



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.11.2018 Bulletin 2018/45

(51) Int Cl.:
H01H 13/02 (2006.01) **H01H 11/00** (2006.01)
H01R 4/48 (2006.01) **F21V 23/04** (2006.01)

(21) Application number: **18000433.5**

(22) Date of filing: **07.05.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **Pizzato, Marco**
36063 Marostica (VI) (IT)
• **Zonta, Simone**
36061 Bassano del Grappa (VI) (IT)

(74) Representative: **Maiello, Helenio Francesco**
Studio Ing. Ranieri Marino
Contrà Paolo Liroy, 24
36100 Vicenza (IT)

(30) Priority: **05.05.2017 IT 201700049143**

(71) Applicant: **Pizzato Elettrica S.r.l.**
36063 Marostica (Vicenza) (IT)

(54) **CONTACT OR LED ELECTRIC UNIT**

(57) An electrical contact unit or LED unit for electrical control circuits of industrial machines or plants comprises a casing (2) housing therein at least one pair of electrical contacts (5) and having a housing for an actuator (3) and/or a LED circuit (26) defining a longitudinal extension axis (L), one pair of clamps (7) for wiring the electrical contacts (5) and the connection thereof to an electrical circuit, the wiring clamps (7) being accessible through respective side holes (6) of the casing (2) for the insertion of the wiring cable terminals and each having

an elastic lamella (8) coupled to a respective electrical contact (5) and at least one push-button (9) slidably inserted into the casing (2) and adapted to be brought into contact with a respective elastic lamella (8) to move it away at least partially from the respective electrical contact (5) and to allow the insertion or removal of the corresponding wiring terminal. The push-buttons (9) are axially slidable in the casing (2) for transmitting to the corresponding elastic lamella (8) an also substantially axial force.

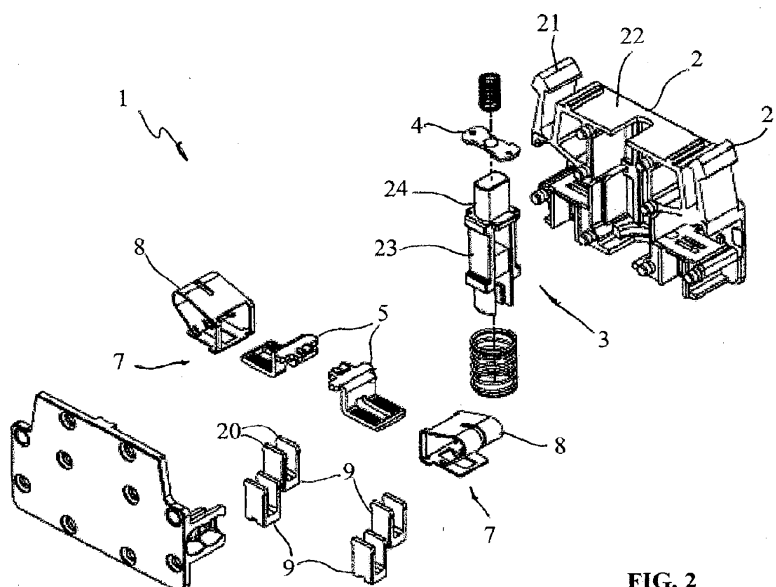


FIG. 2

Description

Technical Field

[0001] The present invention finds application in the field of devices for the control of industrial machines and plants and has for object an electric contact unit or LED unit designed to be inserted inside an electrical circuit for the control of industrial machines or plants.

State of the art

[0002] As known, the contact units are electrical devices suitable for being inserted inside a signalling or control circuit of a machine or industrial plant to send one or more commands and/or signals.

[0003] Typically, the contact units comprise a casing which houses at its inside one or more pairs of fixed contacts designed to be placed in electrical communication with the cables of the electrical circuit to be controlled.

[0004] Moreover, an actuator is provided inside the casing, provided with a movable element which can be operated by an external control and which carries one or more pairs of movable contacts so that the latter can be moved closer or further away from the respective fixed contacts to produce the switching of the associated circuit, according to the command or signal to be generated.

[0005] LED units are also known which are structurally similar to the aforesaid contact units but wherein, in place of the mobile actuator, an LED circuit is provided, whose object is to signal the operating state of a part of the machine or plant by emitting a light beam.

[0006] In both types of units, the casing houses one or more pairs of terminals for wiring the contacts, ie for the removable connection of the ends of the electrical terminals of the circuit with the fixed contacts housed in the casing.

[0007] The most widespread solutions, one of which is described in US6198058, provide that such terminals comprise a screw which moves a clamping element so as to clamp it against the electrical contact, blocking the end of the electric cable therein.

[0008] By turning the screw in the opposite direction it is possible to free the cable from the clamping and disconnect it from the electric unit.

[0009] These known solutions, however widespread, are not exempt from some drawbacks, a first of which is represented by the relative difficulty for the operators in providing for the tightening of the screw during the wiring step, which is not immediate.

[0010] Not least, such clamping systems have relatively reduced reliability over time, especially following high connection and disconnection cycles and can lock when used in dusty or humid environments due to the accumulation of dirt particles.

[0011] Other solutions, just as easy as the previous one, provide that the contacts consist of a metal blade that blocks the cable terminals and that is accessible

through holes through which it is possible to operate on the lamella through a tool, such as the tip of a screwdriver, either directly or through a lever which causes it to be released or locked. A further solution provides that instead of the screw clamps there are provided elastic metal plates acting on the contacts for the clamping of the electrical terminal. The moving away of the resilient lamella from the contact to introduce and/or remove the terminal is obtained by means of a button which slides into the casing and can be operated from the outside by means of a pointed tool.

[0012] However, the button is inserted obliquely in the casing while the blade is operated along a longitudinal direction which is usually the sliding direction of the actuator.

[0013] As a consequence, the button slides in its actuation movement against the wall of the seat in which it is inserted. Moreover, the presence of a transversal component of the force to be impressed on the button and the fact that the operator is forced to operate with the tool in an inclined position makes the operation difficult.

Scope of the invention

[0014] An object of the present invention is to overcome the aforementioned drawbacks by providing an electrical contact unit or LED unit having features of high efficiency and relative cost-effectiveness.

[0015] A particular object is to realize an electric contact or LED unit wherein the wiring of the electrical contacts is simple and rapid.

[0016] Another object is to provide an electric contact or LED unit wherein the terminals have high reliability over time and in use, even if the unit is inserted into dusty or humid environments.

