

THIS SHEET HAS BEEN
REPLACED

REPLACED SHEETS		SG
☒	Description : paged ... ¹ ... to paged ... ¹⁵ ...	
☒	Claim(s) : paged ... ¹⁶ ... to paged ... ²⁰ ...	
☒	Drawing(s) : paged ... ^{1/2} ... to paged ... ^{7/4} ...	
☒	Abstract : paged ... ²¹ ... to paged ... ²⁵ ...	
DATE OF RECEIPT		

A Connection Element for at Least one Electrical Working Means

The invention relates to a connection element for at least one electrical working means, with a housing made of an electrically insulating material and provided with fastening means and with contact means which have electrically interconnected, spaced connection points for electrically conductive parts, at least one of which connection points is configured as a cut-clamp contact point.

For example, from EP 002 099 there is known a connection element for an electrical low-voltage transformer, comprising a housing which is composed of an insulating material, adapted to be fastened at the package of transformer laminations, and in which a number of electrically conductive contact springs are housed as contact means, each of the contact springs having a clamping slit for connecting an external conductor in the cut-clamp technique. The contact springs are provided, in addition, with an additional clamping slit likewise forming a cut-clamp contact point which makes it possible to connect a much thinner wire of the winding in order to establish an electrically conductive connection between the external conductor and the winding. The assembly is effected by attaching first the housing to the package of laminations and, after that, by inserting the wire ends of the winding into slits of the housing. Thereafter, the contact springs are pressed from above into suitable housing chambers which are associated with the slits, whereby the wire ends are pressed into the associated clamping slits, on the one hand, and the contact springs are locked into the chambers of the housing, on the other hand. In an ensuing operation, the external lead-in wires can be inserted into the contact springs' clamping slits which are accessible from the outside. Therefore, the housing and the contact spring usually must be assembled by the manufacturer.

For example, when electric luminaires with a three-pole terminal for gas discharge lamps are to be wired, to date a considerable number of individual connection points must be interconnected by separate lines because, apart from a separate connection block, additional connection points for capacitors and other required working means are present. The wiring expense is cost and time-intensive [sic!].



- 2 -

The problem underlying the invention results therefrom, namely to create a connection element for at least one electrical working means, e.g., a capacitor, which makes it possible to reduce the expenses for wiring and which, in addition, can be used universally for various applications.

In order to solve this problem, the above-cited connection element is characterised in that at least one further connection point of the contact means is configured as a plug-type contact point and that both connection points, i.e., the cut-clamp contact point as well as the plug-type contact point, in the state of operation are arranged in an at least shock-proof insulated manner by surrounding housing portions inside the housing.

The cut-clamp contact point makes possible easy connection of conductors of the wiring by the slit blade insulation piercing connection technology which is especially suitable for the automatic production of wiring layouts by means of a program controlled robot and a wire placing tool moved by the robot along the paths of wiring. At least one plug-type contact makes it possible to simply plug in a line of an electrical working means - or some other line - without need for additional contact points which would have to be reached by the wire placing tool.

For example, at least one plug-type contact can be adapted to plug in a soldering lug or a blade connector, and the arrangement is often such that the connection element comprises two plug-type contacts in side-by-side relationship which are adapted to plug in a soldering lug or a blade connector and each of which is connected in electrically conductive fashion with a proper cut-clamp terminal. In this way it is possible, for example, to connect an electrolytic capacitor, which is provided with the usual soldering lugs, directly to the connection element so that particular terminals, which for this purpose have to be mounted in the apparatus and then wired, become redundant. Similarly, resistors, chokes and the like working means can be connected at those points by means of a blade connector or at other appropriately arranged connection points via their connection wires or, if necessary, associated round connectors.

With a view to automatic wiring and the required freedom of motion of the wire placing tool, it is often advantageous that the connection element has at least one plug-type contact point the direction of insertion of which

This Sheet Has Been Replaced



- 3 -

is at right angles to the direction of insertion of the blade-contact point. Besides that, on the housing there can be provided an accommodating or connecting region for the working means in the region of which there is at least one plug-type contact point and which makes it possible to join the working means to be connected also directly mechanically with the housing. To this end, the accommodating or connecting region can comprise mechanical stop or retention means for the working means.

In order to increase the universal applicability of the connection element, the accommodating or retaining region is conveniently covered in insulating fashion toward the outside by detachable closure means if the connection element is used without working means to be connected at that point.

The closure means may be configured to be latchable to the housing but other closure options are conceivable too, e.g., in the form of screw- or bayonet-type closure means.

In a preferred embodiment, the closure means are associated with electrical connection means for bridging at least two plug-type contact points situated in the accommodating or connecting region so that upon inserting the closure means, an internal switching of various connection points is effected in the connection element. Particularly when the wiring of luminaires is produced, in this way further economy in regard to separate connection points for lines to be laid out can be achieved.

Insertion channels for conductive parts which are to be connected are advantageously associated with the plug-type connection points in the housing, in which these parts can be accommodated over part of their length, optionally including an applied insulation, so that perfect shock-protected insulation is ensured in the contact region without additional provisions. In order to facilitate the insertion of conductive parts to be connected, such an insertion channel can be configured as outwardly flaring in the form of a funnel.

Depending on the design of the apparatus and the associated wiring, it may be advantageous if at least one plug-type contact point is configured to have a direction of insertion aligned in parallel with the direction of insertion of the cut-clamp contact point. Also, the connection element may have at least two plug-type connection points accessible from opposite sides

This Sheet Has Been Replaced



-4 -

of the housing to ensure in this way the greatest possible saving in space for the arrangement of one or more working means or lines to be connected.

In the practical embodiment, the contact means of the connecting element can comprise at least one contact spring of a material of good electrical conductivity in which the cut-clamp contact point and the plug-type contact point or points are formed. There a particularly good contact can be obtained with relatively simple means at the cut-clamp contact point if the same is formed by two contact spring portions which are parallel and not joined over their length and in which two aligned cut-clamp slits are arranged, with the two contact spring portions being laterally guided inside the housing. As a matter of fact, each of the two contact spring portions renders two separate points of contact so that the connected conductor is contacted at a total of four separate contact points.

In an advantageous embodiment, the contact spring can comprise a bottom portion and two facing leg portions extending from the bottom portion, in at least a part of which there is formed a plug-type contact opening covered at least partially by a latch member latchable with a plugged-in part of the conductor to be connected. This latch member can be formed at the contact spring proper as one or more tabs which are cut to be exposed, spread upon insertion of a part, and latch with the same. But into the contact spring there can be inserted a proper clamping spring which has latching parts cooperating with the respective contact opening. For this purpose, in the region of at least one contact opening of the contact spring, the clamping spring may have a connector opening which is delimited by latching tabs which are cut to be exposed and can spread at their ends. Another option implies that at a substantially flat part of the contact spring there is arranged a region of substantially L- or U-shaped cross section, which region forms a plug-type connection, is pressed outward out of the plane of that part, and into which a latching member optionally formed at the aforementioned clamping spring extends.

Moreover, in the region including the bottom and leg portions, the contact spring may be configured to be substantially closed all the way around by upper wall portions, with the two parts bearing the cut-clamp slits cut into the upper wall portions.

This Sheet Has Been Replaced



- 5 -

As a rule, in the novel connection element a plurality of contact springs are arranged inside the housing in separate chambers which are separated from each other by insulating partitions and closed by a common lid. This lid may be omitted if the housing in its state of operation rests directly on an insulating substrate so that the contact means are shut off also on that side toward the outside in a shock-protected manner.

The lid may be arranged on the housing's side facing the cut-clamp contact points and be provided with support means for the contact means' parts forming cut-clamp contacts. The lid and/or the housing or the partitions in the same can be provided with interlocking parts preventing leakage paths, and it is also possible that the housing and/or the lid has at least one passage channel for a conductor looped therethrough.

As noted at the outset, particularly in the utilisation with luminaires it is advantageous if the connection element is adapted to be used with a capacitor as working means and if the housing is provided with form-locking retention means for the capacitor in the above-described accommodating or connecting region. In addition, or as an alternative, the arrangement can be such that a capacitor, a resistor or at least one other component is accommodated in the housing itself, with mounting inside the space enclosed by the respective contact spring appearing attractive.

The connecting element may comprise connection points suitable for connecting fine-wire fuse means or, for example, a shunt, which connection points are either configured as plug-type contact points or are situated within the housing itself.

The novel connection element is universally usable. It can be used to advantage particularly in the automatic production of the wiring of luminaires but its applicability is not restricted to that field.

The drawing shows embodiments of the object of the invention. There show:

- Figure 1, a perspective view of a connection element according to the invention, with the closure member removed,
- Figure 2, a perspective view of the closure member of the connection element of Figure 1,
- Figure 3, a side view of the connection element of Figure 1 in a section along line III-III of Figure 1, with the closure member being

This Sheet Has Been Replaced



- 6 -

- inserted, to show the conditions of the connection of a ground connection and a line,
- Figure 4, a sectional view of the connection element of Figure 1, showing the connection of two external lines and of a capacitor,
- Figure 5, a side view of the connection element of Figure 1 from the side opposite the closure member,
- Figure 6, a plan view of the bottom of the housing of the connection element of Figure 1, with the contact springs removed,
- Figure 7, a sectional side view of the housing of the connection element of Figure 2 along the line VII-VII of Figure 6,
- Figure 8, a sectional side view of the lid of the housing of the connection element of Figure 1 along the line VIII-VIII of Figure 9,
- Figures 9 and 10, a side view and an inside view of the lid shown in Figure 8,
- Figures 12 and 13, a plan view and a side view, respectively, of a contact spring leaf of the closure member of the connection element according to Figure 1,
- Figures 14 through 18, a side view, a top view, two views from the two faces, and a view from below, respectively, of a contact spring of the connection element according to Figure 1,
- Figures 19 through 21, a plan view and a side view, as well as a view from above, of a ground connection element for the connection element according to Figure 1,
- Figures 22 through 24, a side view, a view from above, and a sectional view along line XXIV-XXIV of Figure 23 of the clamping spring for the contact spring of Figures 14 through 18,
- Figure 25, a schematic perspective view of a contact spring according to Figures 14 through 18, with the clamping spring inserted and with a capacitor inserted, and
- Figure 26, a plan view, on a different scale, of a detail of a contact point of a cut-clamp contact of the connection element according to Figure 1.

The connection element illustrated in Figure 1 comprises an integral housing 1 made from plastics and comprising a rectangular base portion 2 with a cap-like lid 3 applied from below, which is latched by latching recesses 4

This Sheet Has Been Replaced



- 7 -

on two opposite faces and by latching protrusions 5 provided on the base portion 2 (Figures 1 and 5). On the base portion 2 there are moulded five connection terminals 5 arranged in a row in side-by-side relationship, each delimited by two parallel, spaced facing walls 6. The connection terminals 5 are adapted to connect lines 7 with the so-called slit blade insulation piercing technique and are of substantially equal shape.

The two parallel side walls 6 delimit an upwardly open terminal housing of each of the connection terminals 5. They bear on their inside two opposite moulded ribs 8 which are situated approximately in the middle between the two front sides of the side walls 6 and confine between themselves a slightly wedge-shaped or parallel-slimly [sic!] limited insertion slit 9 (Figure 5) which on its upper side is broadened by insertion slopes 10. The insertion slit 9 is on its bottom 11 slightly elevated above the contiguous bottom portions 12 of the space limited by the two sides walls 6 on both sides, as can be seen from Figure 3.

