

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 a LED unit designed to be inserted into an electric circuit for the control of machines or industrial plants for sending light signals concerning the operation of the machine or plant.

[0002] The invention also relates to an assembly for mounting LED units and/or electrical contact units that can be inserted into an electrical circuit for the control of industrial machines or plants and/or for sending light signals relating concerning the operation of the machine or plant.

State of the art

[0003] It's known the use of LED units inside electrical circuits for the control of machines or industrial plants in order to provide light signals regarding the operating state of the service or control circuit which the unit is wired to.

[0004] The use of LED units has become preferable compared to conventional incandescent lamps as the former have longer life and lower power consumption, ensuring high reliability, low consumption and high resistance to vibrations.

[0005] Typically, an LED unit comprises a casing inside which the electrical wiring terminals are housed and wherein there is also the LED diode provided with lens and having a printed circuit connected to the terminals, usually by means of soldered pins.

[0006] The casing is also provided with hooking means which can be of the box or panel type, depending on whether the LED unit is to be fixed to the bottom of a junction box or directly to a panel.

[0007] The LED units can also be mounted together with one or more contact units housing pairs of fixed and movable contacts suitable to be wired to a corresponding control or service circuit of the machine or plant in order to switch its status as a result of the action of an actuator movable inside the casing of the contact unit and associated with a drive control. In order to guarantee the interchangeability between the contact units and the LED units, their casings have a substantially identical external shape, except that some parts necessary for stably housing the LED.

[0008] In particular, as shown in **Fig. 1**, a casing **A** for a LED unit **U** according to the state of the art provides for the presence of a collar **C** at the upper hole **H** from which the diode **D** will protrude, while said collar **C** will be absent in the casing of a contact unit.

[0009] It follows that it is necessary to provide two different molds for realizing the casings of contact units and the casing of LED units, with a consequent increase in the total costs for manufacturing and warehouse man-

agement.

[0010] A further drawback of the known LED units is related to the need to provide, outside the casing, an indication relating to the colour of the LED light which allows the operator to quickly select the LED with the desired colour during installation.

[0011] One of the most adopted solutions is to report on the bottom of the casing a sign having a colour corresponding to that of the LED so you can check the colour without having to turn on the LED.

[0012] This solution, however simple, still requires an additional operation during assembly of the unit and is not exempt from the risk of reporting an indication of colour different from that of the LED light.

[0013] Furthermore, colour recognition is not immediate because the only indication provided is that of the coloured sign, which is however very limited and therefore easy to be confused. US2008/073190 discloses a pushbutton provided with a casing that houses therein-side an LED light positioned so as to be visible through the button and connected to a switching unit. The latter is snap-fitted with the casing and further secured with a pair of pins that are inserted into corresponding holes made in a containment body of the switching unit. The same pins are inserted into corresponding holes made in a support strip of the LED diode, so that the latter is completely contained inside the main casing of the button.

[0014] Therefore, the casing of this electrical device cannot be used to realize devices having other functions, for example those typical of the electrical contact units for controlling electrical circuits associated with industrial machines or plants.

[0015] Moreover, since the LED is not directly visible, if not through a translucent cover and button, it is not even immediately visible the colour of its light beam, because the colour of the output beam can be changed through the colour of the cover and the button.

Scope of the invention

[0016] An object of the present invention is to overcome the above drawbacks by providing an LED unit for electrical control circuits of machines or industrial plants with features of high efficiency and relative cost-effectiveness.

[0017] A particular object is to provide an LED unit that can be assembled starting from a casing adapted to be also used for the common contact units in order to use a single mold for both types of units, with consequent economic savings and managing simplification.

[0018] In particular, an object of the invention is to provide a casing which can be used indifferently for the assembly of LED units or electrical contact units.

[0019] Still another object is to provide an LED unit which allows the colour of the light emitted by the LED to be identified simply, quickly and safely.

[0020] These objects, as well as others which will ap-

pear more apparent hereinafter, are achieved by an LED unit which, according to claim 5, comprises a casing housing at least one pair of electrical contacts associated with respective wiring terminals for connection to an electric circuit, said casing having at least one pair of lateral passages for accessing said terminals, at least one LED circuit adapted to be inserted into said housing and having a diode suitable for emitting the light beam and a printed circuit for electrical connection to said electrical contacts.

[0021] The casing comprises a housing for said at least one LED circuit provided with an upper hole and furthermore an anchoring cradle is provided which is adapted to be inserted into said housing for the stable locking of said LED circuit in said casing.

[0022] Optionally, the cradle may be removably inserted to allow removal of the LED circuit.

[0023] Thanks to this combination of features, the mounting of the LED unit may be carried out starting from a casing suitable to be used also for contact units which only the cradle will have to be added to.

[0024] In this way, it will be sufficient to provide a single mold that can be used both for casings for LED units and for contact units, thus obtaining significant savings both in manufacturing costs and management costs as it will not be necessary to manage two different product codes.

[0025] Advantageously, the cradle will be made of plastic material having the same colour or close to that of the light beam emitted by said LED circuit and will also be provided with at least one portion visible from the outside of said casing.

[0026] In this way, the same cradle will give an indication of the colour of the LED light and it will not be necessary to put the sign on the bottom wall.

[0027] The visual recognition of the colour of the LED light will thus be more immediate and free of errors.

[0028] Appropriately, the cradle may comprise a collar with a portion adapted to be snugly fit in said upper hole and within which said diode is at least partially inserted.

[0029] The collar will have both the diode protection function and the function of giving an immediate and clearly visible indication of the colour of the LED light, being of the same colour as the light beam.

[0030] Furthermore, the casing may comprise at least one window for partial viewing said cradle, with the latter comprising an axial plate for supporting said printed circuit in said housing and from which a pin will transversely project which will snugly fit in a window made in the bottom wall of said casing.

[0031] In this way, to know the colour of the light beam emitted by the LED, it will also be sufficient to observe the colour of the cradle through the window.

[0032] In particular, the pin having the colour indicative of the light beam colour will be arranged on the same face on which the coloured sign is usually reported, so as not to modify the operating modes of the operators and without having to perform an additional operation to add such a sign.

[0033] According to a further aspect of the invention, an assembly is provided for mounting LED units or contact units for electrical control systems of machines or industrial plants which, according to claim 1, comprises a casing housing therein two or more fixed electrical contacts associated with respective wiring terminals for connection to an electrical circuit, said casing having a pair of lateral passages for accessing said terminals, at least one LED circuit adapted to be inserted into said casing and having a diode adapted to emit the light beam and a printed circuit for electrical connection of said diode to said electrical contacts, at least one actuator insertable in said casing and having a slider slidable in said casing and having an upper end adapted to be associated with an external control and two or more mobile electric contacts suitable to be brought into contact with corresponding electrical contacts following the translation of said slider, wherein said casing comprises a housing for selectively receiving said at least one LED circuit or said at least one actuator, said housing being provided with an upper hole for the exit of said diode or of the upper end of said slider.

[0034] The assembly also comprises an anchoring cradle adapted to be inserted into said housing for the stable locking of said LED circuit in said casing.

[0035] The cradle may only be inserted when the casing is to be used to create an LED unit, thus eliminating the problem of having to set up two different casings, and therefore two different molds, for LED units and contact units.

[0036] Advantageous embodiments of the invention arc obtained according to the dependent claims.

Brief disclosure of the drawings

[0037] Further features and advantages of the invention will become more apparent in the light of the detailed description of preferred but not exclusive embodiments of an LED unit and an assembly according to the invention, illustrated as a non-limiting example with the aid of the accompanying tables drawing wherein:

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

FIG. 2 is a front view of LED unit of the invention in a first embodiment;

FIG. 3 is a front view of LED unit of the invention in a second embodiment;

FIG. 4 is an exploded view of the LED unit of Fig. 3;

FIG. 5 is a front view of the LED unit of Fig. 4 wherein the casing is without cover for viewing therein;

FIG. 6 is a front view of the LED unit of Fig. 3 wherein the casing is without cover for viewing therein;

FIG. 7 is an exploded view of the LED unit in a third embodiment;

FIG. 8 is a front view of the LED unit of Fig. 7 wherein the casing is without cover for viewing therein;

FIG. 9 is a front view of a variant of the LED unit of

Fig. 7 wherein the casing is without cover for viewing thereinside;

FIG. 10 is an exploded view of the LED unit in a fourth embodiment;

FIG. 11 is a front view of a variant of the LED unit of Fig. 10 wherein the casing is without cover for viewing thereinside;

FIG. 12 is an exploded view of the LED unit in a fifth embodiment;

FIG. 13 is a front view of a variant of the LED unit of Fig. 12 wherein the casing is without cover for viewing thereinside;

FIG. 14 is an exploded view of a contact unit in a first embodiment;

FIG. 15 is an exploded view of a contact unit in a second embodiment.