[0017] These objects, as well as others which will become more apparent hereinafter, are achieved by an electric contact or LED unit which, according to claim 1, comprises a casing housing at least one pair of electrical contacts inside it and having a housing for an actuator and/or for an LED defining a longitudinal axis of development, one or more pairs of terminals for wiring said electrical contacts and their connection to an electric circuit, said terminals being accessible through respective holes of said casing for inserting the wiring terminals and having each one an elastic lamella coupled to a respective electrical contact.

[0018] Each of said terminals comprises at least one button slidably inserted into said casing and adapted to be brought into contact with a respective one of said lamellae to move it away at least partially from the respective of said electrical contacts and allow insertion and/or removal of the corresponding wiring terminal.

[0019] In this way, for the wiring of the electrical contacts or the removal of the electrical terminals it will not be necessary to act directly on the lamella using screwdrivers or similar tools, with the risk of damaging the lamella.

[0020] The actuation of the pushbutton will allow the insertion and removal of the electrical terminals of the cables through a simple gesture, allowing to carry out the operation in a simpler and faster way.

[0021] The use of spring terminals operated by pushbutton will also be more effective and safer than common screw terminals, guaranteeing longer life and greater reliability even in the presence of dust and moisture.

[0022] Moreover, the buttons of each of said terminals are axially slidable in said housing to transmit a substantially axial stress to the corresponding resilient lamellae.

[0023] In this way, the push-button will slide in its seat without imparting a transverse stress either to the housing or to the lamella, making the operation easier and more convenient as the operator can keep the tool used to act on the button in the longitudinal position and not inclined.

[0024] Advantageously, each of said resilient lamella may comprise at least one pair of contrasting arms separated from one another and having one end adapted to be placed in contact with a corresponding electrical contact.

[0025] Moreover, each of said clastic lamellae may be associated with at least one pair of buttons adapted to operate on a respective one of said contrast arms to selectively move it away from the corresponding electrical contact.

[0026] In such a way it will be possible to connect to the same electrical contact two different circuits or in any case two different electrical terminals, allowing their separate insertion or removal in a particularly easy way.

[0027] Last but not least, the particular configuration of the terminals and of the electrical contacts will allow to use casing having similar dimensions if not identical to those of the casing with common screw terminals, and also having the same kind of anchoring means, to possibly couple in cascade both electric units with screw terminals that with spring terminals according to the present invention.

[0028] Advantageous embodiments of the invention are obtained according to the dependent claims.

Brief disclosure of the drawings

[0029] Further features and advantages of the invention will become more apparent in the light of the detailed description of some preferred but not exclusive embodiments of an electric unit according to the invention, illustrated as a non-limiting example with the aid of the attached drawings wherein:

FIG. 1 is an exploded view of a contact unit according to the state of the art;

FIG. 2 is an exploded view of a contact unit according to the invention in first embodiment;

FIG. 3 is an enlarged perspective view of an elastic lamella of the unit of Fig. 2;

FIG. 4 is a side view of the contact unit of Fig. 2;

FIG. 5 is an enlarged perspective view of an electric contact of the unit of Fig. 2;

FIG. 6 is a bottom view of the contact unit of Fig. 2; **FIG. 7** is a front view of the contact unit of Fig. 2 wherein the casing is without cover for viewing thereinside;

FIG. 8 is a front view of a variant of the contact unit in a second embodiment wherein the casing is without cover for viewing thereinside;

FIG. 9 is an exploded view of an LED unit of the invention in a first embodiment;

FIG. 10 is a front view of the LED unit of Fig. 9 wherein the casing is without cover for viewing thereinside;

FIG. 11 is a front view of the LED unit in a second embodiment wherein the casing is without cover for viewing thereinside.

Best modes of carrying out the invention

[0030] With reference to the attached figures, some preferred but not exclusive embodiments of an electric contact unit and an LED electric unit according to the invention are shown, which are designed to be connected to an electrical system for controlling a machine or an industrial plant.

[0031] In particular, the contact unit may be connected to one or more control or service circuits to switch their status according to a command given by a pushbutton or other connected actuator device.

[0032] **Fig. 1** shows a contact unit **U** according to the known art made by the same Applicant, wherein there are two terminals **T** of the screw type.

[0033] In particular, the unit **U** comprises a casing **C** suitably shaped at its inside to house an actuator **A** designed to be connected to a pushbutton or other control device, not illustrated as being known per se, and a pair of fixed electrical contacts **F** designed to interact with movable contacts **M** integral with the actuator **A**.

[0034] Inside the housing **C** there are also two screw terminals **T** for tightening the connection terminals of the electric circuit cables to be connected to the contact unit **U**.

[0035] **Fig. 2**, instead, shows an electric contact unit according to the present invention, indicated globally by **1**, comprising a casing **2** housing inside it a sliding actuator **3** provided with a pair of movable electric contacts **4** adapted to interact with respective fixed electric contacts **5** arranged in the casing **2**.

[0036] The fixed contacts **5** are in turn adapted to be connected to an electrical circuit to be switched by means of wiring terminals, not shown, which can be inserted through respective side holes **6** of the casing **2**, more clearly visible in **Fig. 4**.

[0037] The wiring terminals will be appropriately tightened on the fixed electrical contacts **5** by means of corresponding clamps **7** each comprising an elastic lamella **8** coupled with a respective fixed electrical contact **5**.

[0038] Furthermore, each clamp **7** also comprises at

least one push-button 9 slidably inserted into the casing 2 and adapted to be brought into contact with a respective resilient lamella 8 to remove it at least partially from the respective fixed electrical contact 5 and allow insertion or removal of the corresponding wiring terminal.

[0039] In the shown embodiment, preferred but not exclusive of the invention, each clamp 7, shown in greater detail in Fig. 3, is associated with a pair of push-buttons 9 which will be accessible from the bottom wall 10 of the casing 2, as more evident from Fig. 6.

[0040] In turn, each resilient lamella 8 comprises at least one pair of contrast elastic arms 11 which are mutually separated and have one end adapted to be placed in contact with a corresponding fixed electrical contact 5.

[0041] In this way each elastic lamella 8 will be associated with a pair of push-buttons 9 adapted to operate on a respective contrast arm 11 to selectively move it away from the corresponding fixed electrical contact 5 and allow insertion of the wiring terminal or its removal, without risk of removing any additional terminal connected to the other contrast arm 11.