Two opposite narrow grooves 13 extend from below into the ribs 8 up to about the level of the insertion slopes 10 and accommodate in pairs legs 15 of two cut-clamp contacts 16 (Figure 26) of a contact spring 21 of spring steel or spring bronze, with each leg defining a cut-clamp slit 16 open at its edge. The narrow plate-shaped cut-clamp contacts 16 are embedded into the insulating material of the housing 1 with the narrow sides between the side walls and in the grooves 13 up to the blade sections formed at the legs 15 and facing the cut-clamp slit 14, with legs 15 being guided to be movable to a limited extent in the grooves 13. Together with the cut-clamp slit 14 they form the zone of contact of the connection point formed by the respective connection terminal 5.

As can be inferred particularly from Figures 1, 3, and 5, the side walls 6, together with the associated bottom wall 12, are on both sides contiguous to the ribs 12 and, hence, the insertion slit 9, and define a groove-like recess of rectangular cross section, which opens toward the upper side near insertion slit 9. The two groove-like recesses 17 on both sides of the insertion slit 9 are arranged to be aligned with each other and with the insertion slit. On the top they are likewise limited by a slope 10 for insertion. As shown in, say, Figure 3, the depth of the groove-like recesses 17 exceeds the depth of the insertion slit 9, and also the width is much greater than the width of the insertion slit 9 (see Figure 5).

This Sheet Has Been Replaced



- 8 -

The dimensions of the various parts are chosen such that with an insulated conductor pressed in through the insertion slit 9 (see Figure 4), the insulation is cut open in the cut-clamp slit 14 by the legs 15 of the two cut-clamp contacts 16, while at the same time a gas-tight contact between the cut-clamp contacts 16 and the conductor 19, which is deformed at the point of clamping, is obtained, as illustrated in detail in Figure 27. Since the two cut-clamp contacts 16 are separated - as will be explained below in detail - they form two contact spots which are spaced in the longitudinal direction of the conductor, which means that the conductor 19 is contacted at four different spots 14 which are delimited by the two cut-clamp slits 14. It is ensured in this way that an especially effective contact is established.

The conductor 19, which was pressed in, is clamped at its insulation 20 in the insertion slit 9 between the two ribs 8. The fixed and connected conductor 7 runs through one of the groove-like recesses 17, whereas the cut end is situated in the other groove-like recess 17, as illustrated in Figure 4. Both width and depth of the groove-like recesses 17 and their axial length are dimensioned so that electric-shock protection is automatically obtained for the cut end of the conductor 7. This means, that the standardized sensor tip can enter up to the exposed, cut end in the depth of the associated groove-like recess 17 when a test for electric shock protection is made.

Underneath the terminal 5 there are arranged four contact springs 21 (Figures 14 to 18) with clamping springs 22 (Figures 22 to 24) inserted in the same which are associated with the various terminals 5 in the substantially hollow housing 1.

Each of the contact springs 21 is formed as an integral piece out of a strip of spring brass or spring bronze. It has a substantially trapezoidal, closed bottom portion 23 (Figure 14) which is limited by a flat bottom portion 24, two laterally contiguous, inwardly inclined leg wedges 25, and two upper wall portions 26 parallel to the bottom portion 24. The two upper wall portions 26 are followed by two tabs 27 bent upwards under a right angle, which, when in the normal state, bear against each other with their broad sides under a light bias, along the plane 28 of symmetry. Each of the two tabs 27 is at its upper edge provided with the cut-clamp slit 14 which is limited by the two legs 15. They form the two cut-clamp contacts 16 and, in the assembled state, extend from below into the two slits 13 of the respective terminal 5, where they are laterally and movably guided.

This Sheet Has Been Replaced



- 9 -

The substantially C-shaped clamping spring 22 (Figures 22 to 24) is inserted into the closed lower part 23 of the contact spring 21, with the contact spring conforming to the inner periphery, having a width equal to that of the contact spring 21, and with a flat bottom portion 29 and two punched lateral legs 30 flush with the bottom portion 24 and the legs 25 of the contact spring 21. The clamping spring 22 is made from spring steel.

In the leg portion 25, which in Figure 26 is the left leg portion of the contact spring 21, there is a rectangular recess 31 following on the top of the upper wall portion 26, while at the top of the opposite leg portion 25 there are provided two approximately oval passage openings 32 in side-by-side relationship (Figures 16 and 17). The recess 31 and the two openings 32 are covered by the two legs 30 of the inserted clamping spring 22, and the clamping spring's 32 leg 30 associated with the openings 32 is divided by a longitudinal slit 34 into two independently movable, tongue-shaped parts each of which is associated with an opening 32.

The recess 31 and the openings 32 of the contact spring 21, together with the associated legs 30 of the clamping spring 22, form plug-type contact points one of which 31, 30 is adapted to connect a soldering lug or a blade connector and the other two 32, 30 are designated to connect two round wires or two stranded conductors as will still be explained in greater detail.

An approximately L-shaped, upwardly bent fastening tab 35 (Figure 14), which forms an extension of the bottom portion 24 on that side, is unlatched from the contact spring's 21 leg portion 25 associated with the openings 32. In the center of the bottom portion 24 there is punched a circular opening 36 which on one side is followed by an opening 37 of rectangular cross section (Figure 18), whereas on the other side, near the associated leg portion 25, the bottom portion 24 is provided with a downwardly unlatched tab 38 of approximately L-shaped cross section (Figure 17). The tab 38 is situated near a longitudinal edge of the bottom portion 24 and is parallel with the plane of symmetry of the same. It is cut free on both sides at 39, 40. As can be inferred from Figures 22 to 25, in the region above the tab 38, in the clamping spring 22, there is provided a cut-free, downwardly inclined protruding latching tab 41, which, in the assembled state, cooperates with the L-shaped tab 38 of the contact spring 21 and forms with the same a plug-type contact point facilitating connection of a plugged-in conductor 44 in the manner shown in Figure 3. An embossed crimp 46 serves as a reinforcement.



- 10 -

Above the rectangular opening 37 in the bottom portion 24 of the contact spring 21 there is provided, in the clamping spring 22, a plug-type contact point which is formed by two inclined, inwards and upwards bent, laterally cut-free latching tabs 47. When a flat connection member is pushed in from below through the opening 37 of the contact spring 21, the two tabs 47 are spread inwards; they latch with the pushed-in member in a manner known per se so that the same cannot be withdrawn anymore.

Finally, in the upper wall portion 26 of the contact spring 21, near the two openings 32 there is arranged a rectangular perforation 48 (Figure 26) which serves to introduce a releasing tool, e.g., a screwdriver, to undo the clamping of the conductor at this plug-type contact point.

Under each of the connection terminals 5 in the base portion 2 of the housing 1, on one side there are formed two axially parallel, cylindrical wire insertion channels 49 each of which tapers in funnel-like fashion into a coaxial bore 50 which leads into the interior of the housing and points to the associated opening 32 of the inserted associated contact spring 21.

As Figure 4 shows, the insertion channel 49 accommodates the insulation 20 of an inserted line 7 the conductor 19 of which, upon being pushed in through the opening 32 of the contact spring 21, spreads away inwardly the associated leg portion 30 of the clamping spring 22 so that the same acts as a latching member and, while establishing contact, prevents conductor 19 from being withdrawn. The conductor 19 bears fully onto the upper wall portion 26 of the contact spring 21 so that perfect contact over a large area is ensured.

If the clamping is to be undone, a tool is introduced through the perforation 48 of the contact spring 21 through an opening 21 provided near the associated connection terminal in the housing 1 in order to press the inwardly spread leg portion 30 springily downwards, whereby conductor 19 is being released.

On the opposite side the housing 1 has a centrally located socket 52, which is situated on a vertical plane and is substantially circular cylindrical, for an electrolytic capacitor 53 shown in Figure 4. The electrolytic capacitor 53 is provided with two conventional soldering lugs 54 on its front face which, when the electrolytic capacitor 53 has been inserted into the socket 52, protrude through matching housing recesses toward outward exposed perforations 31 of the two associated contact springs 21 [sic!] and

This Sheet Has Been Replaced



- 11 -

are pressed against the upper wall portion of the contact spring 21, upon insertion, by the inwardly spread legs 30 of the clamping spring 22 and are firmly latched. The plug-type contact point formed in this way for the soldering lugs 54, like the facing plug-type contact points for the conductors 19, have their (horizontal) direction of insertion at right angles with the (vertical) direction of insertion of the cut-clamp contacts of the connection terminal 5. They allow a particular space-saving and advantageous arrangement of the capacitor 53, as well as of lines which run underneath the lines 7 having contact with the connector terminal 5 and, hence, do not obstruct automatic laying and contact establishment with the lines 7 in the cut-clamp contact-connection terminals 5.

On the side near the socket 25, on the front side there are configured two additional passage channels 56 for conductors below in housing 1, which, in the manner shown at 44 in Figure 3, are electrically conductively connected with the contact springs 21, 22 via the tab 38 and the latching tab 41 of the contact spring 21 and the clamping spring 22, respectively, via a plug-type junction.

A ground connector 59, which is inserted from below through an appropriate slit 58 in the lid 3 (Figure 9) and is held between the inwardly spread latching tabs 47 (Figure 3), makes it possible to establish a connection between the contact spring 21 associated with the ground line and a metallic housing part or a special ground-connection terminal.

Details of the ground connector 59 are shown in Figures 19 through 21. It has a narrow insertion lug 61 which is slightly pointed at its extremity at 62, and is provided at the ensuing broadened part 63 with two cut-free latching tabs 64 which are laterally slightly bent out of the plane of the ground connector 59 as shown particularly in Figure 20. They make it possible to latch the ground connector 59 within a slit-like opening of the bottom of the apparatus [sic!].

As an alternative - as illustrated in Figure 4 - in the metallic bottom portion 65 of an apparatus, e.g., of an electric luminaire, there can be provided a cut-free grounding tab 66 which is bent upwards under a right angle and onto which the connection element is placed during assembly so that it protrudes inward through the opening 58 in the lid 3 and is latched in the previously described manner at the latching tabs 47 of the clamping spring 22, while contact is being established at the same time.

This Sheet Has Been Replaced



- 12 -

As can be inferred from, say, Figures 6 and 7, in the housing 1 there are formed chambers 67 under the connection terminals 5 in side-by-side position, which chambers are separated by parallel partitions 68. A contact spring 21 with an inserted clamping spring 22 is accommodated in each of the chambers 67 in the manner shown in Figures 3 and 4. The attachment tips 35 (Figure 14) of the inserted contact springs 21 overlap a transverse front wall 69 of the housing and extend into a transverse channel 71 which is situated within the base portion 2 before the front walls 69 and is closed toward the bottom by the applied lid 3.

For example, a by-pass resistor for the capacitor 53 can be mounted in the channel 71, which resistor is shown as a cylindrical circuit element with metallic connection caps attached to its ends and is illustrated in Figure 4 at 73. The by-pass resistor 73 is inserted so that its two connection caps are kept in electrically well-conducting connection with the attachment lugs 35 of neighbouring contact springs 21.

Some other circuit element, e.g., a fine-wire fuse, could be provided in place of the by-pass resistor 73, which fuse could be replaceable, if necessary, via a lateral opening in the base portion 2 and the lid 3.