Best modes of carrying out the invention

[0038] With reference to the attached figures, some preferred but not exclusive embodiments of an LED unit according to the invention designed to be connected to an electrical plant for controlling a machine or industrial plant are shown.

[0039] In particular, the LED unit 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.

[0040] **Fig. 2** shows a first embodiment of the LED unit, generally indicated by **1**, provided with a casing **2** having anchoring means **3** of the bottom box-type, i.e. associated with the bottom wall **4** of the casing **2** and designed to allow the fixing of the LED unit **1** to the bottom wall of a junction box, not shown because known per se.

[0041] **Fig. 3** shows indeed a second embodiment of the LED unit **1** which differs from the previous one essentially in that the anchoring means **3** are of the panel type, i.e. associated with the upper wall **5** of the casing **2** for anchoring to a panel or similar support for one or more LED and/or contact units and to which one or more controls may be applied.

[0042] In the present text the terms "lower" and "upper" are used only for a better clarity but in use the parts indicated with these terms may be mounted also in inverse way.

[0043] As can be seen more clearly from **Fig. 4**, the LED unit **1** comprises a casing **2** housing thereinside a pair of fixed electrical contacts **6** associated with respective wiring terminals **7** for connection to an electrical circuit.

[0044] The casing **2** essentially consists of two parts, that is a containment body **8**, wherein the housings for the various components are formed, and a cover **9** which is removably coupled to the front face of the containment body **8** to allow the insertion of the various components during assembly.

[0045] The fixing of the cover **9** to the containment body **8** can be obtained by means of a plurality of pins **10**

projecting from the containment body **8** and insertable into corresponding holes **11** of the cover **9**, or vice versa.

[0046] The cover **9** may be applied removably but more preferably it will be fixed by blocking the pins **10** inside the holes **11**, for example by ultrasonic welding.

[0047] Alternatively, the fixing of the cover **9** on the containment body **8** may be carried out by similar means, for example screws or similar members, or by means of gluing or welding to make the enclosure **2** no longer openable.

[0048] The containment body **8** also comprises at least one pair of lateral passages **12** for inserting the wiring cables and their access to the terminals **7**.

[0049] The LED unit **1** comprises a LED circuit **13** adapted to be inserted into the casing **2** and having a diode **14** adapted to emit the light beam and a PCB or printed circuit **15** for electrical connection of the diode **14** to the electrical contacts **6** and for managing the diode **14**, in particular the switching on, timing, adjusting of the light intensity.

[0050] The structure of the printed circuit **15** and its programming, as well as the configuration of the diode **14** are not limitative of the present invention and therefore will not be considered in the present description.

[0051] Analogously, also the connection mode of the printed circuit **15** with the electrical contacts **6** may vary according to the requirements and for example the printed circuit **15** will comprise soldered pins connected to the contacts **6**.

[0052] The LED circuit **13** is designed to be inserted inside a housing **16** arranged centrally in the casing **2** and extending throughout the height of the casing **2**.

[0053] The housing **16** has an upper hole **17** for connecting the diode **14** placed externally, while the printed circuit **15** will be placed inside the casing **2**.

[0054] An anchoring cradle **18** is adapted to be inserted into the housing **16** for the stable locking of the LED circuit **13** inside the casing **2**.

[0055] The cradle **18** may be inserted into the housing **16** both in a fixed manner and in a removable manner and in this second case, if the casing **2** is also openable, it will allow removal of the LED circuit **13** and its replacement, possibly together with the cradle **18**, or replacement of the cradle only **18**.

[0056] In particular, the cradle **18** comprises a collar **19** which can be inserted above the upper hole **17** and has a lower annular projection **20** adapted to be inserted into the upper hole **17** to lock the collar **19** on the casing **2**.

[0057] The diode **14** is designed to be inserted inside the collar **19** so as to be permanently arranged on the casing **2** and to be protected in a manner similar to that required for the LED units according to the state of the art.

[0058] The collar **19** also comprises one or more axial slots **21** for the passage of the filaments **22** for the electrical connection of the diode **14** to the printed circuit **15**.

[0059] In the present text the term "axial" refers to the main development direction of the cylindrical housing **16**.

[0060] Furthermore, the cradle **18** comprises an axial

plate **23** for supporting the printed circuit **15** inside the housing **16** and having means for the stable but removable fixing of the printed circuit **15**.

[0061] In particular, the printed circuit **15** may be snap-coupled to the plate **23**, with the latter comprising a pair of upper ribs **24** and lower ribs **25** which will delimit a seat having a height corresponding to the axial dimension of the printed circuit **15**.

[0062] The cradle **18** will be made of a sufficiently rigid material but having such flexibility as to allow snap coupling with the printed circuit **15**.

[0063] Alternatively, the printed circuit **15** may simply be placed on the plate **23** and held in position due to the connection with the diode **14**.

[0064] Furthermore, different means for holding the printed circuit **15** on the plate **23** may be provided.

[0065] In order to increase the stability of the positioning of the cradle **18**, the housing **16** will comprise an axial groove **26** in which the plate **23** will be inserted.

[0066] Preferably, the cradle **18** will be made of plastic material having the same colour or a colour close to that of the light beam emitted by the diode **14**, so as to give an immediate indication of the colour of the emitted light already during the selection and assembly of the LED unit **1**.

[0067] Suitably, the cradle **18** may have at least one portion protruding from the casing **2** or otherwise visible from the outside even when the casing **2** is completely assembled to give immediate evidence of the colour of the light beam.

[0068] In particular, an immediate indication of the colour of the light beam will already be provided by the collar **19**.

[0069] According to a further aspect, the casing **2** comprises at least one window for partial viewing of the cradle **18**, so as to allow to immediately know the colour and consequently also know the colour of the LED light.

[0070] According to the preferred but not exclusive embodiment of the figures, the window is defined by a hole **27** formed in the bottom wall **4** of the casing **2** in correspondence with the housing **16** and has such a size as to snugly fit a fin **28** projecting transversely from the lower end of the plate **23**.

[0071] Fig. 5 shows the LED unit **1** in a particular variant and in an assembled condition but without the cover **9** to allow viewing therein.

[0072] In this embodiment, the electrical contacts **6** are constituted by shaped metal plates associated with terminals **7** of the spring type, that is constituted by one or more shaped elastic lamellae on which corresponding push-buttons **29** can be operated from the outside to allow insertion or removal of the wiring terminal.

[0073] The anchoring means **3** are of the panel type and therefore associated with the upper wall **5** of the casing **2**.

[0074] Fig. 6 shows a variant of the previous LED unit **1** which differs from this essentially in that the anchoring means **3** are of the box-like type and therefore associated

with the bottom wall **4** of the casing **2**.

[0075] In both embodiments described above, the spring-loaded terminals **7** may be replaced with clamps of conventional type, in particular of the screw type, without departing from the scope of protection of the present invention.

[0076] As matter of fact Fig. 7 shows a further embodiment of the LED unit **1** which differs from the previous ones essentially in that the terminals **7** are of the screw type.

[0077] In this embodiment the anchoring means **3** are of the panel type.

[0078] As can be seen more clearly from Fig. 8, the casing **2** will be substantially similar to the configuration with terminals **7** of the spring type unless minor modifications needed to adapt it to the different shape of the terminals **7**.

[0079] Fig. 9 shows a further variant of the LED unit **1** with screw terminals **7** wherein the anchoring means **3** are of the bottom box-type.

[0080] Fig. 10 shows a fourth embodiment of the LED unit **1**, which differs in that it has an LED circuit **13** of the SMT (*Surface-Mount Technology*) type.

[0081] In this variant the LED diode **14** is mounted on the printed circuit **15** to be completely contained in the casing **2** and flush with the upper hole **17**, as can be seen more clearly from Fig. 11.