[0042] With a rigid conductor, it will not be necessary to press the push-button 9 upon insertion as the terminal itself will produce the deflection of the contrast arm 11.

[0043] The operation of the push-buttons 9 may be obtained either manually or with the aid of a tool such as a screwdriver or other pointed tool, avoiding anyway to intervene directly on the elastic lamella 8.

[0044] Each fixed electrical contact 5 comprises a pair of flat contact surfaces 12 for respective wiring terminals on which a corresponding contrast arm 11 of the respective elastic lamella 8 acts.

[0045] The contact surfaces 12 will be suitably knurled to increase the friction and transversely separated by a longitudinal slot 13 to allow the passage of the push-buttons 9, as will appear clearer later.

[0046] In turn, each elastic lamella 8 comprises a support plate 14 on which a corresponding contact surface 12 rests and having a first central opening 15 placed at the longitudinal slot 13, again to allow the passage of the push-buttons 9 when these are pressed.

[0047] As visible from Fig. 7, the contrast arms 11 have a U-shaped configuration so as to be flexible and be deformed by crushing following the pressure of the corresponding push-button 9, so as to move away from the respective electrical contact 5 and leave the space for insertion of the wiring terminal, or to free it from the tightening on the fixed electrical contact 5.

[0048] The contrast arms 11 are integral, by means of respective connection members, substantially thread-like, to the support plate 14 on which the contact surfaces 12 are positioned.

[0049] The connecting elements 16 are offset from each other to define a second opening 17 crossed by an L-shaped formation 18, belonging to the corresponding fixed electrical contact 5 and integral with the respective contact surfaces 12, on whose end a metal pad 19 is arranged, visible in greater detail in Fig. 5, which will

interact with the movable contacts 4 of the actuator 3.

[0050] In this embodiment, the pad 19 is V-shaped with a central groove to increase the points of interaction with the corresponding movable contact 4 and thus be more efficient. The shapes of the elastic lamellae 8 and of the fixed electrical contacts 5 as illustrated in the figures are only exemplary of the invention since different shapes can also be used. The push-buttons 9 have a U section with a pair of thrust arms 20 having free ends arranged to act on corresponding contrast arms 11 of the elastic lamellae 8.

[0051] The particular embodiment of the push-buttons 9 will allow them to reach the contrast arms 11 through both the slot 13 of the fixed electrical contact 5 and the opening 15 of the support plate 14 of the elastic lamellas 8.

[0052] In particular, when the push-button 9 is pressed, its thrust arms 20 will be arranged straddling the corresponding contact surface 12 of the fixed electrical contact 5, with the innermost thrusting arm passing through the slot 13 and the central opening 15 to operate on the contrast arm 11 of the lamella 7 without interfering with the fixed electrical contacts 5.

[0053] From Fig. 6 it is also observed that the push-buttons 9 each have a central notch which will favor the insertion of the tip of a tool such as a screwdriver or the like, useful for facilitating the pushing of the push-button 9.

[0054] From the same figure it is also observed the presence on the bottom wall 10 of a pair of holes 32 adapted to allow the insertion of the tip of a tester and its contact with the elastic lamellae 8 for checking electrical continuity with the contacts 5.

[0055] Advantageously, these holes 32, in addition to having dimensions large enough to allow the insertion of the common testers, have axial development to make the verification operation easy.

[0056] From Fig. 7, on the other hand, it is observed that the push-buttons 9 are axially slidable inside the casing 2 for transmitting a substantially axial stress to the corresponding elastic lamellae 8.

[0057] In the first shown embodiment, the casing 2 is provided with panel-type anchoring means 21, i.e. associated with the upper wall 22 of the housing 2 for anchoring to an upper panel, not shown.

[0058] Fig. 8 shows a variant of the previous contact unit 1 which differs from this essentially in that the anchoring means 21 are of the box-like type and therefore associated with the bottom wall 10 of the casing 2, to anchor to the bottom wall of a junction box or similar, not shown.

[0059] In this case, the push-buttons 9 will be accessible from the upper wall 22 of the casing 2, whose internal configuration will suitably vary in order to adequately house the components described above according to the different arrangement, but without this leading to differences from an operative point of view.

[0060] In this figure, one of the buttons 9, in particular

the left one, is shown in the pressed condition in which it operates on the contrast arm **11** of the corresponding elastic lamella **8**.

[0061] According to a particularly advantageous aspect, in both embodiments, the panel or bottom box type anchoring means **21** may be defined by a pair of flexible fins.

[0062] Moreover, the casing **2** has on the wall **10**, **22** opposite to that provided with the fins **21**, a pair of slots for the partial insertion of the fins and each having a retaining tooth **33** adapted to cooperate with the corresponding fins **21** of a further electrical unit placed below or above, depending on the type of anchoring means **21**. In this way it will be possible to place two or more units in position.

[0063] The actuator **3** will have any of the typical configurations for this kind of product and in general will comprise a slider **23** slidably housed in the casing **2** and having an upper end **24** adapted to protrude from the casing **2** to be connected to an external control, not illustrated as known per se.

[0064] The slider **23** is made integral with the pair of movable electric contacts **4** to bring them into contact with corresponding fixed contacts **5** following its actuation, or to move them away from each other, according to the type of operation of the unit **1**.

[0065] In the configuration in which two or more electric units **1** are stacked, it will be sufficient that only the slider **23** of the upper unit **1** is connected directly to a push-button or other command since its actuation will cause the other sliders to be cascaded **23**.

[0066] **Fig. 9** shows an LED electric unit **25** which differs from the contact units **1** illustrated above essentially in that the casing **2** houses a LED circuit **26** in place of the actuator **3**.

[0067] In a known manner, the LED unit **25** may be connected to a control or service circuit in order to signal the operating status of a part of the machine or plant by emitting a continuous or flashing light beam.

[0068] The LED circuit **26** essentially comprises a printed circuit **27**, simply shown schematically in the figures, electrically connected to the fixed contacts **5**, generally by means of soldering pins, and connected to a diode **28** for the emission of the light beam. In this first configuration, the casing **2** comprises panel-type anchoring means **21**. Moreover, the LED circuit **26** is associated with an anchoring cradle **29** which allows it to be housed inside the casing **2** and which comprises an anchoring plate **30** for the printed circuit **27** and a collar **31** designed to protrude from the casing **2** for the protection of the LED diode **28**.

[0069] In this way the casing **2** may be used both for the assembly of the LED unit **25** and of a contact unit **1** as previously illustrated.