On the inside of the lid 3, which on its outside has locking feet 74 serving as fastening elements, there are moulded parallel cylindrical support prongs 75 as shown particularly in Figures 3 and 8, which, in the assembled state, protrude through the central hole 36 (Figure 18) of the contact spring and of the respective clamping spring and which on the front side support the two tabs 27 of the clamping spring 21 forming the clamping contacts 16. This supporting action prevents the contact spring 21 from being deflected downward when a conductor 19 is pressed into the cut-clamp slits 14.

Besides that, on its inside the lid 3 bears moulded longitudinal ribs 76 and parallel springs 77 arranged so that, in the assembled state, the longitudinal ribs 76 together with the partitions 68 of the housing 1 support the contact springs 21 axially, whereas the springs 77 engage matching grooves 78 on the front faces of the partitions 68 to prevent in this way the development of leakage paths between neighbouring contact springs 21.

In applications in which a capacitor 53 is not used, the socket 52 which is laterally moulded on the housing (Figures 1 and 4) and forms a zone for

This Sheet Has Been Replaced



- 13 -

accommodating and connecting the capacitor 53, is closed by a lid-shaped closure element 80 (Figures 2 and 3) which is inserted into the socket 52 and guided therein by a cylindrical member 81. On the inside of the closure element 80 there are moulded two locking hooks 82 which overlap matching housing portions 84 at the socket 52. The closure element 80, which, when applied, covers the two partially exposed contact springs 21 on the front face in the socket 52 in a shock-protecting manner, is on its inside provided with a moulded plate 85 which, having been inserted, extends into a matching slit-like opening 86 above the two associated contact springs 21, as can be seen particularly in Figure 3.

On the underside of plate 85 there is arranged a contact bridge 87 made from springy brass sheet (Figures 12, 13) and bearing on one side two parallel cut-free contact prongs 88 which, in the manner shown in Figure 13, are bent downward under an angle and bent further to form an angle at their extremities. A likewise cut locking tab 89 enters into the central opening 90 of the plate 85 and holds the contact bridge 87 in place.

It can be inferred specifically from Figure 3 that, when the closure element 80 is in the inserted state, the two contact prongs 88 of the contact bridge 87 are pressed, from above and by a biasing force, onto the neighbouring upwardly exposed contact springs 21 in the opening 86, which implies that a secure electrical connection is established between these two contact springs 21 via the contact bridge 87 and, hence, the associated connection terminals 5.

When the connection element is used for wiring a luminaire equipped with gas discharge lamps, the closure element 80 therefore allows the connection of the power net lines L and N, as well as of the ground conductor (at the contact spring 21 facing the slit 58 in the lid 3), on the one hand, while, on the other hand, the luminaire can be optionally wired so that it can be operated either uncompensated or compensated with a capacitor connected in parallel to the power net or in capacitive fashion with a series capacitor, without need for additional wiring from the outside. If necessary, there can be connected an interference suppressing capacitor the two connecting wires of which are simply plugged through the insertion channels 56 (Figure 1) into the plug-type connectors formed by the two tabs 38 (Figures 3 and 18).

This Sheet Has Been Replaced



- 14 -

In an alternative embodiment, the closure element 80 can be configured so that it bears on its inner side circuit elements, e.g., a fine-wire fuse or an interference suppressing capacitor the connection parts of which are adapted to be plugged into the recesses 31 of the two contact springs 21 exposed in the socket 52. The arrangement may also be such that these circuit elements are fixed within the socket 52 at the housing 1 and are only supported by the closure element 80 and covered toward the outside.

The form of the accommodating and connecting zone as a socket 52 is not restricted to connecting a capacitor 53 with a cylindrical beaker. It is always adapted to the respective form of the circuit element to be connected and three-dimensionally applied.

Figure 26 shows an alternative for arranging a capacitor 530 or some other circuit element, e.g., a resistor. The substantially block-shaped capacitor 530 is inserted into the cavity enclosed by the bottom portion 23 of two adjacent contact springs 21, with the two connection wires 95 bent upwards in the form of a U such that they are clamped between the top of the capacitor 530 and the inner side of the upper wall portion 26 of the contact springs 21 with a biasing force required for making good contact.

In order to provide mechanical support of the capacitor 530, the partitions 68 of the housing 1 (Figure 7) and the ribs 76 of the lid 3 (Figure 8) have appropriate recesses or shapes, whereas the support prongs 75 are redundant in the case of two contact springs 21 in which axial support of the cut-clamp contacts 16 is effected by the inserted capacitor 530 proper.

In order to ensure easy identification of the various connection terminals 5 when the novel connection element is used in the automatic production of wire layouts, they are provided with a code which, for example, can be formed by a dot code attached to the front face, as indicated at 100 in Figure 1 for a connection terminal 5.

Furthermore, the connection element can be formed so that looping through of lines is possible, as it may be occasionally required when wiring layouts are produced. To this end, at least one passage channel 96 (Figure 5) may be formed between neighbouring connection terminals 5, but it is also conceivable to arrange corresponding means in the base 2 or at other parts of the housing.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

- 15 -

Finally, there are conceivable embodiments in which in addition to, or in place of, at least one of the plug-type contacts at 30, 32 on the connection side with screw-type clamping terminal is provided [sic!] or in which the plug-type connection terminal is connected through an intermediate member (connecting strap or connecting line) with a screw-type terminal.

This Sheet Has Been Replaced



This Sheet Has Been Replaced



- 16 -

Claims

1. A connection element for at least one electrical working means, with a housing made of an electrically insulating material and provided with fastening means and with contact means which have electrically interconnected, spaced connection points for electrically conductive parts, at least one of which connection points is configured as a cut-clamp contact point, characterised in that at least one further connection point (31, 32, 38) is configured as a plug-type contact point and that both connection points (16, 31, 32, 38) in the state of operation are arranged in at least shock-proof insulated manner by surrounding housing portions inside the housing (1).
2. The connection element according to Claim 1, characterised in that at least one plug-type contact point (31) is adapted to plug in a soldering lug or a blade connector.
3. The connection element according to Claim 1 or 2, characterised in that it has two plug-type contact points (31) in side-by-side relationship which are adapted to plug in a soldering lug or a blade connector and each of which is connected in electrically conductive fashion with a proper cut-clamp terminal (16).
4. The connection element according to any one of the preceding claims, characterised in that it comprises at least one plug-type contact point (31, 32, 38) the direction of insertion of which is at right angles to the direction of insertion of the blade-contact point (16).
5. The connection element according to any one of the preceding claims, characterised in that at the housing (1) there is provided at least one accommodating or connecting zone (52, 71, 23) for a working means (53, 73, 530) in the region of which there is at least one plug-type contact point (31, 35, 26).



* C L M S *

This Sheet Has Been Replaced



- 17 -

6. The connection element according to Claim 5, characterised in that the accommodating or connecting zone comprises mechanical stop or retention means (52, 3) for the working means.
7. The connection element according to Claim 5 or 6, characterised in that the accommodating or connecting region is covered in insulating fashion toward the outside by detachable closure means (80, 3).
8. The connection element according to Claim 7, characterised in that the closure means (80, 3) are configured to be latchable to the housing (1).
9. The connection element according to Claim 5 or 6, characterised in that the closure means (80) are associated with electrical connection means (87) for bridging at least two contact points situated in the accommodating or connecting region.
10. The connection element according to any one of the preceding claims, characterised in that insertion channels (49, 50; 56) for conductive parts which are to be connected are associated with the plug-type connection points in the housing (1), in which these parts can be accommodated over part of their length, optionally including an applied insulation (20).
11. The connection element according to Claim 10, characterised in that at least one insertion channel (50) is configured to flare outwardly in the form of a funnel.
12. The connection element according to any one of the preceding claims, characterised in that at least one plug-type contact point (at 47) is configured to have a direction of insertion which is parallel to the direction of insertion to the cut-clamp contact point (16).
13. The connection element according to any one of the preceding claims, characterised in that it has at least two plug-type connection points (31; 32) accessible from opposite sides of the housing (1).



* C L M S *

This Sheet Has Been Replaced



- 18 -

14. The connection element according to any one of the preceding claims, characterised in that the contact means comprise at least one contact spring (21) made from a material of good electrical conductivity, in which the cut-clamp contact point (16) and the plug-type contact point or points (31, 32, 47) are formed.

15. The connection element according to Claim 14, characterised in that the cut-clamp contact point (16) is formed by two contact spring portions (27) which are parallel and not joined over their length and in which two aligned cut-clamp slits (14) are arranged and that the two contact spring portions (27) are laterally guided inside the housing (1).

16. The connection element according to Claim 14 or 15, characterised in that the contact spring (21) comprises a bottom portion (24) and two facing leg portions (25) extending from the same, in at least a part (24, 25) of which there is formed a plug-type contact opening (31, 32, 47) covered at least partially by a latch member (30, 22) adapted to latch in a plugged-in part (54, 19, 59).

17. The connection element according to Claim 16, characterised in that into the contact spring (21) there is inserted a clamping spring (22) which has latching parts (30, 47) cooperating with the respective contact opening (31, 32, 37).

18. The connection element according to Claim 17, characterised in that, near at least one contact opening (37), the clamping spring (22) has a connector opening which is delimited by latching tabs (47) which are cut in and adapted to spread on one side.

19. The connection element according to Claims 15 to 17, characterised in that, in the region including the bottom and leg portions (24; 25), the contact spring (21) is configured to be substantially closed all the way around by upper wall portions (26) and that the parts (27) bearing the cut-clamp slits (14) are cut into the upper wall portions (26).



* C L M S *

This Sheet Has Been Replaced



- 19 -

20. The connection element according to any one of Claims 14 to 19, characterised in that at a substantially flat part (24) of the contact spring (21) there is arranged a region (38) of substantially L- or U-shaped cross section, which region forms a plug-type connection, is pressed outward out of the plane of that part, and into which region a latching member (41) extends.

21. The connection element according to any one of the preceding claims, characterised in that a plurality of contact springs (21) are arranged inside the housing (1) in separate chambers (67) which are separated from each other by insulating partitions (68) and optionally closed by a common lid (3).

22. The connection element according to Claim 21, characterised in that the lid is arranged on the housing's side facing the cut-clamp contact points (16) and is provided with support means (75) for the contact means' parts (27) forming cut-clamp contacts.

23. The connection element according to Claim 21 or 22, characterised in that the lid (3) and/or the partitions (68) are provided with interlocking parts (77, 78; 76) preventing leakage paths.

24. The connection element according to any one of Claims 21 to 23, characterised in that the housing (1) and/or the lid (3) have at least one passage channel (96) for a conductor looped therethrough.

25. The connection element according to any one of Claims 6 to 24, characterised in that it is adapted to be used with a capacitor (53, 350) as working means and that the housing (1) is provided with form-locking retention means (52, 3) for the capacitor in the accommodating or connecting region.

26. The connection element according to any one of Claims 5 to 24, characterised in that it is provided with contact connection points (35) adapted to connect a by-pass resistor (73).



* C L M S *

This Sheet Has Been Replaced



- 20 -

27. The connection element according to any one of Claims 14 to 26, characterised in that at least one electrical working means (530) is arranged in a region at least partially enclosed by at least one contact spring (21).

28. The connection element according to Claim 27, characterised in that the cut-clamp contact point (16) of the contact spring (21) which is electrically connected with the electrical working means (530) is mechanically supported by the working means.



* C L N S *

This Sheet Has Been Replaced



- 21 -

Abstract

An electrical connection element for at least one electrical working means has cut-clamp contact points and additional plug-type contact points for the connection of conductive parts.