[0082] Moreover, the diode **14** will emit the light beam in a direction parallel to the plane defined by the printed circuit **15** so as to exit from the upper hole **17**.

[0083] The anchoring cradle **18** will be free of the collar **19** and provided only with the annular projection **20** which can be inserted into the upper hole **17** and having the axial slot **21** for the passage of the light beam.

[0084] The LED unit **1** has spring-loaded terminals **7** even if in a not shown variant the terminals **7** may be of the screw type.

[0085] Moreover, the anchoring means **3** are of the panel type but may also be of the bottom box-type.

[0086] Figs. 12 and 13 show yet another embodiment of the LED unit **1** also having in this case a LED circuit **13** of the SMT type in which the LED diode **14** is housed inside a collar **19** integral with the anchoring cradle **18** and protruding externally from the upper hole **17**.

[0087] Also in this case the spring terminals **7** may be replaced by screw terminals, as well as the panel type anchoring means **3** may be replaced by bottom box-type one.

[0088] Fig. 14 shows a contact unit **30** provided with a casing **2** which can be used for the assembly of the LED unit **1** according to the invention.

[0089] In this case, the casing **2** will house, in place of the LED circuit **13**, a known type of actuator **31** having a slider **32** slidable in the casing **2** and with an upper end **33** adapted to be associated with an external control, not illustrated since known per se.

[0090] The slider **32** is integral with two movable electric contacts **34** adapted to be brought into contact with

corresponding fixed electrical contacts **6** present in the casing **2** upon the translation of the slider **32**.

[0091] The anchoring cradle **18** is not present and will be arranged only when it will be necessary to arrange the LED circuit **13** instead of the actuator **31**.

[0092] Fig. 15 shows a variant of the previous contact unit **30** which differs in that it has spring terminals **7** in place of the screw terminals of the previous embodiment.

[0093] In both these last two embodiments, the lower hole **27** may be used, when the unit is configured as contact unit **30**, to connect multiple contact units in cascade, i.e. with the respective actuators **31** arranged in column and connected to each other through the respective lower holes **27** and with a single actuator **31**, the upper one, connected directly to a button or other control device so that the actuation of the button or device operates substantially all the actuators **31** simultaneously.

[0094] From above it is apparent that the LED unit and the assembly according to the invention achieve the intended objects and in particular that of allow to use a single casing, and therefore a single mold, both to mounting an LED unit and a contact unit.

[0095] The LED unit and the assembly according to the invention are 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.

[0096] Although the LED unit and the assembly have been disclosed 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 assembly for mounting LED units or contact units for electrical systems for controlling industrial machines or plants, comprising:

- a casing (**2**) housing therein two or more fixed electrical contacts (**6**) associated with respective wiring terminals (**7**) for connection to an electrical circuit, said casing (**2**) having at least one pair of lateral passages (**12**) for accessing said terminals (**7**);
- at least one LED circuit (**13**) adapted to be inserted into said casing (**2**) and having a diode (**14**) for emitting a light beam and a printed circuit or PCB (**15**) for the electrical connection with said electrical contacts (**6**);
- at least one actuator (**31**) adapted to be inserted into said casing (**2**) and having a slider (**32**) slidable in said casing (**2**) with an upper end (**33**)

adapted to be associated with an external control and two or more movable electrical contacts (**34**) adapted to be brought into contact with respective fixed electrical contacts (**6**) upon the translation of said slider (**32**);

wherein said casing (**2**) comprises a housing (**16**) for selectively receiving said at least one LED circuit (**13**) or said at least one actuator (**31**), said housing (**16**) being provided with an upper hole (**17**) for connecting said diode (**14**) with said PCB (**15**) or for the exit of said upper end (**33**) of said slider (**32**);

characterized by comprising an anchoring cradle (**18**) adapted to be arranged in said housing (**16**) to allow insertion and blocking of said LED circuit (**13**) in said casing (**2**) in absence of said actuator (**31**).

2. Assembly as claimed in claim 1, **characterized in that** said anchoring cradle (**18**) comprises an axial plate (**23**) adapted to be snugly fitted into said housing (**16**) and having means for the stable but removable fixing of said PCB (**15**).
3. Assembly as claimed in claim 1 or 2, **characterized in that** said anchoring cradle (**18**) comprises a collar (**19**) with a portion (**20**) adapted to be snugly fitted in said upper hole (**17**) and inside which said diode (**14**) is at least partially inserted, said collar (**19**) having one or more axial slots (**21**) for the electrical connection of said diode (**14**) with said PCB (**15**).
4. An LED unit for electrical control circuits of machines or industrial plants obtained by mounting an assembly according to one or more of the previous claims.
5. An LED unit for electrical circuits for the control of machine or industrial plants, comprising:

- a casing (**2**) housing at least one pair of electrical contacts (**6**) associated with respective wiring terminals (**7**) for connection to an electrical circuit, said casing (**2**) having at least one pair of lateral passages (**12**) for accessing said terminals (**7**);
- at least one LED circuit (**13**) adapted to be inserted in said casing (**2**) and having a diode (**14**) for emitting the light beam and a PCB or printed circuit (**15**) for the electrical connection with said electrical contacts (**6**);

wherein said casing (**2**) comprises a housing (**16**) for said at least one LED circuit (**13**) provided with an upper hole (**17**);

characterized by comprising an anchoring cradle (**18**) adapted to be inserted into said housing (**16**) for the stable locking of said LED circuit (**13**) in said casing (**2**).

6. LED unit as claimed in claim 5, **characterized in that** said cradle (18) is made of plastic material having a colour equal or close to that of the light beam emitted by said LED circuit (13), said cradle (18) being provided with at least one portion visible from the outside of said casing (2). 5

7. LED unit as claimed in claim 5 or 6, **characterized in that** said cradle (18) comprises a collar (19) with a portion (20) adapted to be snugly fitted in said upper hole (17), said diode (14) being at least partially inserted therein, said collar (19) having one or more axial slots (21) for the electrical connection of said diode (14) with said PCB (15). 10
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8. LED unit as claimed in claim 6 or 7, **characterized in that** said LED circuit (13) is a SMT (*Surface-Mount Technology*) LED.

9. LED unit as claimed in any preceding claim, **characterized in that** said casing (2) comprises at least one window (27) for the partial view of said cradle (18). 20

10. LED unit as claimed in any preceding claim, **characterized in that** said cradle (18) comprises an axial plate (23) for supporting said PCB (15) in said housing (16). 25

11. LED unit as claimed in claim 10, **characterized in that** said axial plate (23) comprises means (24, 25) for the stable but removable fastening of said PCB (15). 30

12. LED unit as claimed in claim 10 or 11, **characterized in that** said cradle (18) comprises a fin (28) protruding transversely from the lower end of said axial plate (23). 35

