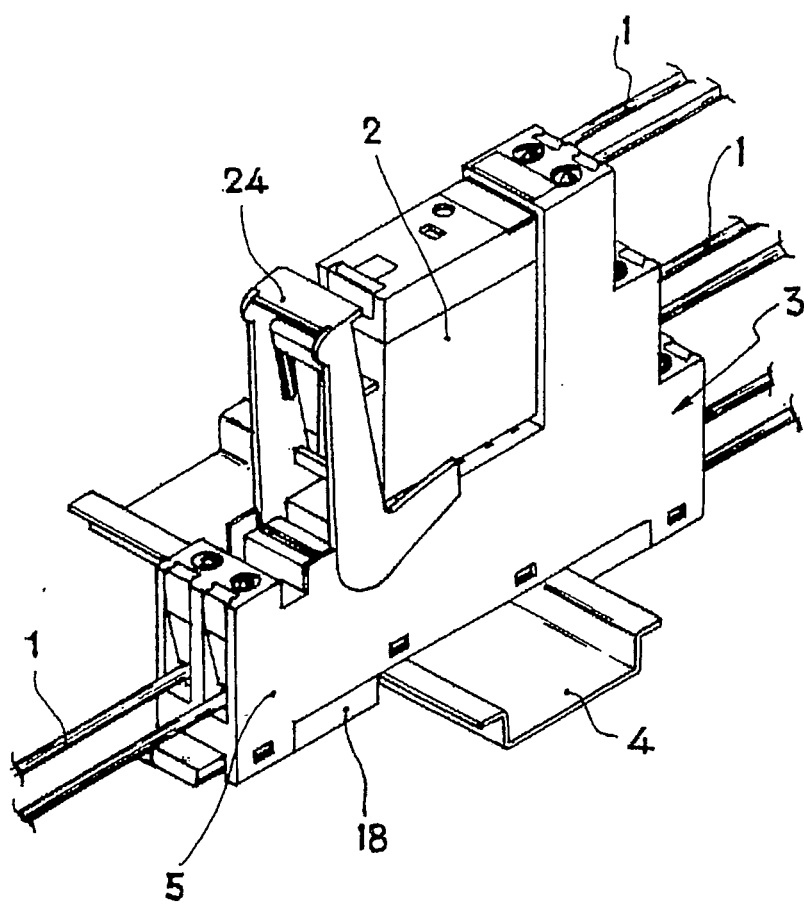


FIG. 1

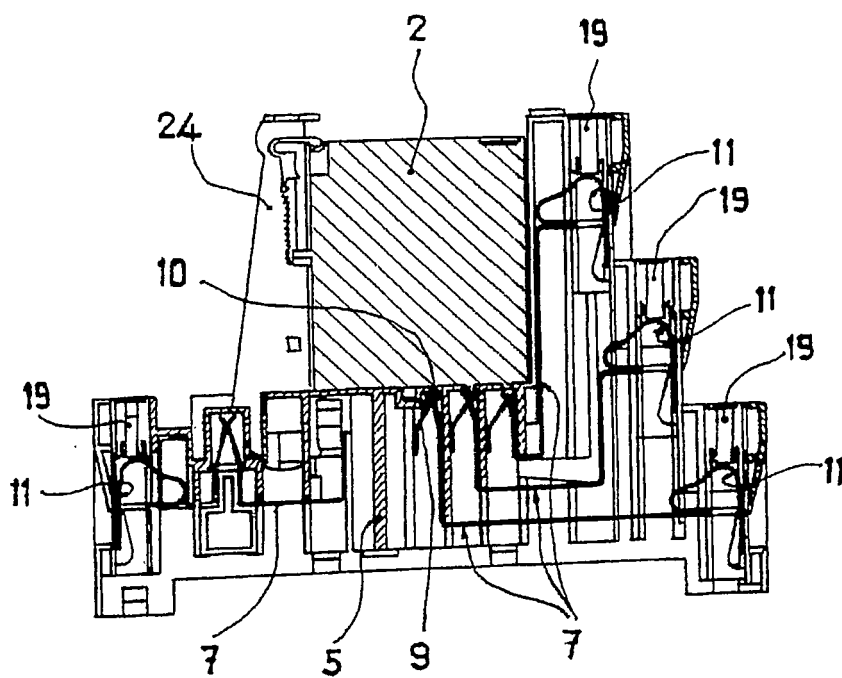


FIG. 2

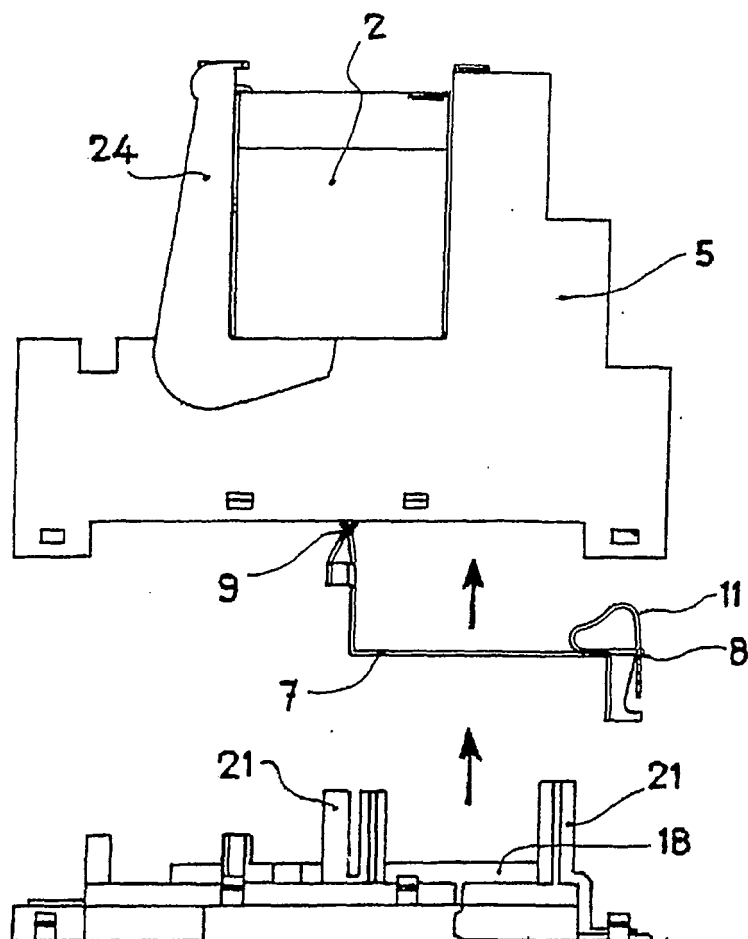


FIG. 3

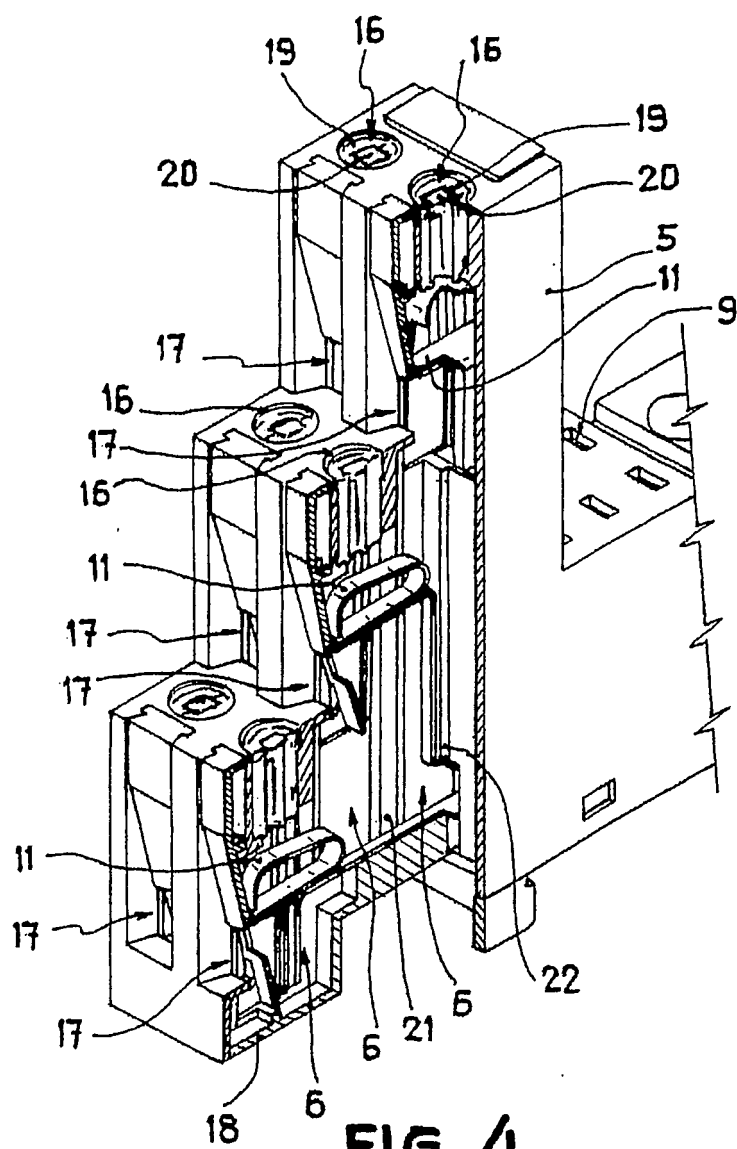


FIG. 4

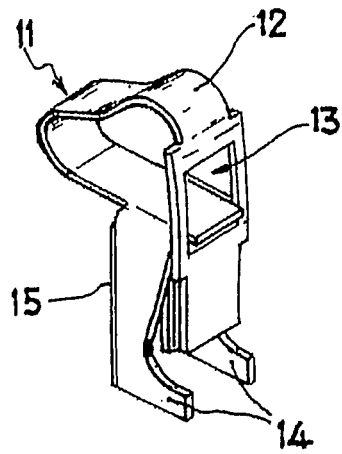


FIG. 5

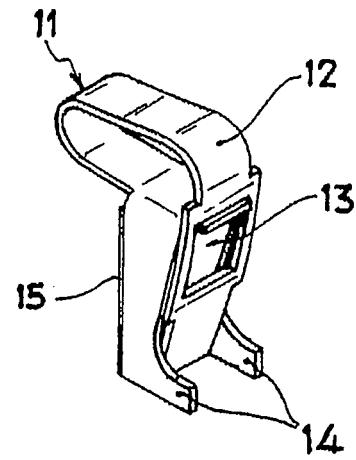


FIG. 6

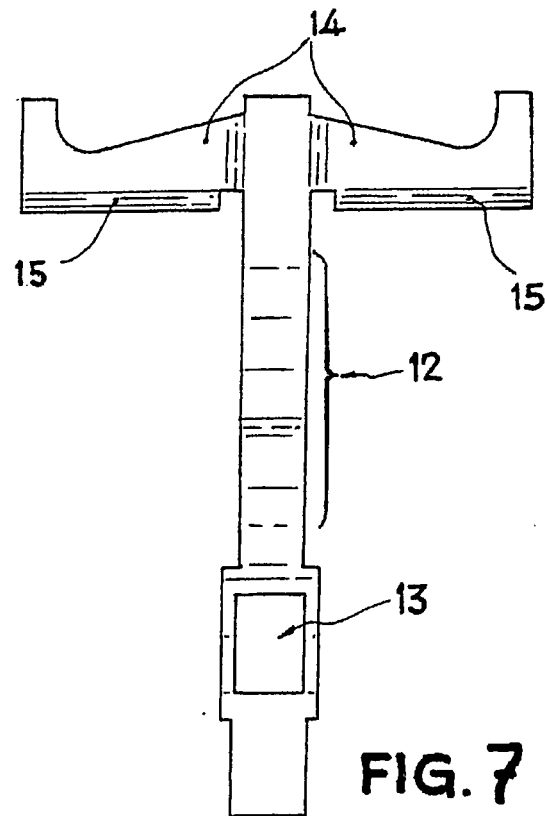