(Figure 1).

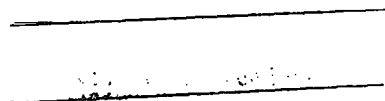
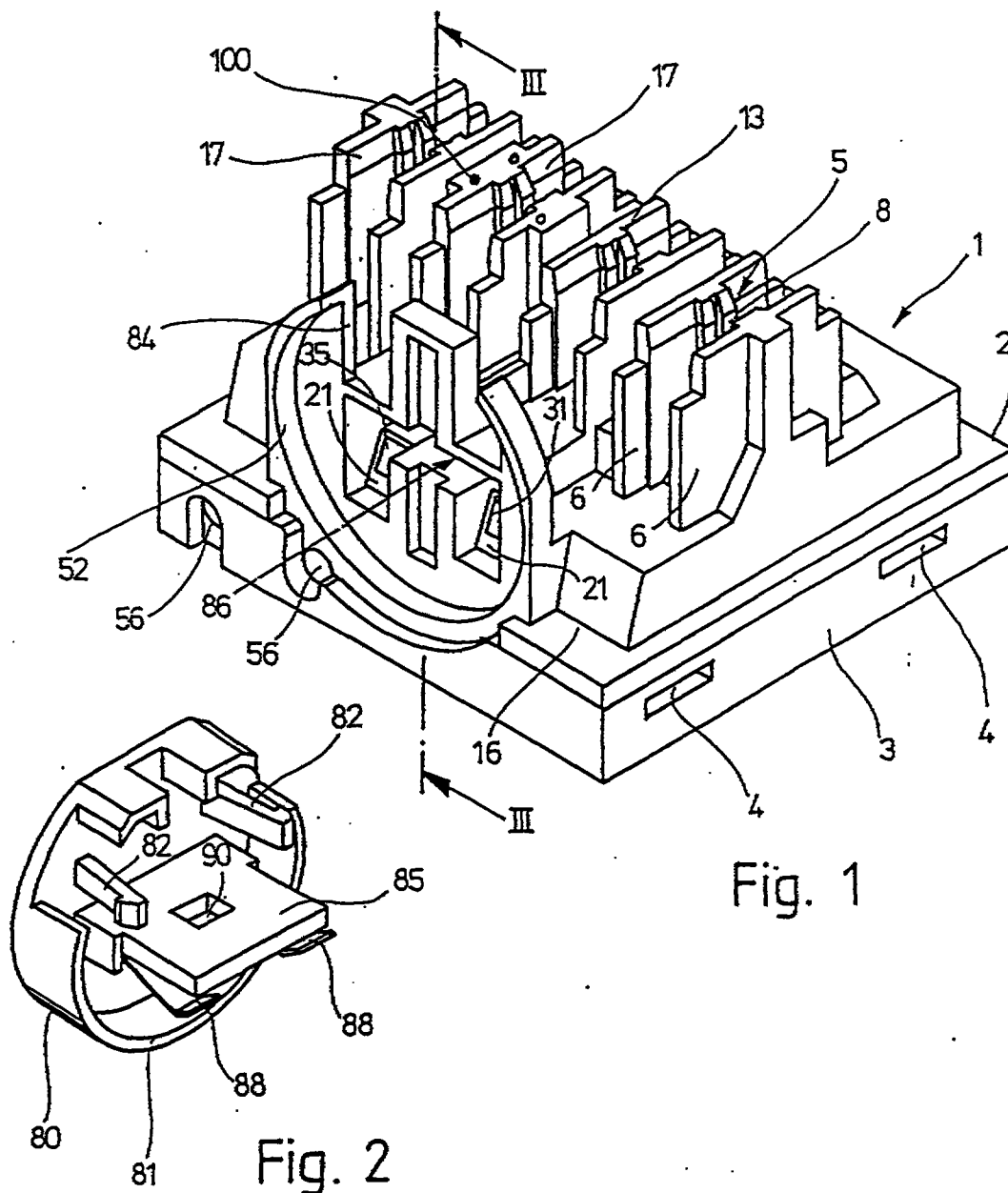


FIG. 1

This Sheet Has Been Replaced



1/7



This Sheet Has Been Replaced



2/7

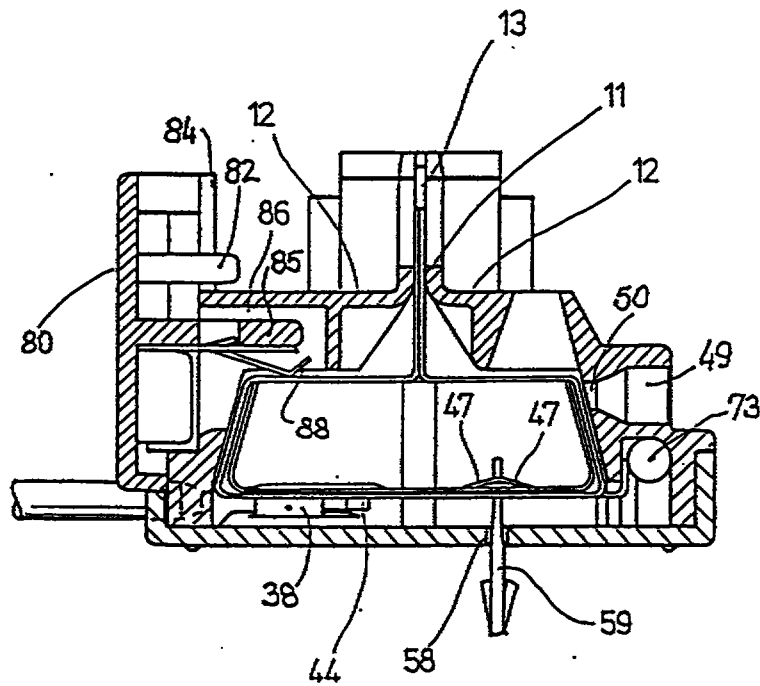
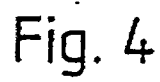
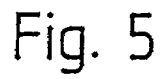


Fig. 3



3/7



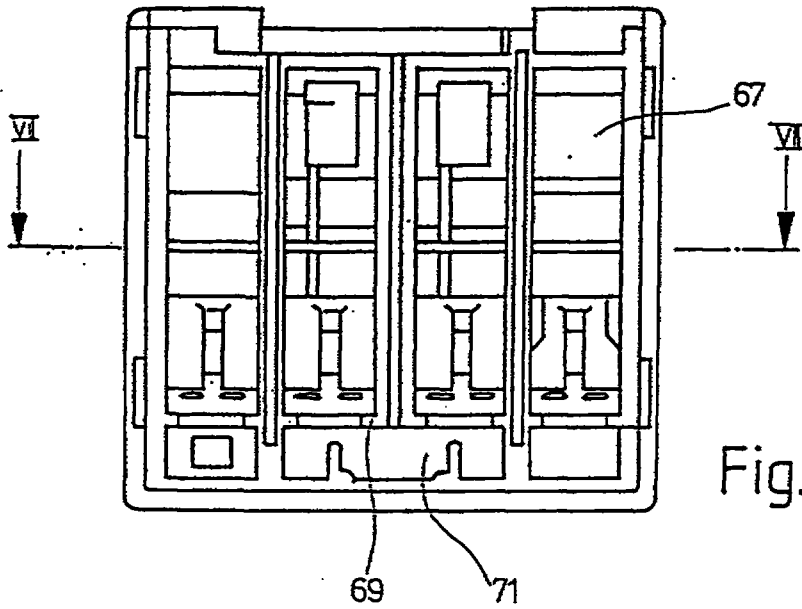


Fig. 6

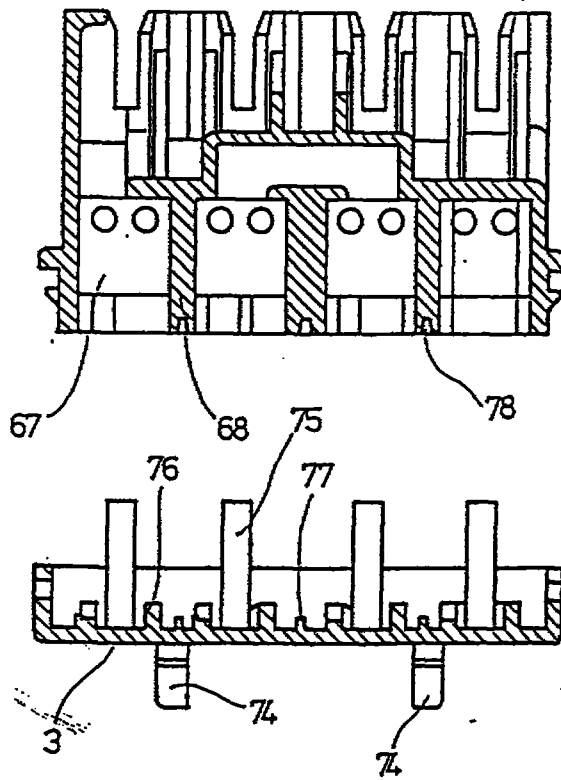


Fig. 7

Fig. 8

This Sheet Has Been Replaced



5/7

Fig. 10

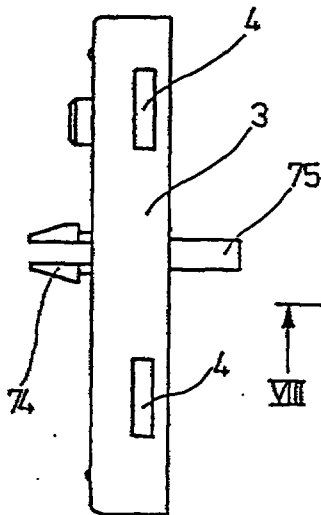


Fig. 9

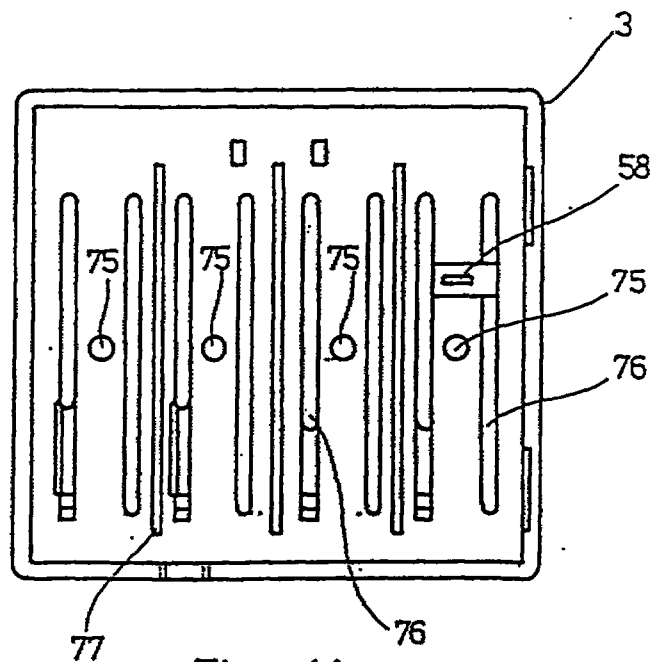
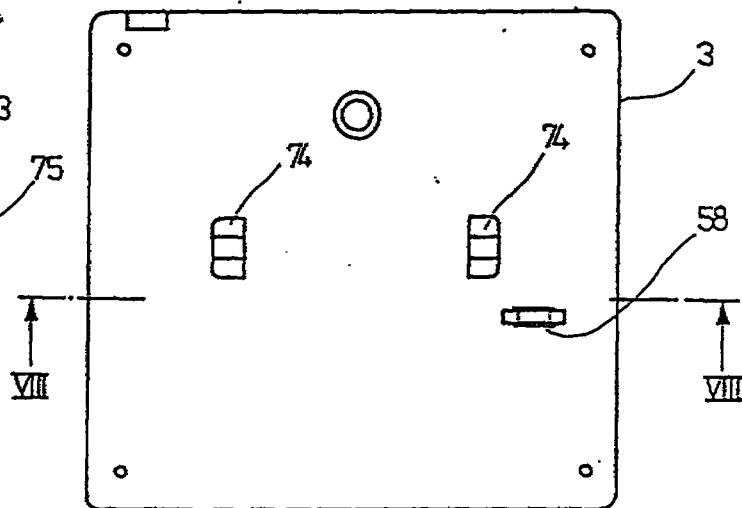