13. LED unit as claimed in claim 12, **characterized in that** said window (27) is realized in the bottom wall (4) of said casing (2) and has such dimensions as to accommodate said transverse fin (28) of said cradle (18). 40
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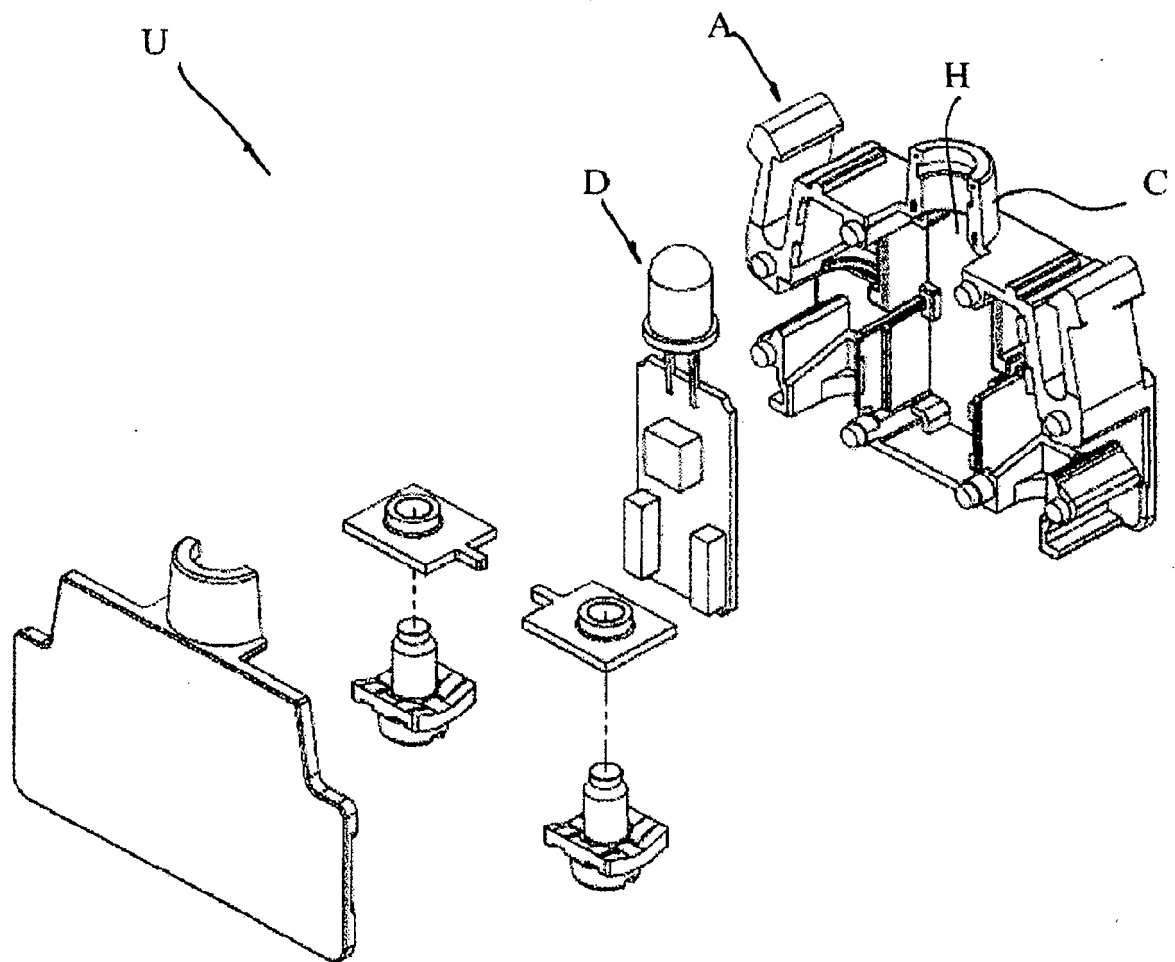