FIG. 7

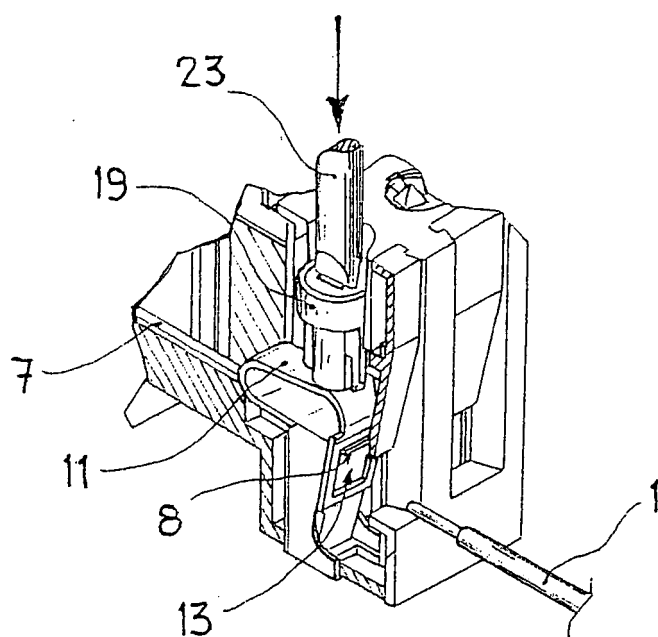


FIG. 8

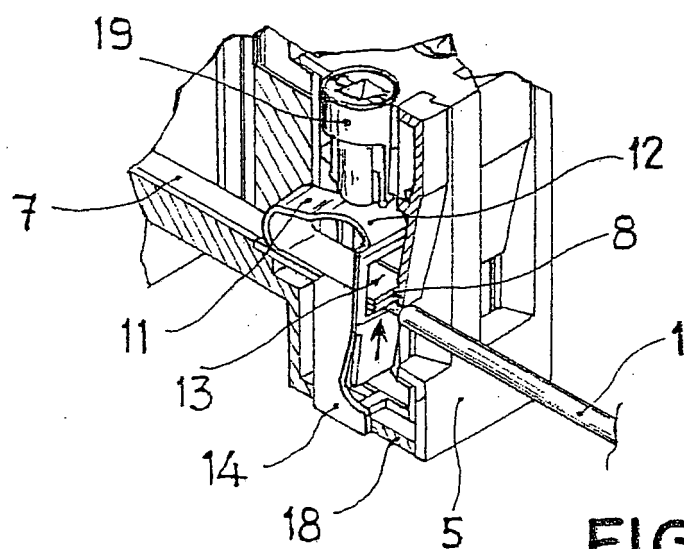


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES 2004/000421

A. CLASSIFICATION OF SUBJECT MATTER		
IPC ⁷ H01R 4/28, 4/48, H01H 45/14		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC ⁷ H01R 4/00, 4/28, 4/48, H01H 45/00, 45/02, 45/04, 45/14		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
CIBEPAT, EPODOC, WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	EP 1376765 A1 (TYCO ELECTRONIC AMP GMBH) 02.01.2004 The whole document	1-3
A	DE 10034589 A (PHOENIX CONTACT GMBH & CO) 31.01.2002 Abstract; Figures 1, 2a, 2b, 3a, 3b	3, 4
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
16 November 2004 (16.11.2004)		30 November 2004 (30.11.2004)
Name and mailing address of the ISA/ SPTO		Authorized officer
Facsimile No.		Telephone No.

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International application No.

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