Fig. 11

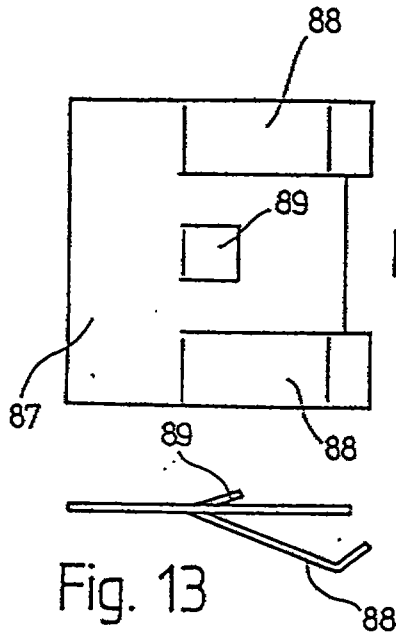
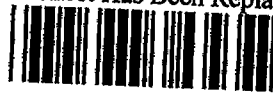


Fig. 12

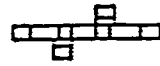


Fig. 21

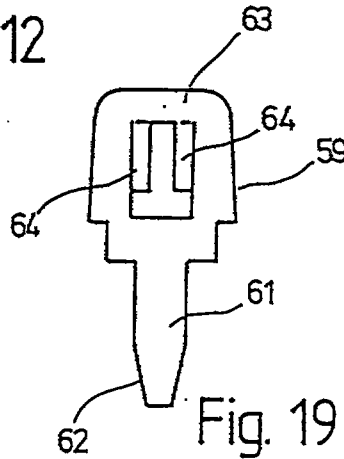


Fig. 19



Fig. 20

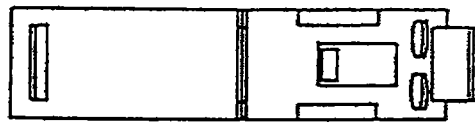


Fig. 15

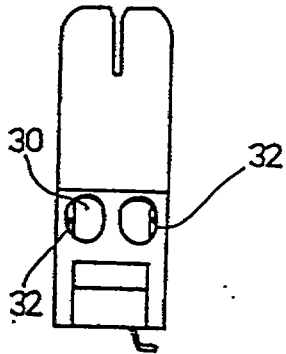


Fig. 16

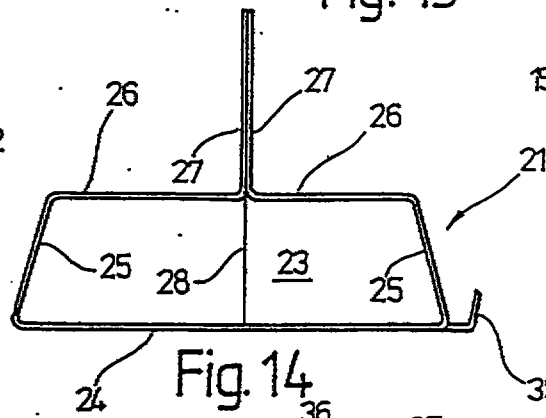


Fig. 14

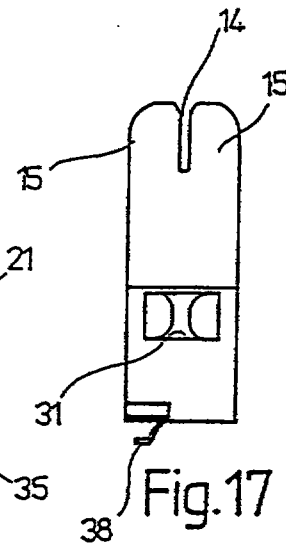


Fig. 17

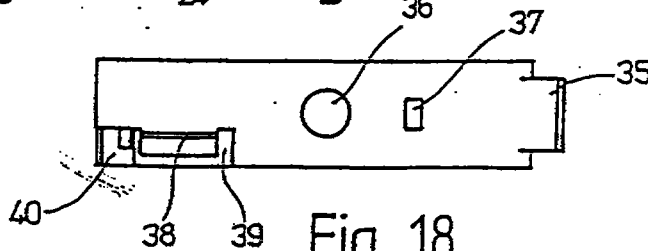
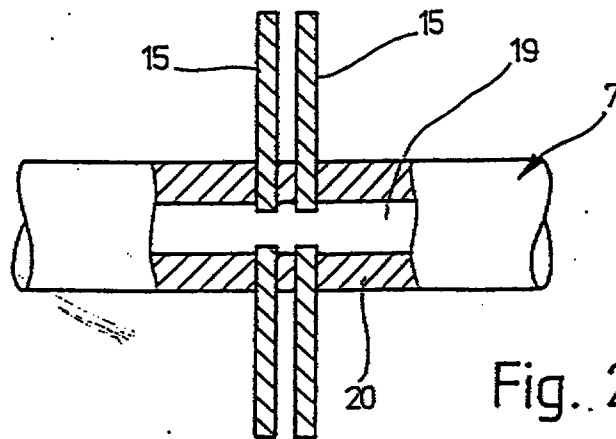
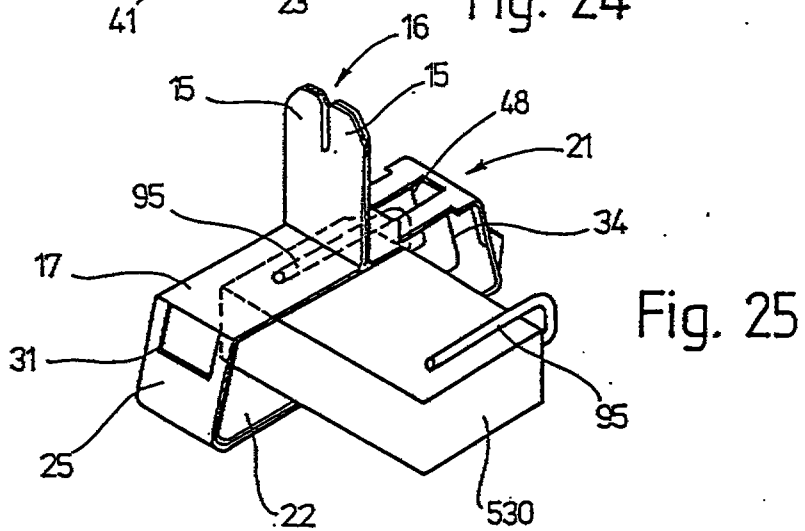
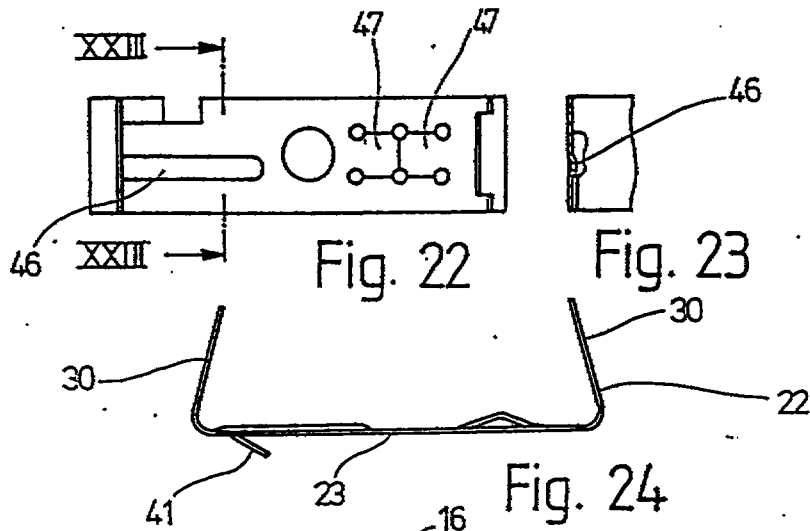


Fig. 18

This Sheet Has Been Replaced



7/7



THIS SHEET HAS BEEN
REPLACED

REPLACEMENT SHEET

Date : 16 OCT 1996

- 21 -

A CONNECTION ELEMENT FOR AT LEAST ONE ELECTRICAL
WORKING MEANS

ABSTRACT

An electrical connection element for at least one electrical working means has cut-clamp contact points and additional plug-type contact points for the connection of conductive parts.

(Figure 1).