FIG. 1 – STATE OF THE ART

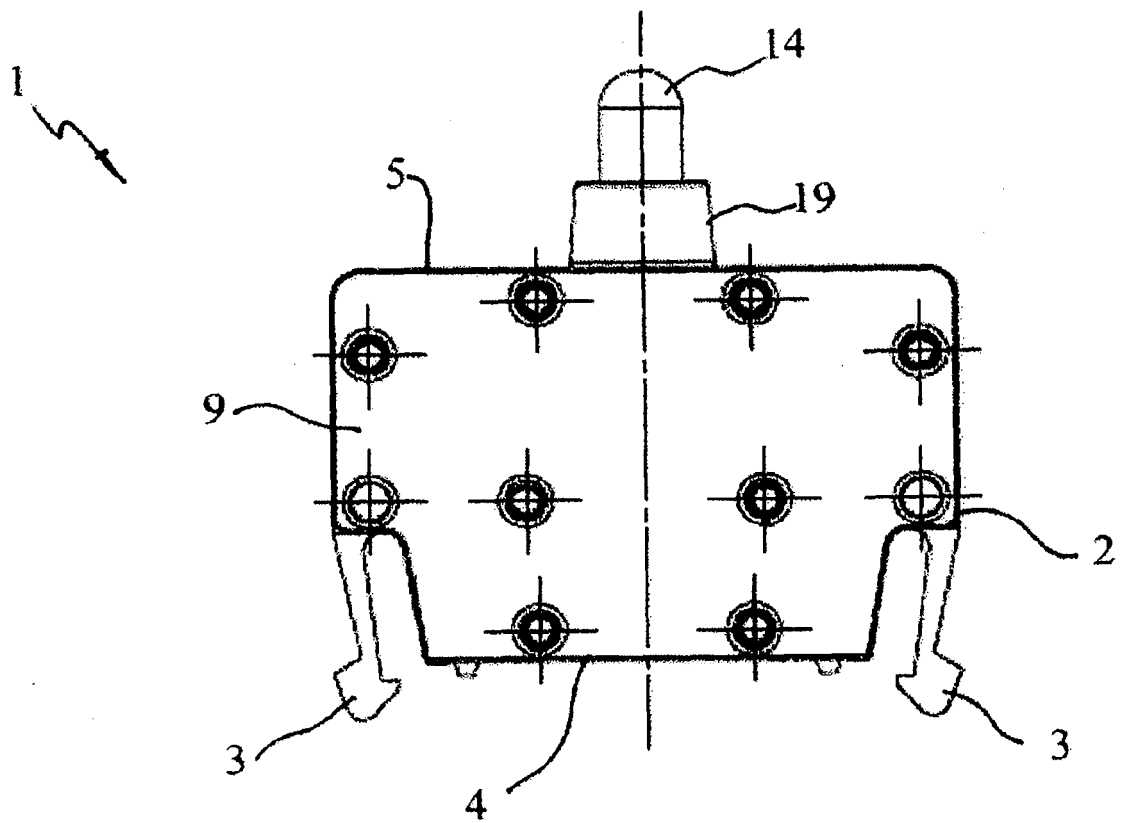


FIG. 2

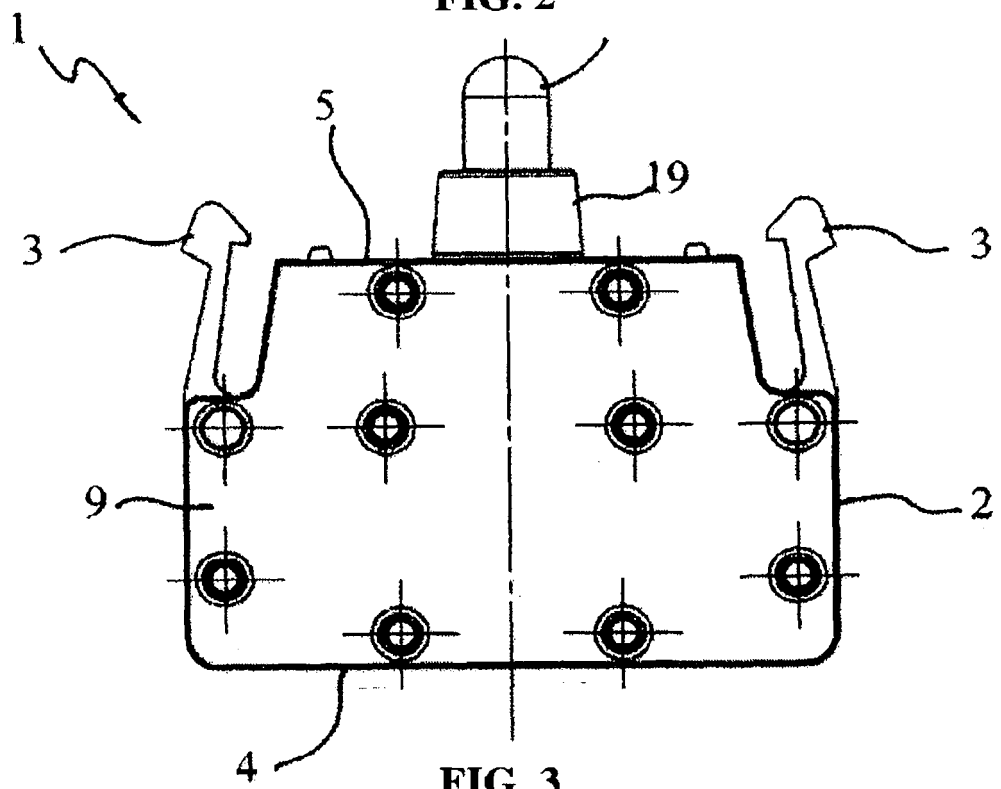


FIG. 3

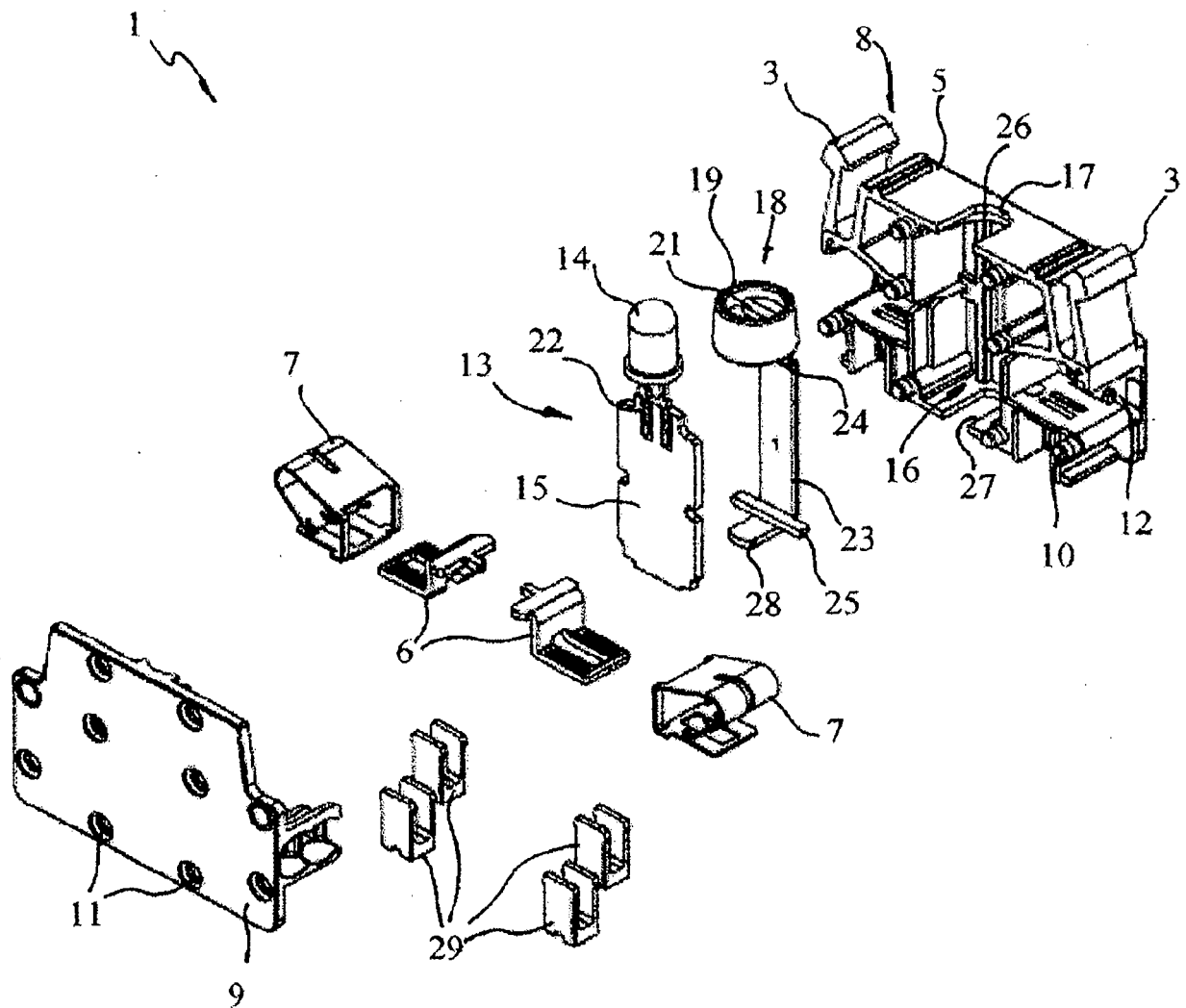


FIG. 4

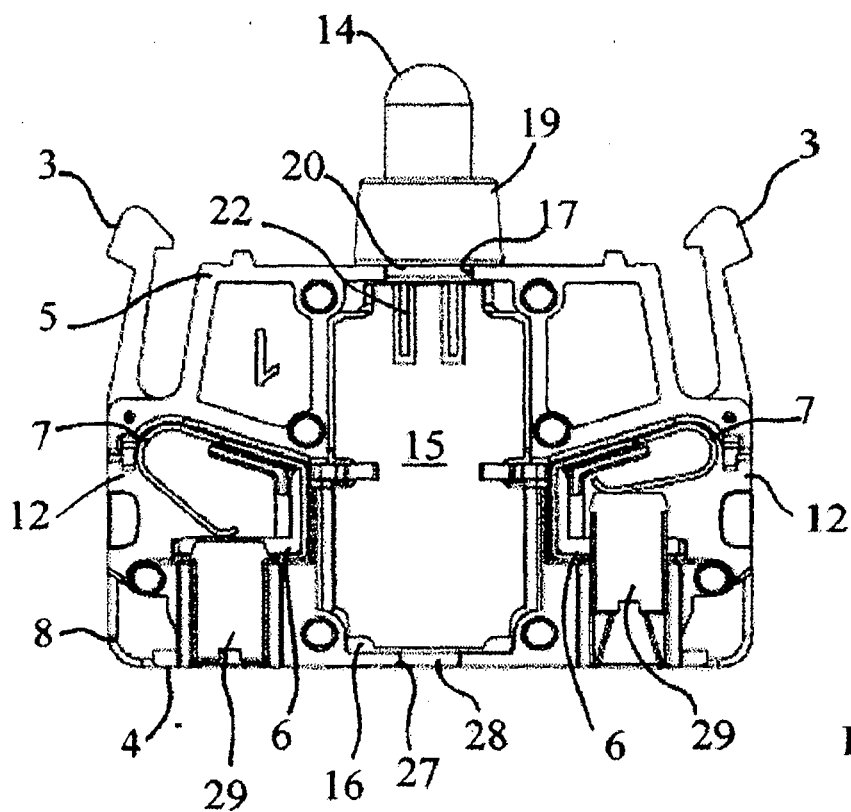