[0070] **Fig. 10** shows the same assembled LED unit **25** in which one of the push-buttons **9** is pressed to operate on a corresponding contrast arm **11** of an elastic lamella **8** and move it away from the corresponding fixed

electrical contact **5**.

[0071] Finally, **Fig. 11** shows a variant of the previous LED unit **25** which essentially differs in that it has anchoring means **21** of the bottom box-type.

[0072] Also in this case one of the push-buttons **9** is shown in the pressed condition in which it operates on the corresponding contrast arm **11** of an elastic blade **8** to move it away from the corresponding fixed electrical contact **5**.

[0073] The electric contact unit or LED according to the invention is susceptible of numerous modifications and variations, all of which are within the inventive concept expressed in the appended claims. All the details may be replaced by other technically equivalent elements, and the materials may be different according to requirements, without departing from the scope of protection of the present invention.

[0074] Even though the unit has been described with particular reference to the attached figures, the reference numbers used in the description and claims are used to improve the intelligence of the invention and do not constitute any limitation to the claimed scope of protection.

Claims

1. An electrical contact unit or LED unit for electrical control circuits of industrial machines or plants, wherein an electric circuit comprises one or more wiring terminals, which unit comprises:

- a casing (**2**) housing therein at least one pair of electrical contacts (**5**) and having a housing defining a longitudinal extension axis (**L**);
- an actuator (**3**) or a LED circuit (**26**) selectively housed into said casing (**2**) and electrically connected with said electric contact (**5**);
- at least one pair of clamps (**7**) for wiring said electrical contacts (**5**) and the connection thereof to an electrical circuit, said wiring clamps (**7**) being accessible through respective side holes (**6**) of said casing (**2**) for the insertion of the wiring cable terminals and wherein each of said clamps (**7**) comprises an elastic lamella (**8**) coupled to a respective of said electrical contacts (**5**) and having one or more contrast arms (**11**) adapted to hold the wiring terminals on said electric contacts (**5**);

wherein each of said clamps (**7**) comprises at least one push-button (**9**) slidably inserted into said casing (**2**) and adapted to be brought into contact with a respective of said elastic lamellae (**8**) to promote the elastic flexion of said contrast arms (**11**) and move them away from the respective of said electrical contacts (**5**) to allow the insertion or removal of the corresponding wiring terminal;

characterized in that the push-buttons (**9**) of

- each of said clamps (7) are slidable in said casing (2) along a respective direction parallel to said longitudinal extension axis (L) for transmitting to a corresponding one of said elastic lamellae (8) an also substantially axial force.
2. Electric unit as claimed in claim 1, **characterized in that** each of said elastic lamellae (8) comprises at least one pair of contrast arms (11) staggered with each other and having a free end adapted to rest on a corresponding one of said electrical contacts (5).
 3. Electric unit as claimed in claim 2, **characterized in that** each of said elastic lamellae (8) is associated with at least one pair of push-buttons (9) operating on a respective of said contrast arms (11) to selectively move it away from a corresponding one of said electrical contacts (5).
 4. Electric unit as claimed in claim 2 or 3, **characterized in that** each of said electrical contacts (5) is fixed in said casing (2) and comprises a pair of contact surfaces (12) for respective wiring terminals on which a correspondent of said contrast arms (11) of the respective elastic lamella (8) operates, said contact surfaces (12) being possibly knurled and transversely staggered by a longitudinal slot (13).
 5. Electric unit as claimed in claim 4, **characterized in that** said elastic lamellae (8) comprise a support plate (14) on which said contact surfaces (12) lie on the respective of said electrical contacts (5) and which has a first central aperture (15) located at said longitudinal slot (13).
 6. Electric unit as claimed in claim 5, **characterized in that** each of said push-buttons (9) has a U-section with a pair of thrust arms (20) having free ends arranged to operate on respective contrast arms (11) of said elastic lamellae (8).
 7. Electric unit as claimed in any preceding claim, **characterized in that** said casing (2) has a bottom wall provided with a pair of axial holes (32) communicating with said elastic lamellae (8) for checking electrical continuity.
 8. Electric unit as claimed in any preceding claim, **characterized in that** said casing (2) has anchoring means (21) associated with one between its upper wall (22) and its bottom wall (10), the other of said walls (10, 22) being provided with retaining teeth (33) for engaging the anchoring means (21) of a further stacked electrical unit (1).
 9. Electric unit as claimed in any preceding claim, **characterized in that** said casing (2) houses an actuator (3) having a slider (23) with an end (24) adapted to be connected to an external control and provided with at least one pair of movable electrical contacts (4) adapted to be brought into contact with corresponding fixed electrical contacts (5).
 10. Electric unit as claimed in any claims from 1 to 9, **characterized in that** said casing (2) houses a LED circuit (26) having a PCB (27) electrically connected to said electrical contacts (5) and a LED diode (28).
 11. Electrical unit as claimed in claim 9 or 10, **characterized in that** each of said elastic lamellae (8) comprises a pair of connecting elements (16) for connecting said support plate (14) to said contrast arms (11), said connecting elements (16) being staggered with each other to define a second opening (17), said electrical contacts (5) having an L-shaped formation (18) extending through said second opening (17) to interact with said movable contacts (4) of said actuator (3) or with said PCB (27) of said LED circuit (26).