REPLACEMENT SHEETS SG

1. Description :	paged	to paged
2. Drawing(s) :	paged	to paged
3. Abstract :	paged 21	to paged 21

DATE OF RECEIPT

This Sheet Has Been Replaced



8-0001111

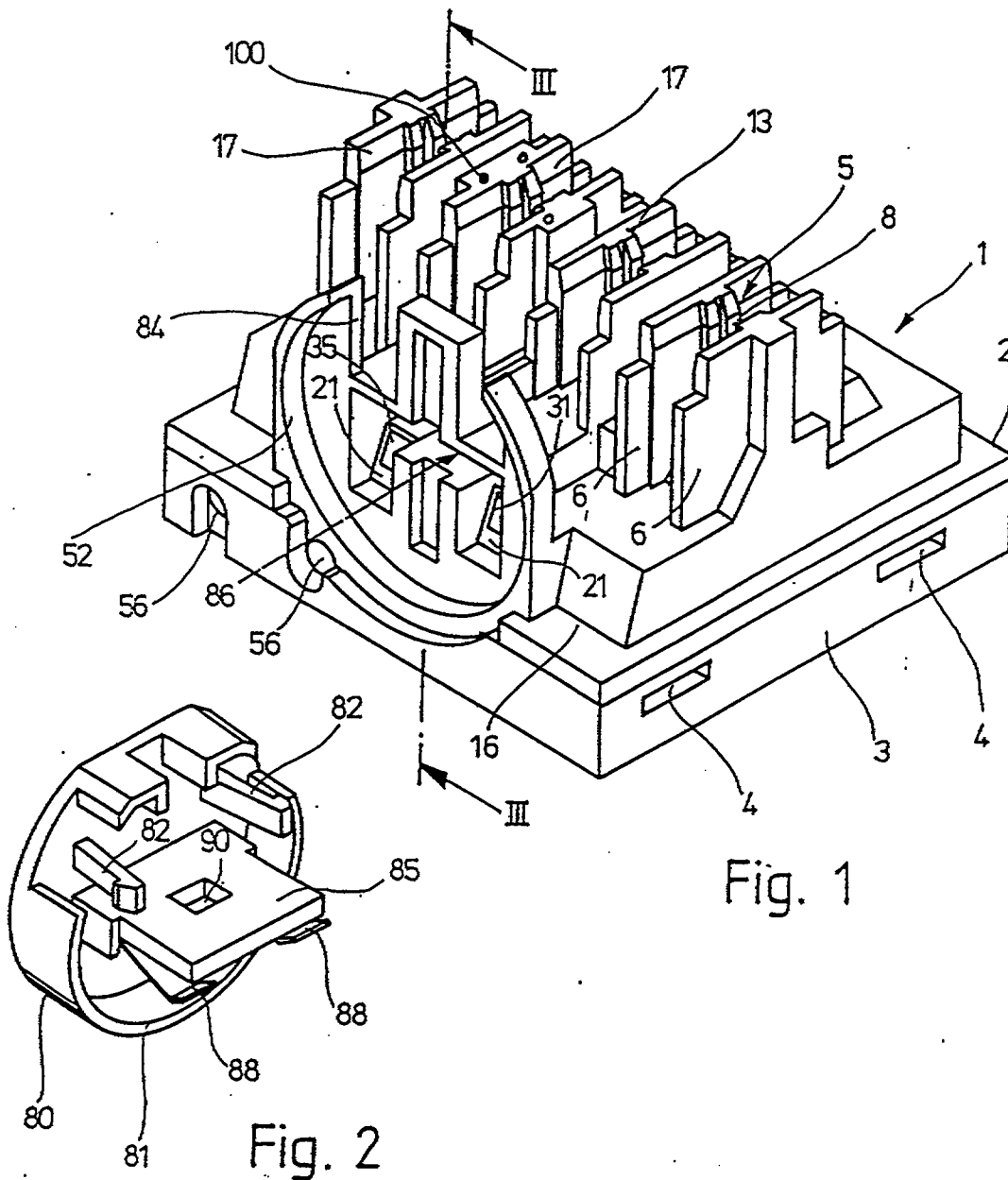


Fig. 1

Fig. 2

2/7

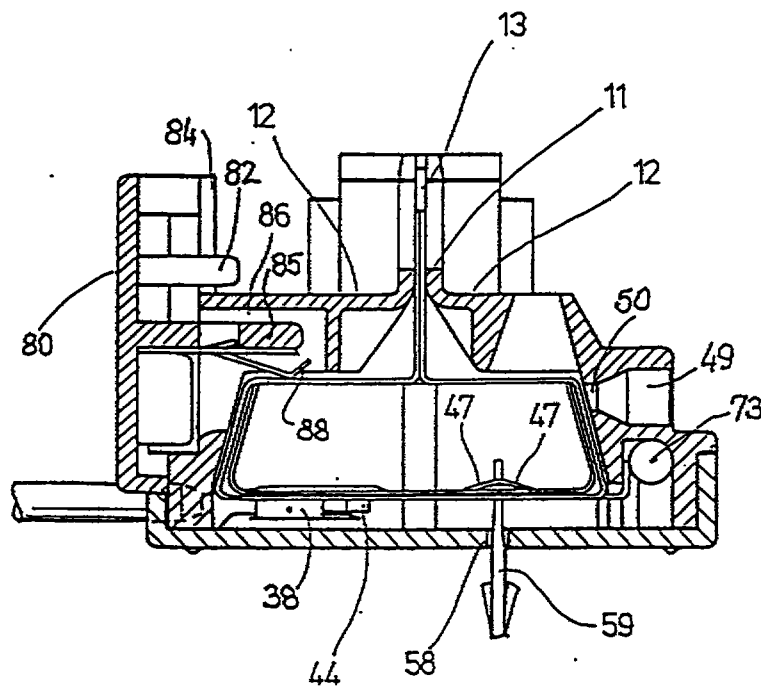


Fig. 3

3/7

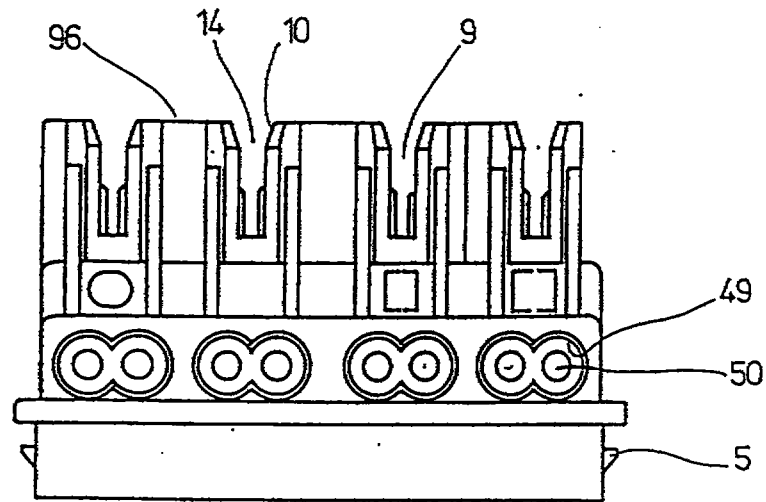


Fig. 5

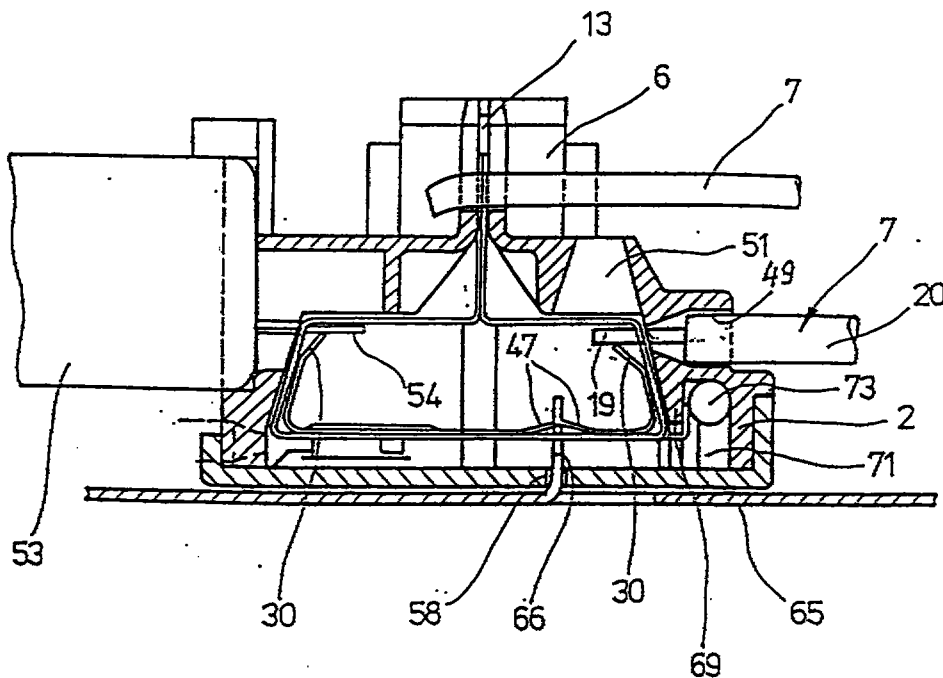


Fig. 4

4/7

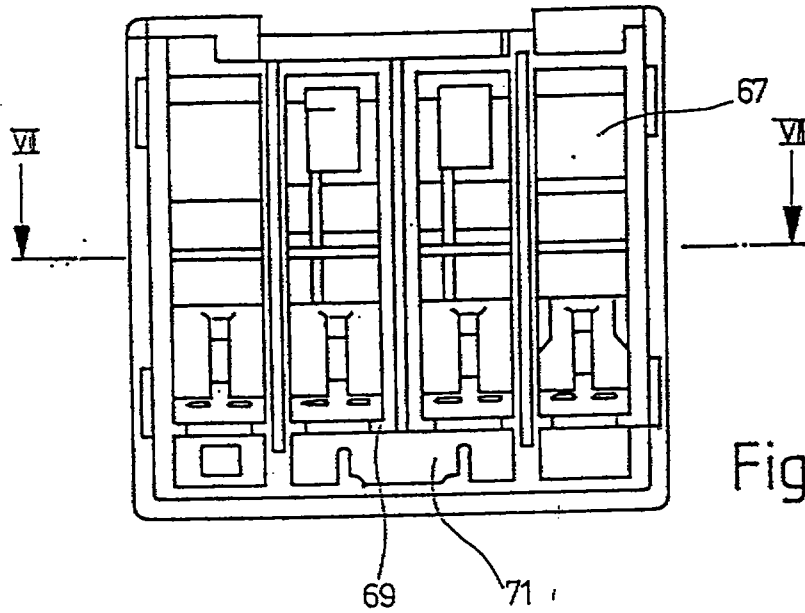


Fig. 6

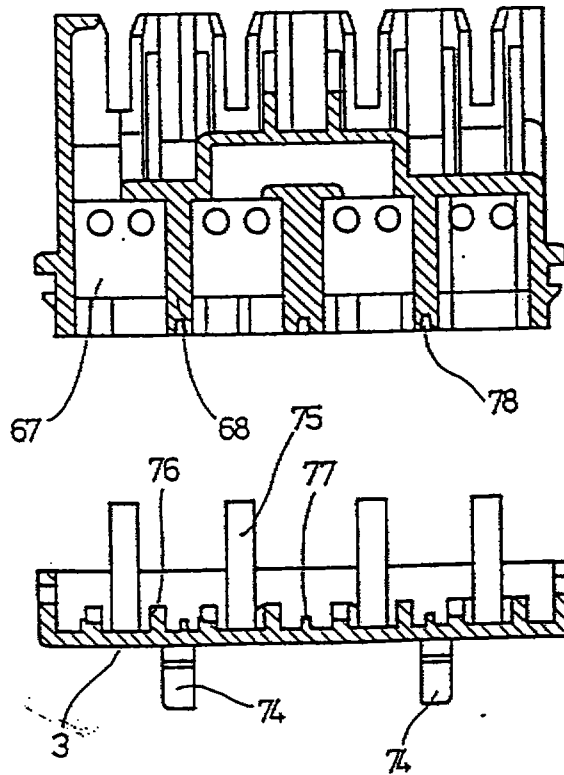


Fig. 7

Fig. 8

5/7

Fig. 10

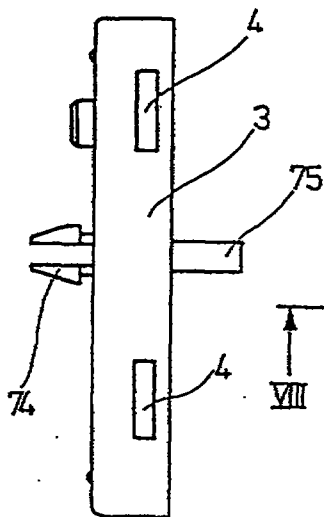


Fig. 9

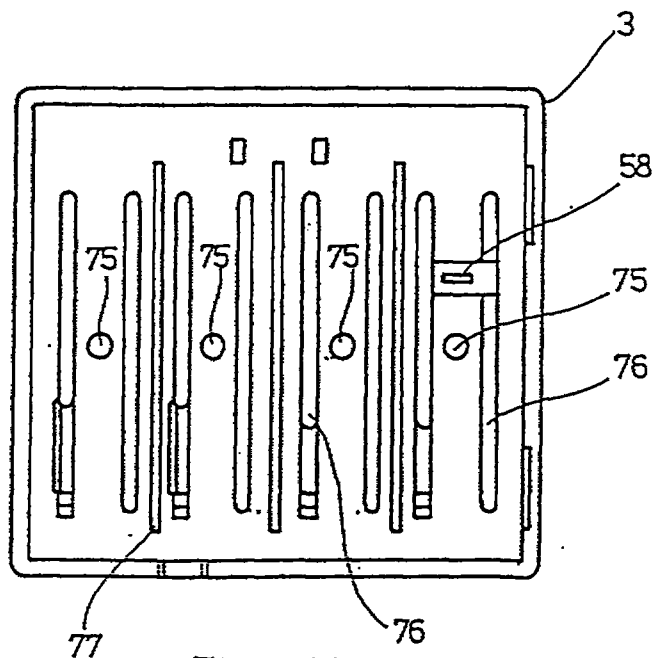
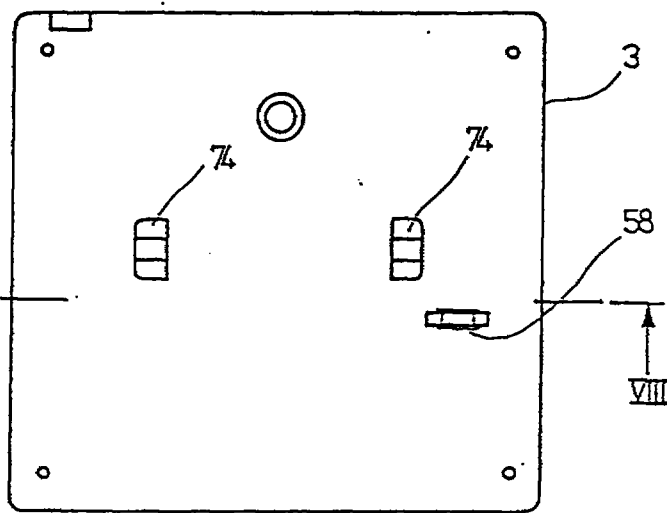
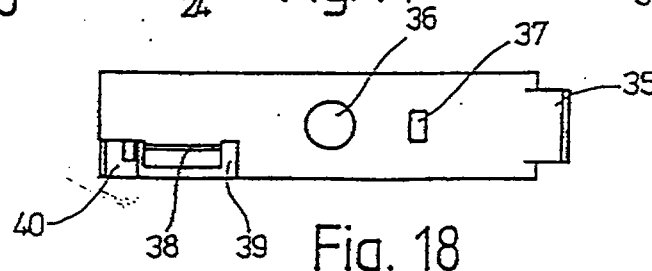
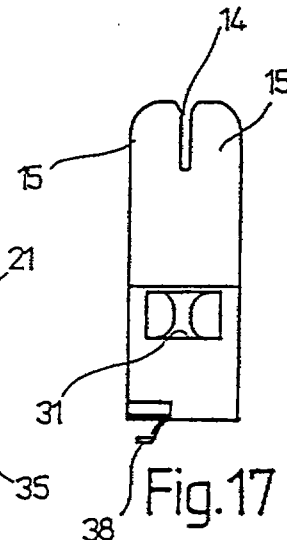
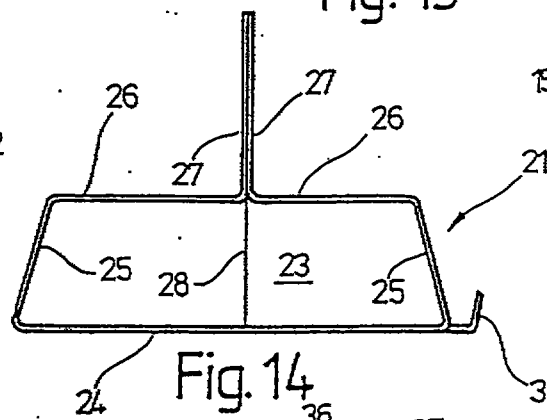
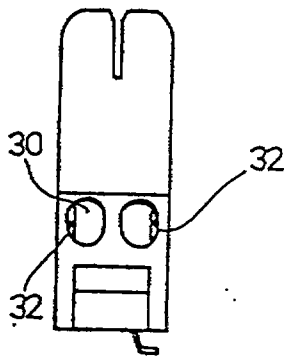
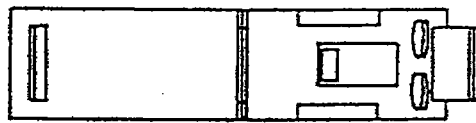
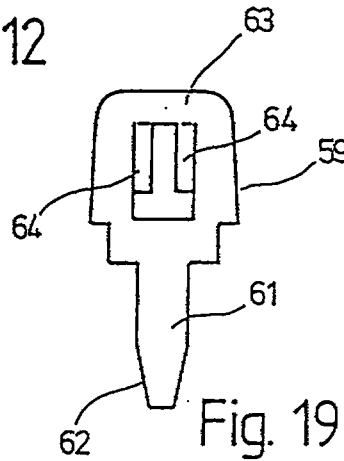
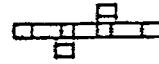
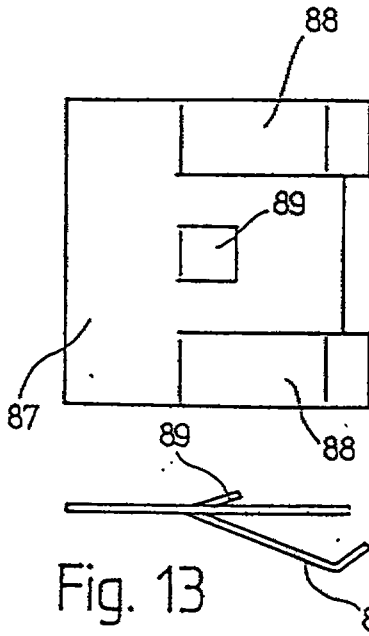
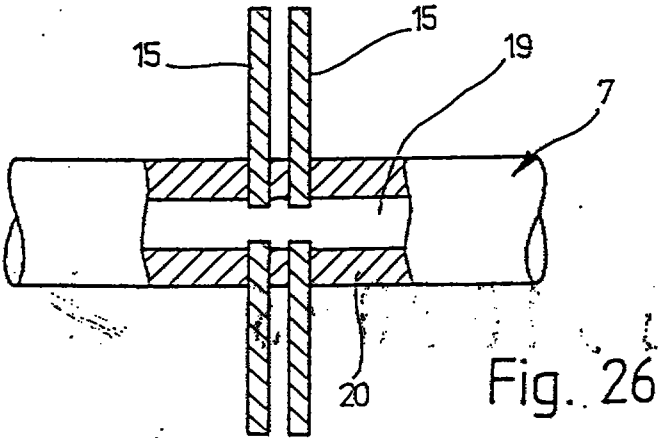
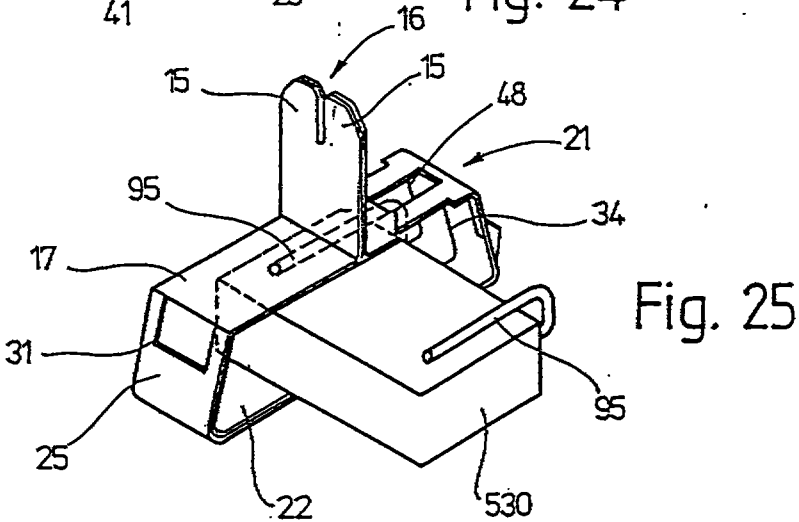
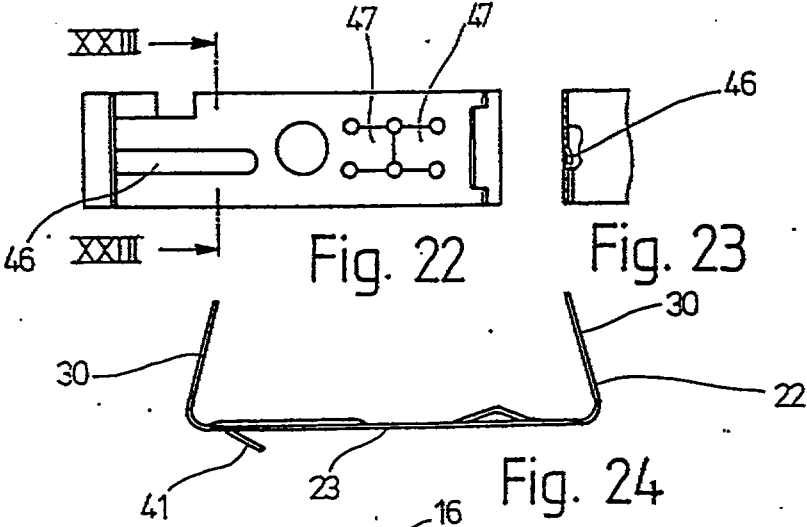


Fig. 11

6/7



7/7



Date : 03 FEB 1997

- 1 -

CONNECTION STRUCTURE FOR AT LEAST ONE ELECTRICAL DEVICE

Reference is made to the following applications, the disclosure of which is hereby incorporated by reference:

European Patent Application: EP 002 099

German Patent Application: P 43 12778.9

Field of the Invention: The invention relates to a connection structure for at least one electrical device, having a housing with fastening devices and comprising electrically insulated material and having contact means that have electrically conductively joined-together, spatially separated connection points for electrically conductive parts, of which at least one connection point is embodied as a slit blade insulation-piercing connector.