FIG. 5

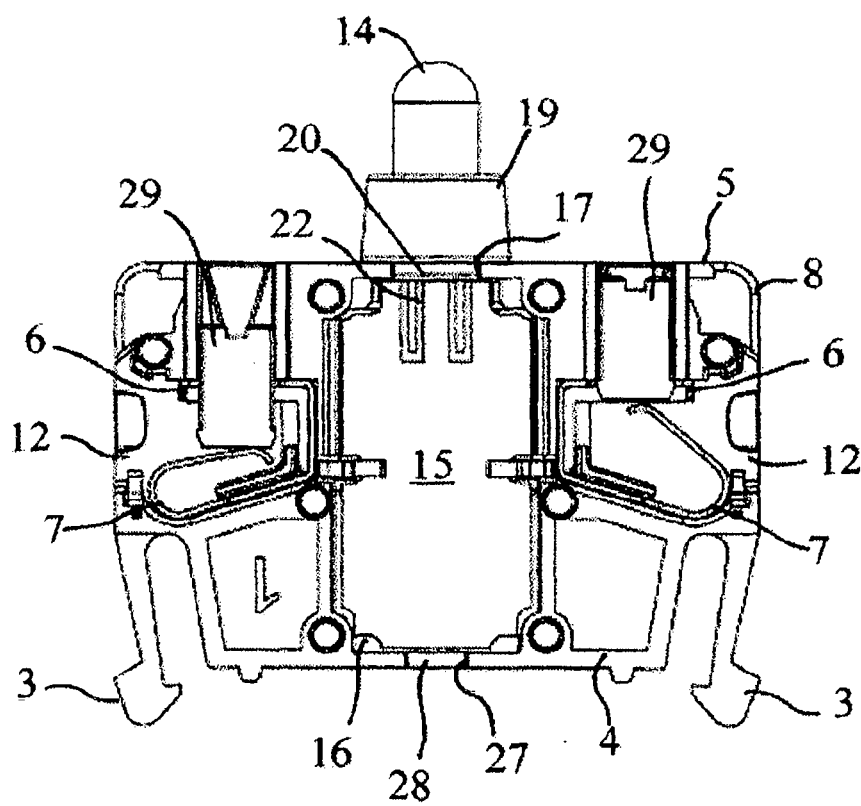


FIG. 6

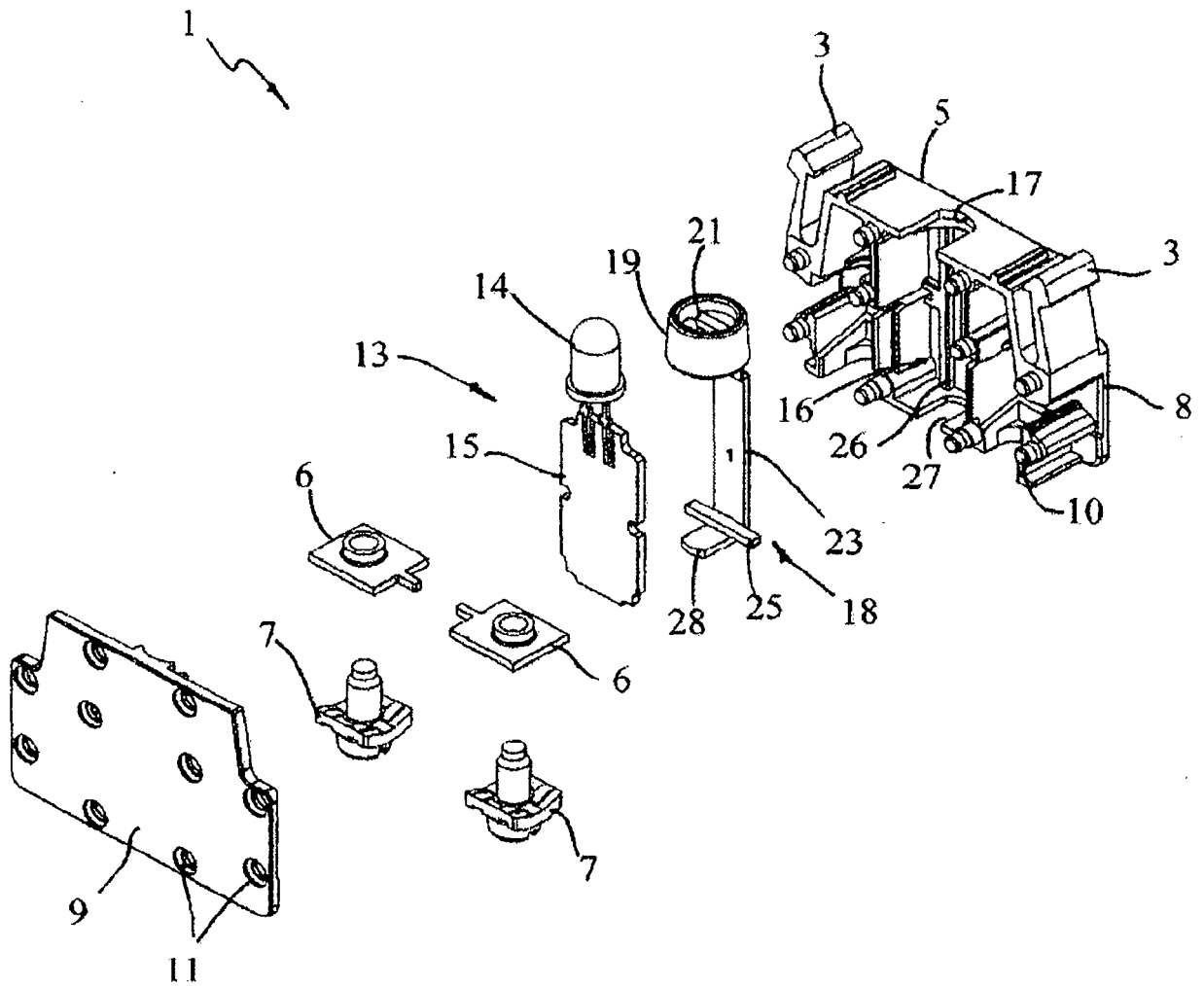


FIG. 7

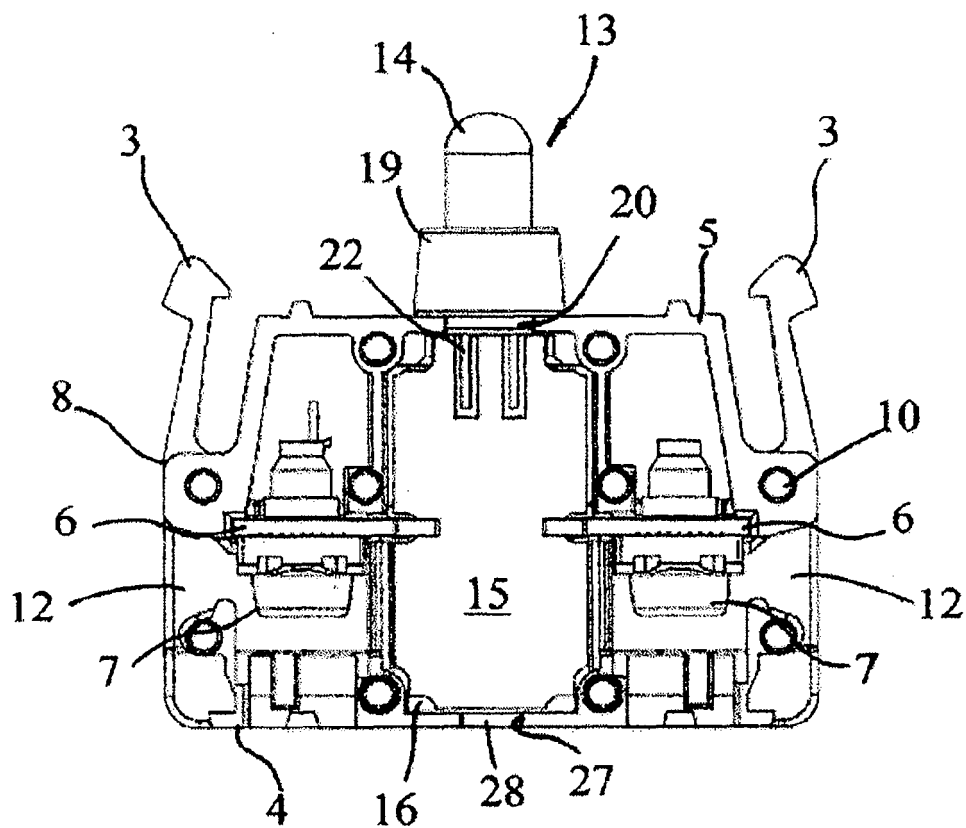


FIG. 8

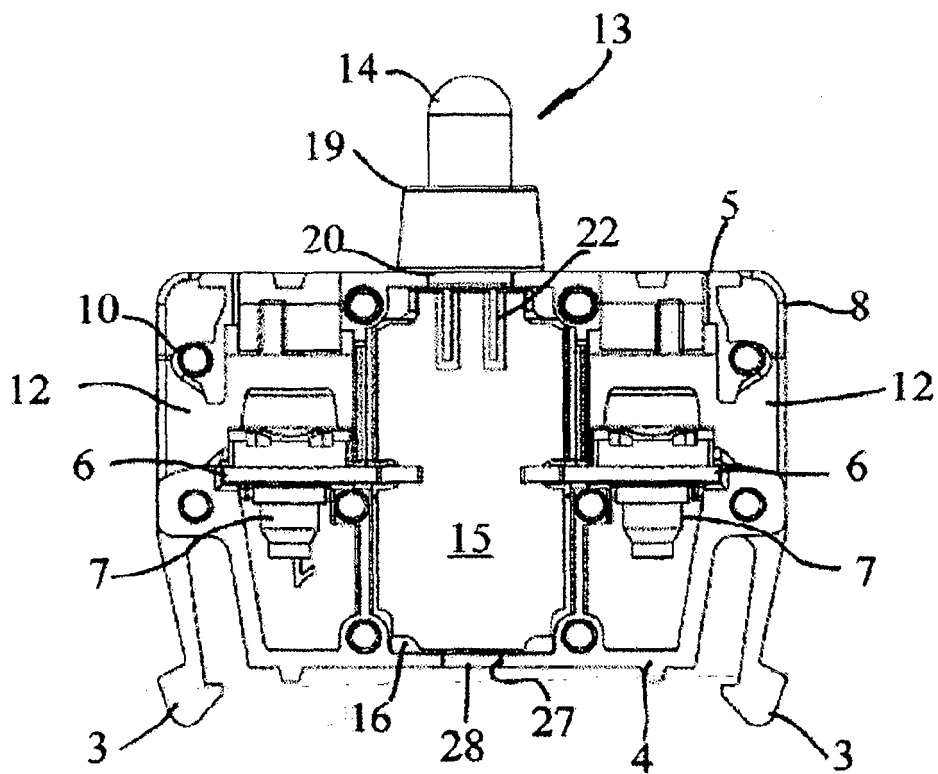