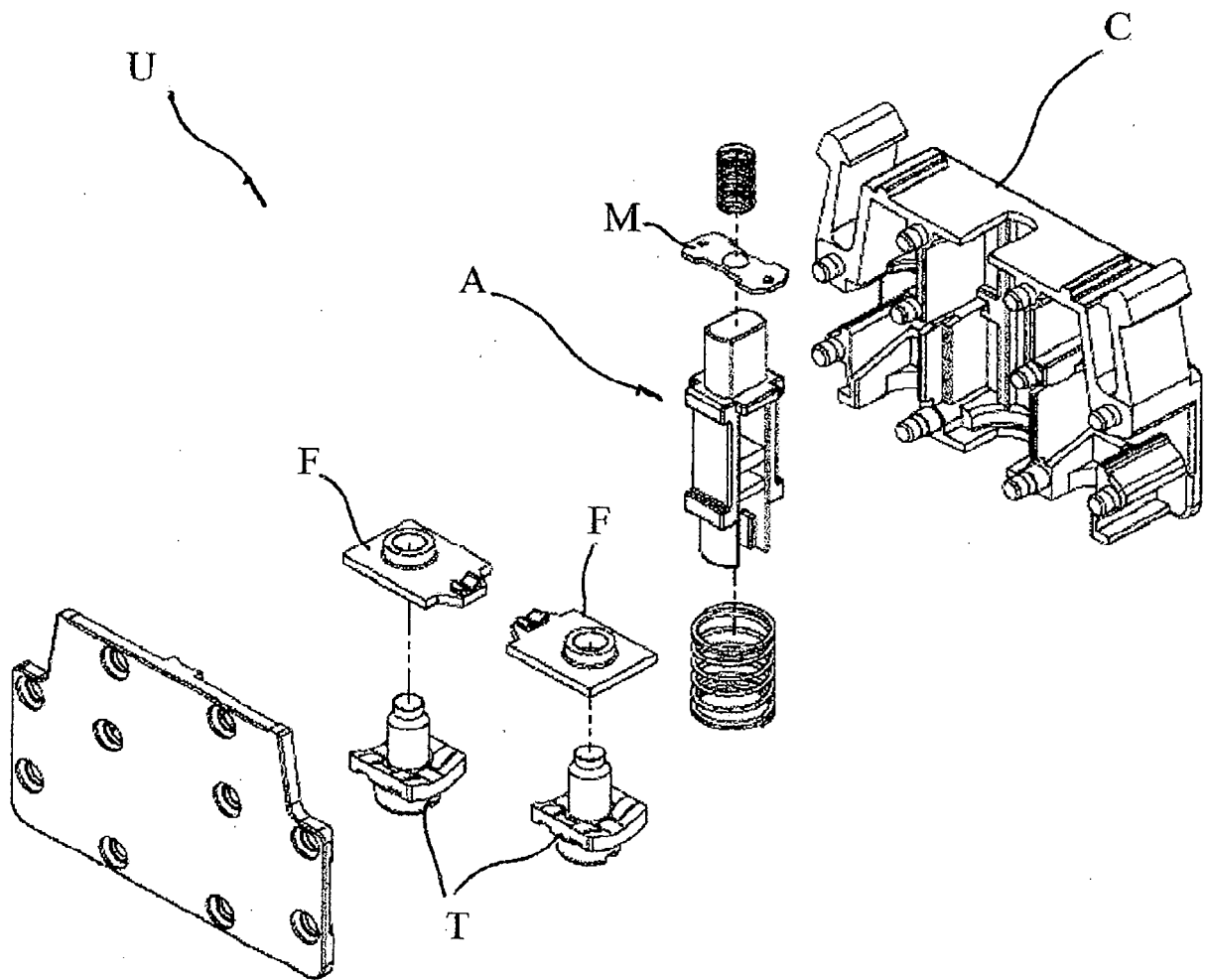


FIG. 1

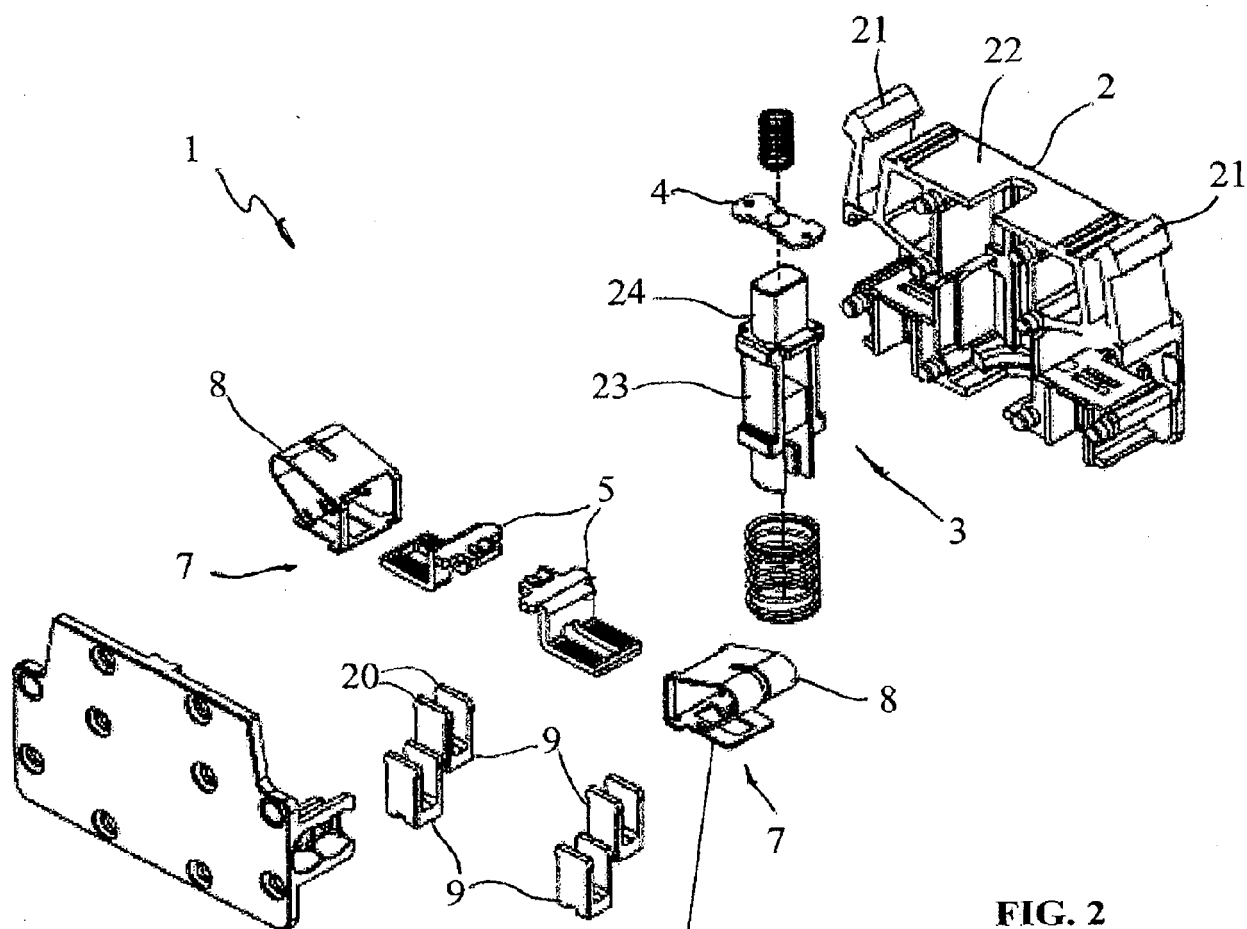


FIG. 2

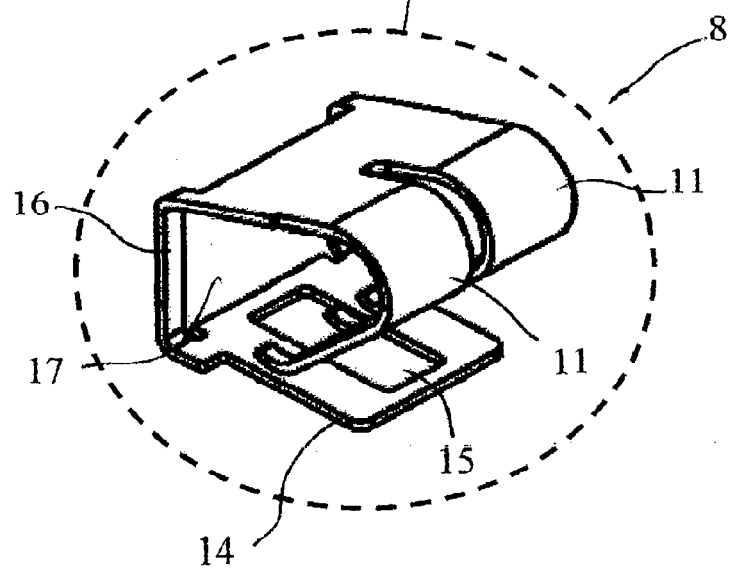


FIG. 3

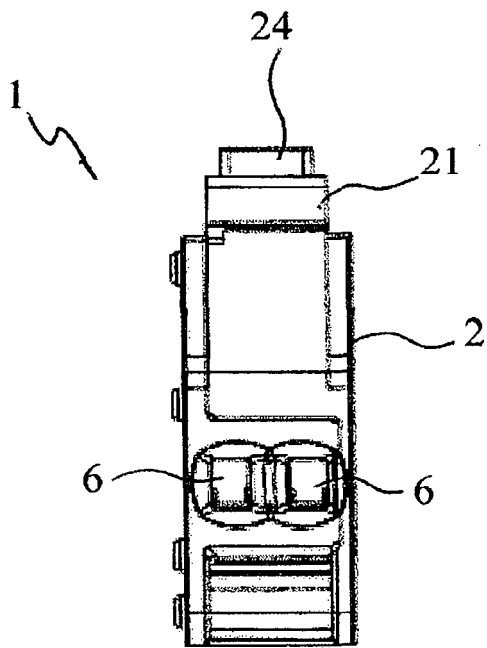


FIG. 4

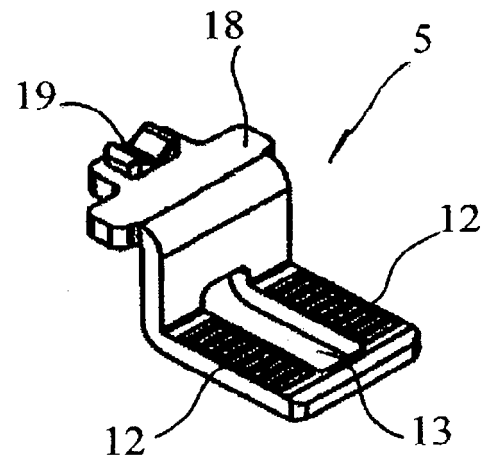


FIG. 5

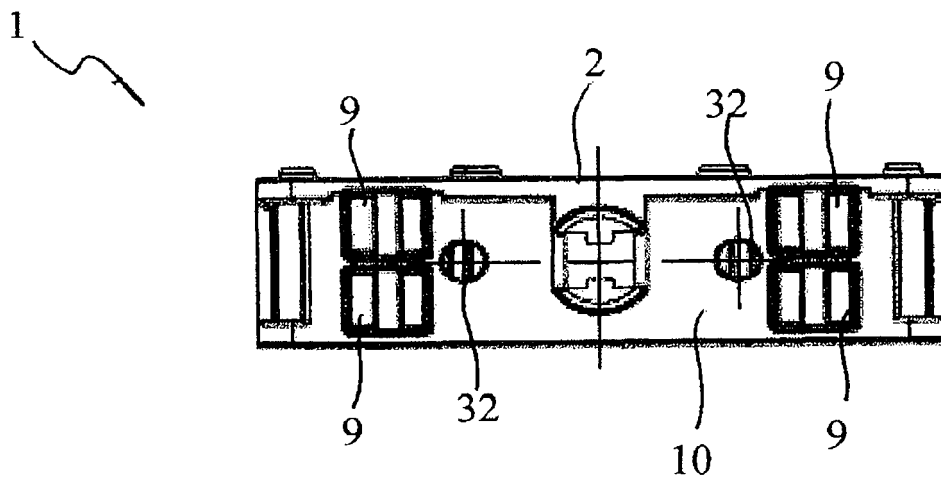


FIG. 6

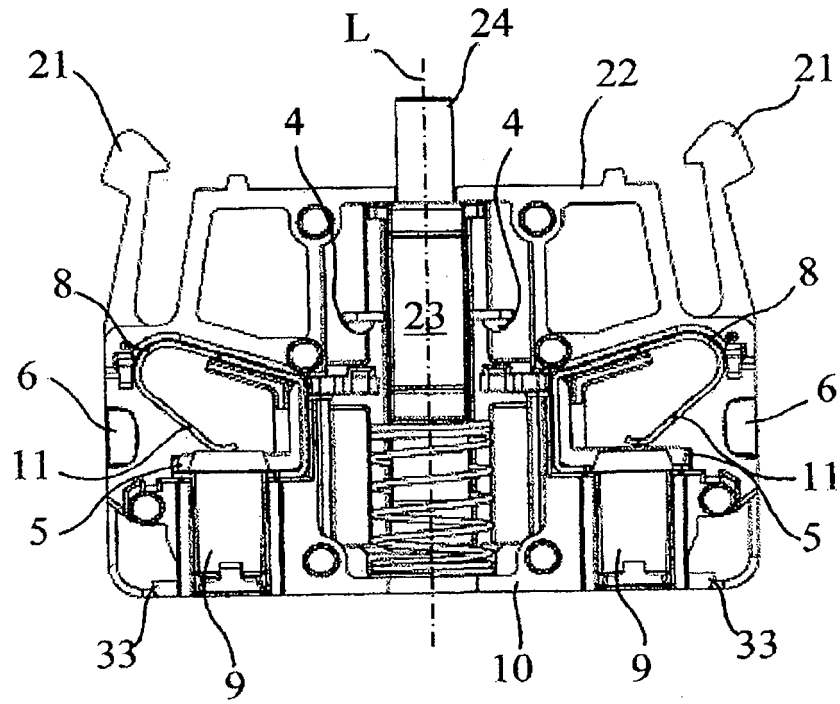


FIG. 7

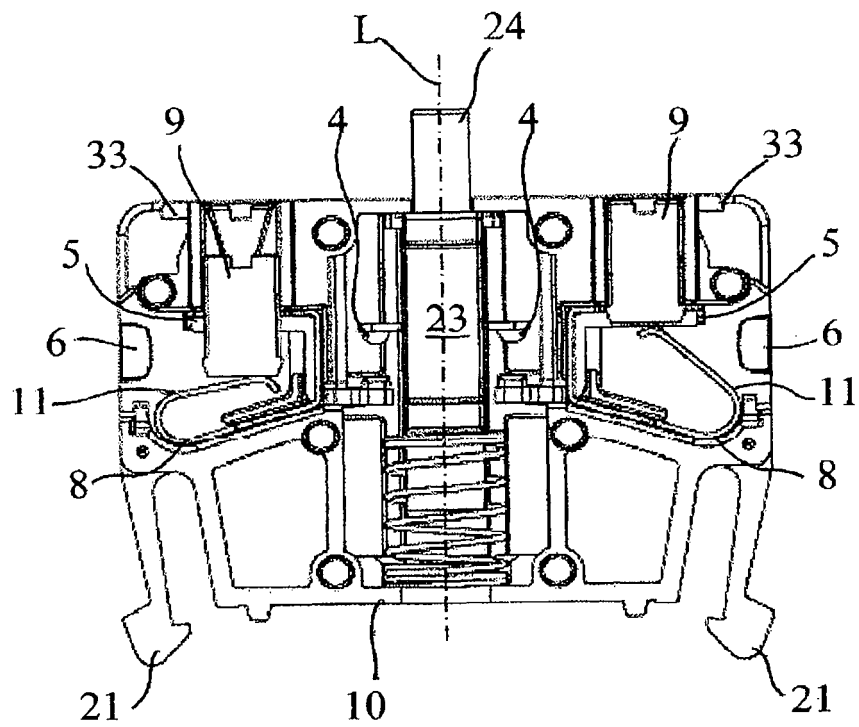


FIG. 8

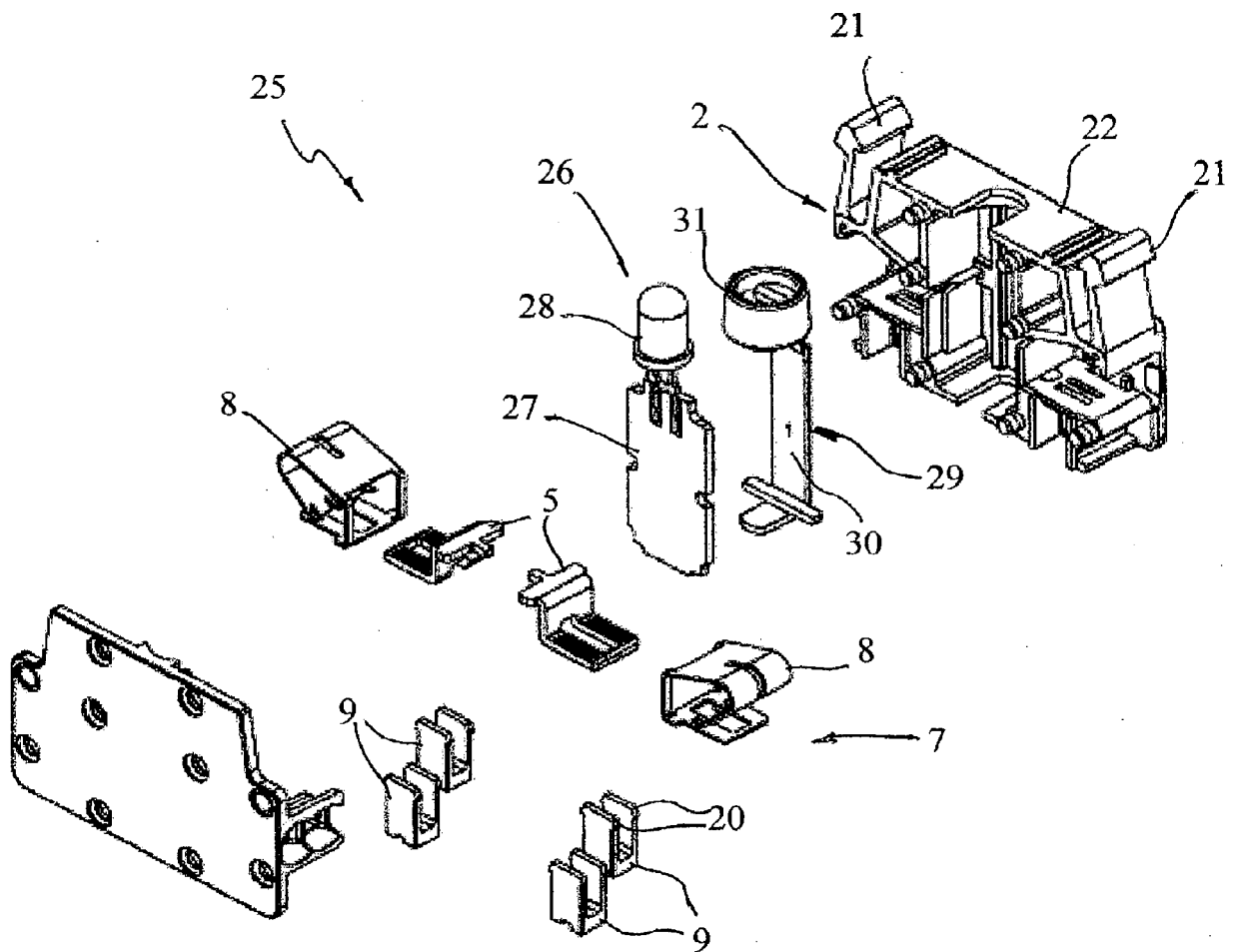


FIG. 9

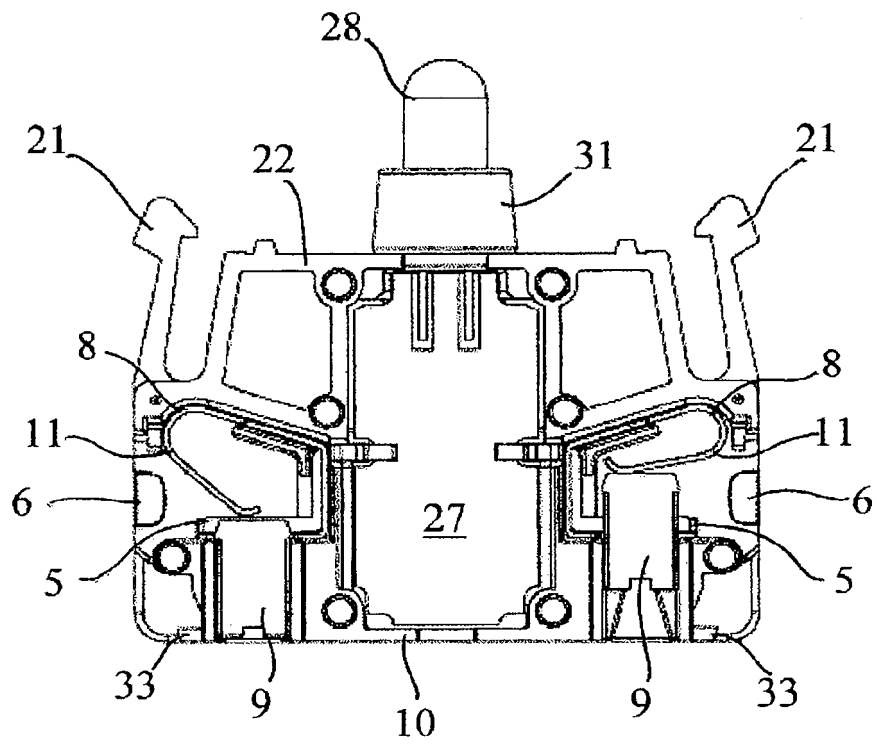


FIG. 10

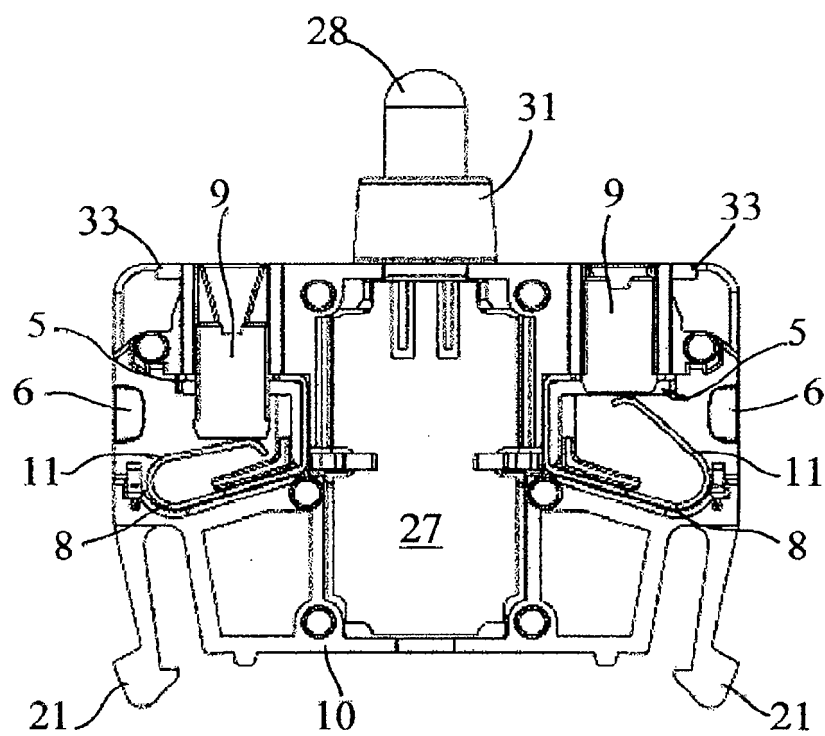


FIG. 11



EUROPEAN SEARCH REPORT

Application Number
EP 18 00 0433

5