REPLACEMENT SHEET	
☒ Description : pages 1 to page 22	
☒ Claim(s) : pages 23 to page 27	
☐ Drawing(s) : pages to page	
☒ Abstract : pages 28 to page	
DATE OF RECEIPT 3/2/97	

- 2 -

Background: From EP 002 099, for instance, a connection structure for an electrical low-voltage transformer is known, which has a housing made of insulating material and arranged for fastening to the lamination stack of the transformer; accommodated in the housing, as contact means, are a number of electrically conductive contact springs, each of which has an insulation-piercing slit for connection of an external conductor by slit blade insulation piercing connection technology. In addition, the contact springs are provided with a further insulation-piercing slit, likewise forming a slit blade insulation piercing connector, which makes it possible to attach a substantially thinner wire of the coil winding, so as to make an electrically conductive connection between the external conductor and the winding. Assembly is done in such a way that first the housing is secured to the lamination packet, and then

- 3 -

the wire ends coming from the winding are inserted into slits in the housing. Next, the contact springs are inserted by pressure from above into corresponding chambers of the housing associated with the slits; on the one hand, this presses the wire ends into the associated insulation piercing slits, and on the other the contact springs are locked in place in the chambers of the housing. In an ensuing step, finally, the external supply line wires can be inserted into the externally accessible insulation piercing slits of the contact springs. As a rule, assembly of the housing and of the contact spring must therefore already be done by the manufacturer of the transformer unit.