FIG. 9

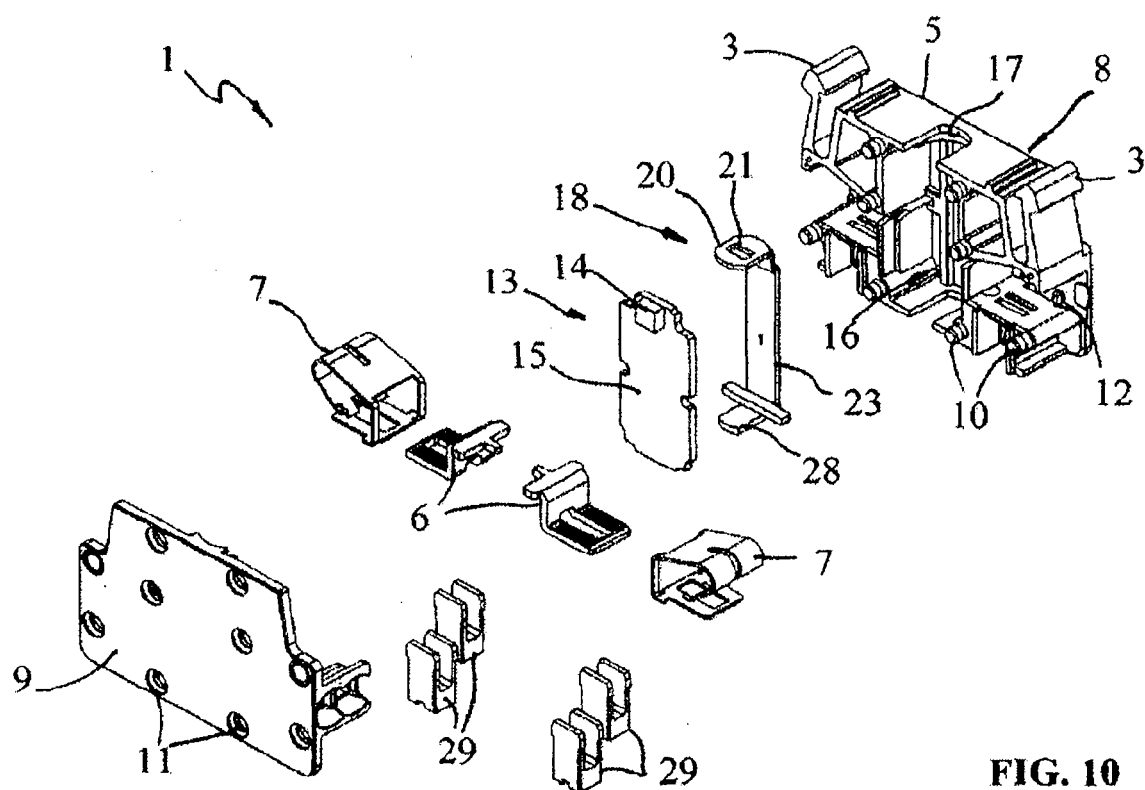


FIG. 10

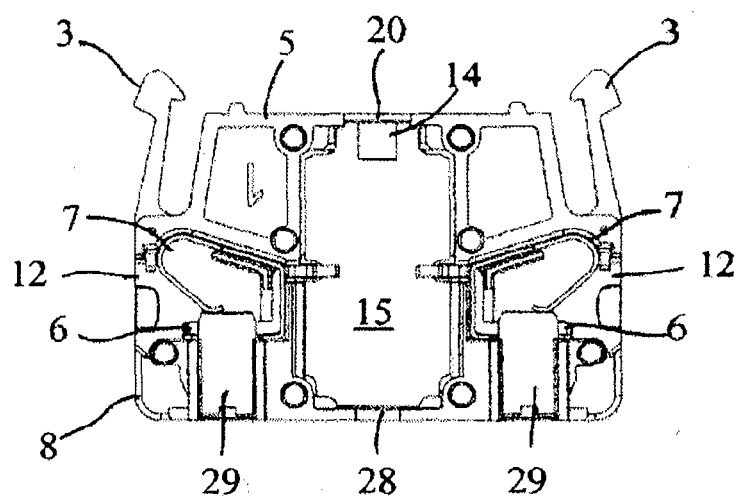


FIG. 11

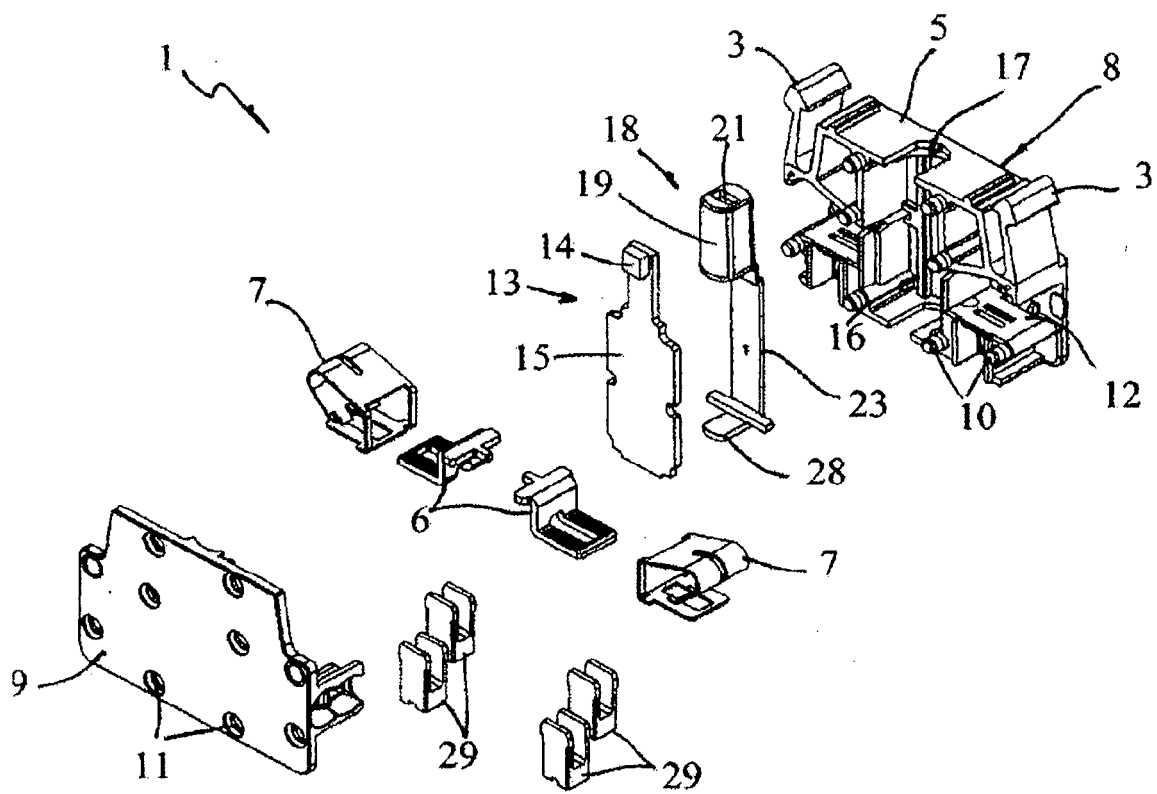


FIG. 12

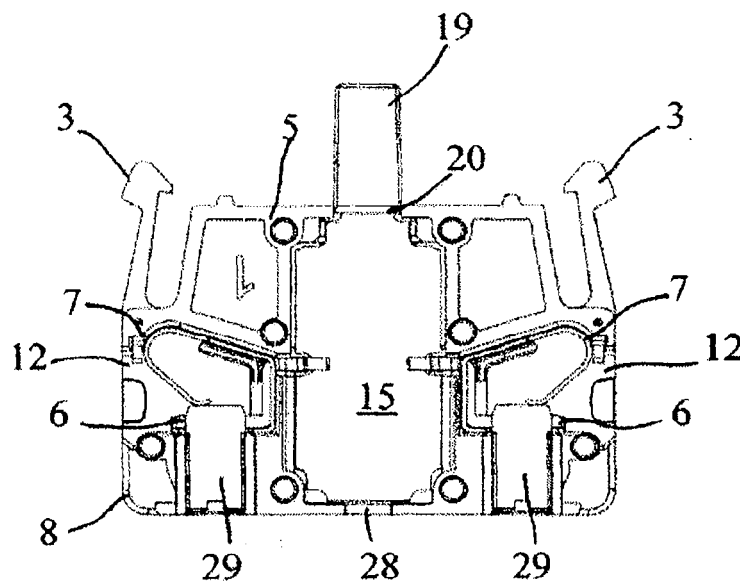


FIG. 13