10

15

20

25

30

35

40

45

50

55

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|--|--|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
| X | WO 2015/155675 A1 (PIZZATO ELETTRICA SRL [IT]) 15 October 2015 (2015-10-15) | 1,7,8,10 | INV. H01H13/02 |
| Y | * page 5, paragraph 0030 - page 10, paragraph 0081; figures 7-13 * | 2-6,9,11 | H01H11/00 |
| Y | DE 16 90 400 A1 (VEDDER GMBH FABRIK ELEKTROTECH) 27 May 1971 (1971-05-27) | 2-6,11 | ADD. H01R4/48 F21V23/04 |
| A | * page 7, paragraph 1 - page 10, paragraph 2; figures 1-4 * | 1,7-10 | |
| Y | EP 2 624 674 A1 (OMRON TATEISI ELECTRONICS CO [JP]) 7 August 2013 (2013-08-07) | 9 | |
| A | * page 4, paragraph 0026 - paragraph 0029; figures 4-6 * | 1-8,10,11 | |
| Y,D | US 6 198 058 B1 (GRANINGER FRANK J [US] ET AL) 6 March 2001 (2001-03-06) | 9 | |
| A | * column 5, line 21 - column 9, line 53; figures 4-11 * | 1-8,10,11 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | H01H H01R F21V |
| The present search report has been drawn up for all claims | | | |
| Place of search Munich | | Date of completion of the search 11 September 2018 | Examiner Pavlov, Valeri |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | | | |

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 00 0433

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-09-2018

10

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|---|--|
| WO 2015155675 A1 | 15-10-2015 | CN 105408943 A EP 2987204 A1 WO 2015155675 A1 | 16-03-2016 24-02-2016 15-10-2015 |
| DE 1690400 A1 | 27-05-1971 | NONE | |
| EP 2624674 A1 | 07-08-2013 | CN 103227068 A EP 2624674 A1 JP 6007498 B2 JP 2013157272 A US 2013199907 A1 | 31-07-2013 07-08-2013 12-10-2016 15-08-2013 08-08-2013 |
| US 6198058 B1 | 06-03-2001 | DE 10047998 A1 US 6198058 B1 | 29-03-2001 06-03-2001 |

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 6198058 B [0007]