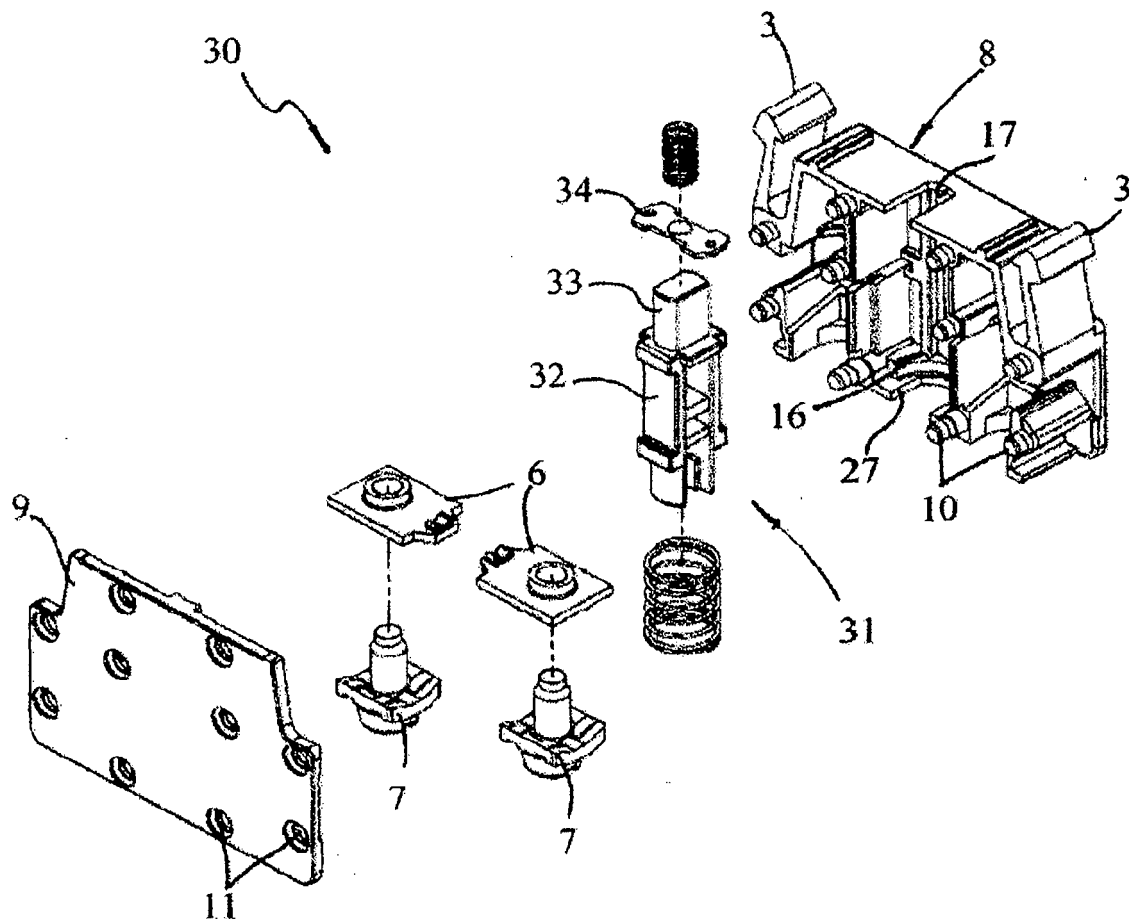


FIG. 14

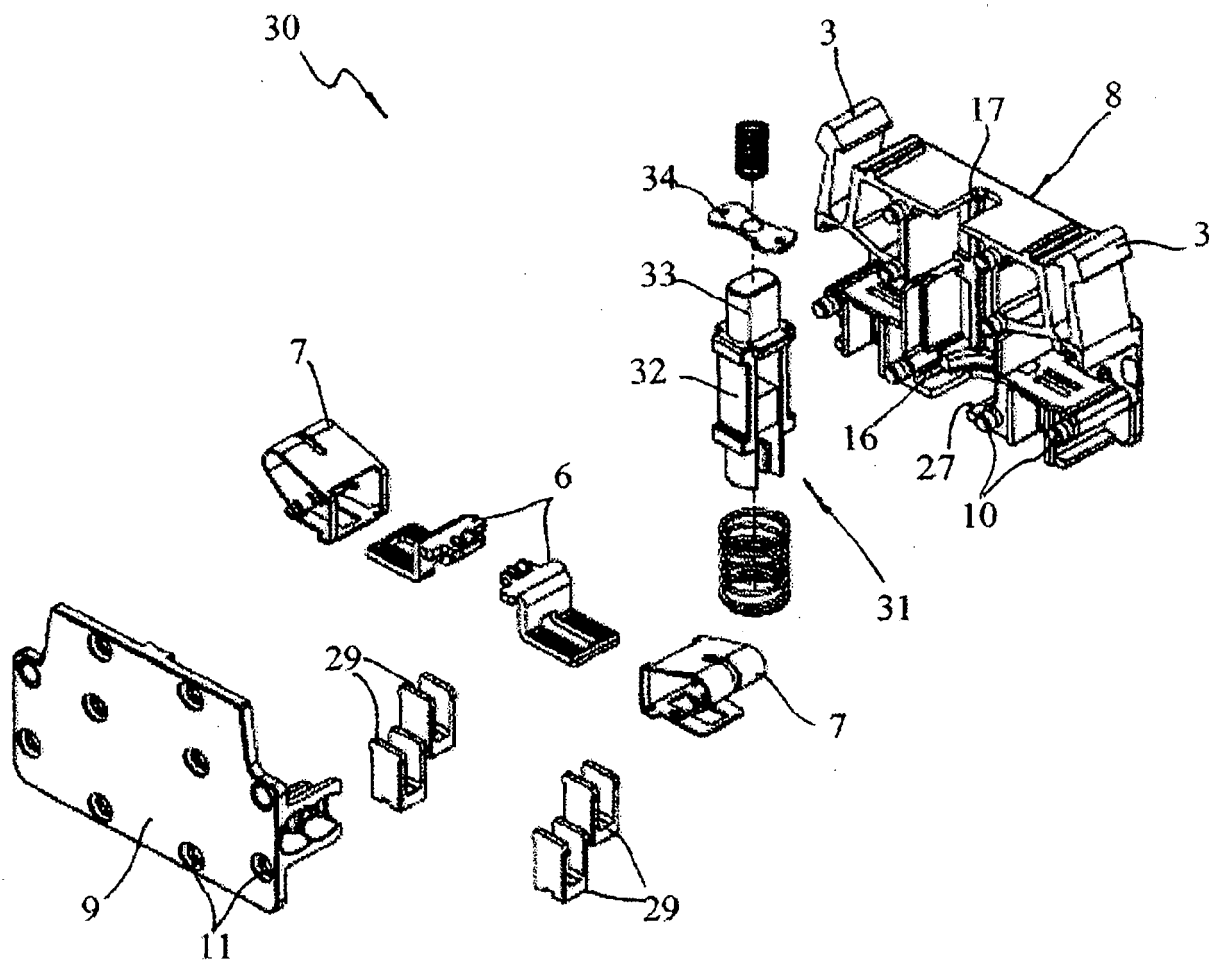


FIG. 15



EUROPEAN SEARCH REPORT

Application Number
EP 18 00 0432

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