In wiring electrical fixtures or luminaires with a three-pole connection clamp for gas discharge lamps, e.g., fluorescent lamps, it was previously necessary to join a considerable number of separate connection points together by their own lines, because the arrangement includes not only a separate connection block, but also additional connection points for capacitors and other necessary accessories. Hence the wiring process is costly and labor-intensive.

- 4 -

The Invention: It is an object to create a connection structure for at least one electrical device, optionally a capacitor, which makes it possible to reduce the expense and effort for wiring and moreover can be used universally for various applications.

According to the invention, there is provided, a connection structure for at least one electrical device, optionally a capacitor, comprising

a housing of electrically insulating material, said housing being formed with attachment means for attachment to a support;

spatially separated electrical connection points for electrically conductive parts;

contact means electrically conductively joined to said connection points,

at least one connection point being formed as a slit-blade insulation-piercing connector, and at least one other connection point being formed as a plug or push-in connector;

a reception region, including a socket, for said electrical device formed on said housing,

at least one of said connection points being located in the reception region; and

shock-protection means formed from portions of said electrically insulating housing protecting each of said connection points against accidental and undesired electrical contact.

- 5 -

Drawing:

Exemplary embodiments of the subject of the invention are shown in the drawing.

Fig. 1 is a perspective view of a connection structure according to the invention with the closure part removed;

Fig. 2 is a perspective view of a closure part of the connection structure of Fig. 1;

Fig. 3 is a sectional view from the side, cut along the line III-III of Fig. 1, of the connection structure of Fig. 1, with the closure element inserted and showing the connection conditions for a ground connection and a wire;

Fig. 4 is a sectional view corresponding to Fig. 3 of the connection structure of Fig. 1, showing the connection of two external wires and one capacitor;

Fig. 5 is a side view from the side opposite the closure element of the connection structure of Fig. 1;

Fig. 6 is a plan view on the bottom of the housing of the connection structure of Fig. 1, with the contact springs removed;

Fig. 7 is a side view, in a section taken along the line VII-VII of Fig. 6, of the housing of the connection structure of Fig. 1.

Fig. 8 is a side view in section, taken along the line VIII-VIII of Fig. 9, of the cover of the housing of the connection structure of Fig. 1;

Figs. 9 and 10 are a side view and an inside view, respectively, of the cover of Fig. 8;

Figs. 12 and 13 are a plan view and a side view, respectively, of a contact spring bow of the closure part of the connection structure of Fig. 1;

- 6 -

Figs. 14-18 are a side view, a top view, two views from both face ends, and a view from below, respectively, of a contact spring of the connection structure of Fig. 1;

Figs. 19-21 are a plan view, a side view and a view from the top of a ground connection structure for the connection structure of Fig. 1;

Figs. 22-24 are a side view, a view from the top and a sectional view along the line XXIV-XXIV of Fig. 23 of the clamping spring for the contact spring of Figs. 14-18;

Fig. 25 is a schematic perspective view of a contact spring of Figs. 14-18 with an inserted clamping spring and an inserted capacitor; and

Fig. 26 shows a plan view of a detail, on a different scale, of a connector of a slit blade insulation piercing contact of the connection structure of Fig. 1.

- 7 -

Detailed Description:

The connection structure shown in Fig. 1 has a housing 1, made in one piece of plastic, with a rectangular base part 2, onto the bottom of which a caplike cover 3 is mounted, which is locked in detent fashion at two opposed face ends, via detent recesses 4 and detent protrusions 41 provided on the base part 2 (see Figs. 1, 5). Five connection terminals 5 are formed onto the base part 2, located side by side in a row, each of which is defined by two parallel walls 6 facing one another in spaced-apart fashion. The connection terminals 5 are arranged for connecting wires 7 by the so-called slit blade insulation piercing connection technique and are essentially identical in design.

In each of the connection terminals 5, the two parallel side walls 6 define a terminal housing that is open at the top. On their inside, they have two opposed formed-on ribs 8, which are located approximately in the middle between the two face ends of the side walls 6 and between them define a slightly wedge-shaped or parallel-sided insertion slit 9 (Fig. 5), which is widened on top by insertion slopes 10. On its bottom 11, the insertion slit 9 is located in somewhat raised fashion compared with the bottom parts 12, adjoining it on both sides, of the chamber defined by the two side walls 6, as can be seen from Fig. 3.

Extending into the ribs 8 from below to approximately the height of the insertion slopes 10 are two opposed narrow grooves 13, which receive the paired legs 15, each defining one insulation piercing slit 14 open at the edge, of two slit blade insulation piercing contacts 16 (Fig. 26) of a contact spring 21 made of spring steel or spring bronze. The narrow slit blade insulation piercing contacts 16, in the form of small plates, are embedded on

- 8 -

the narrow side in the insulating material of the housing 1 between the side walls and in the grooves 13, except for the cutting segments formed on the legs 15 and oriented toward the insulation piercing slit 14; the legs 15 are guided in the grooves 13 so as to be movable to a limited extent. Together with the insulation piercing slit 14, they form the contacting zone of the connection point formed by the respective connection terminal 5.

As can be seen especially from Figs. 1, 3 and 5, the side walls 6 together with the associated bottom wall 12 form one groovelike indentation of rectangular cross section adjoining the ribs 12 and hence the insertion slit 9 on each side; the indentation is open toward the top next to the insertion slit 9. The two groovelike indentations 17 on both sides of the insertion slit 9 are in alignment with one another and with the insertion slit. They are likewise limited at the top by an insertion slope 10. As shown in Fig. 3, for instance, the depth of the groovelike indentations 17 is greater than that of the insertion slit 9, and their width is likewise substantially greater than the width of the insertion slit 9 (see Fig. 5).

The dimensions of the various parts are chosen such that in an insulated conductor pressed through the insertion slit 9 (see Fig. 4), the insulation is cut open in the insulation piercing slit 4 by the legs 15 of the two slit blade insulation piercing contacts 16, and at the same time gas-tight contacting is brought about between the slit blade insulation piercing contacts 16 and the conductor 19 that deforms at the clamping point, as shown in detail in Fig. 26. Since the two slit blade insulation piercing contacts 16 are separate from one another - as will be described in further detail hereinafter - they form two connectors, spaced apart from one another longitudinally of the conductor, and as a

- 9 -

result the conductor 19 is simultaneously contacted at four separate points, which are defined by the two insulation piercing slits 14. This assures especially effective contacting.

With its insulation 20, the pressed-in conductor 19 is simultaneously firmly clamped in the insertion slit 9 between the two ribs 8. The thus-fixed connected wire 7 extends through one of the groovelike indentations 17, while its severed end rests in the other groovelike indentation 17, as shown in Fig. 4. The width and depth of the groovelike indentations 17 and their axial length are dimensioned such that automatic shock hazard protection is brought about for the severed end of the wire 7. This means that the standardized feeler finger, in the check for shock hazard protection, cannot penetrate as far as the bared, severed end at the depth of the associated groovelike indentation 17.

In the essentially hollow housing 1, four contact springs 21 (Figs. 14-18) with clamping springs 22 (Figs. 22-24) inserted into them are located underneath the connection terminals 5 and are associated with the various connection terminals 5.

Each of the contact springs 21 is bent in one piece from a strip of spring brass or spring bronze. They have an essentially trapezoidal lower part 23 (Fig. 14), which is defined by a flat bottom part 24, two inwardly inclined leg wedges 25 adjoining the bottom part laterally, and two upper wall parts 26 parallel to the bottom part 24. Adjoining the upper wall parts 26 are two tabs 27 bent upward at a right angle, which in the normal state rest against one another broadside, with slight initial stress, along the plane of symmetry (28). In the region of their upper periphery, the two tabs 27 are each provided with the insulation piercing slit 14 that is defined by the two legs 15. They form the two slit blade insulation piercing contacts 16 and in the

- 10 -

installed state protrude from below into the two slits 13 of the respective connection terminal 5, in which they are guided laterally movably.

The clamping spring 22 (Fig. 22-24), shaped to fit the internal outline and essentially C-shaped, is inserted into the closed lower part 23 of the contact spring 21; its width is equal to that of the contact spring 21, and it rests flush, with a flat lower part 29 and two attached lateral legs 30, against the bottom part 24, and the legs 25 of the contact spring 21. The clamping spring 22 is of spring steel.

A rectangular recess 31 is formed in the left leg part 25, as seen in Fig. 26, of the contact spring 21, adjoining the upper wall part 26 at the top, while two side-by-side, approximately oval, continuous openings 32 (Figs. 16, 17) are provided on the opposed leg part 25, likewise at the top. The recess 31 and the two openings 32 are covered by the two legs 30 of the inserted clamping spring 22; the leg 30 of the clamping spring 22 associated with the openings 32 is subdivided by a longitudinal slit 34 into two tonguelike parts movable independently of one another, each of which is associated with one opening 32.

The recess 31 and the openings 32 of the contact spring 21, together with the associated legs 30 of the clamping spring 22, form plug connectors, one of which, 31, 30, is arranged for connection of a solder lug or a blade connector, and the other two of which, 32, 30, are intended for the connection of two round wires or two stranded connectors, as will be described in detail hereinafter.

A securing protrusion 35 (Fig. 14) bent upward in an approximately L shape is bent out from the leg part 25, associated with the openings 32 of the contact spring 21 and forms an

- 11 -

extension of the bottom part 24 on that side. In the bottom part 24 itself, a circular opening 36 is stamped out, which is adjoined by an openings 37 of rectangular cross section (Fig. 18), while on the other side, in the vicinity of the associated leg part 25, the bottom part 24 is provided with a tab 38 (Fig. 17) of approximately L-shaped cross section bent downward out of it. The tab 38 is located in the vicinity of a long edge of the bottom part 24 and is oriented parallel to its plane of symmetry. It is cut loose on both sides at 39, 40. As can be seen from Figs. 22 to 25, a cut-loose, obliquely downwardly protruding locking tab 41 is provided on the clamping spring 22, in the region above the tab 38, and in the installed state cooperates with the L-shaped tab 38 of the contact spring 21 and with it forms a plug connector, which in the manner visible from Fig. 3 enables the connection of an inserted conductor 44. A pressed-in bead 46 serves as reinforcement.

A plug connector is likewise formed in the clamping spring 22 in the region above the rectangular opening 37 in the bottom part 24 of the contact spring 21, being formed by two locking tabs 47 bent inward and upward in inclined fashion and cut loose laterally. If a flat connection component is thrust from below through the opening 37 of the contact spring 21, then the two tabs 47 are spread apart on the inside; they accordingly lock to the thrust-in part in a manner known per se, so that this part can no longer be pulled out.

In the upper wall part 26 of the contact spring 21, finally, in the vicinity of the two openings 32, there is also a rectangular aperture 48 (Fig. 26), which is used for the introduction of a loosening tool, such as a screwdriver, in order to loosen the clamping of the conductor at this plug connector.

- 12 -

Two axially parallel, cylindrical wire insertion channels 49 are each formed on one side, below each connection terminal 5, in the base part 2 of the housing 1; each of these channels tapers in funnellike fashion to a coaxial bore 50, which leading into the inside of the housing is aimed at the associated opening 32 of the inserted associated contact spring 21.

As Fig. 4 shows, the insertion channel 49 receives the insulation 20 of an inserted wire 7, whose conductor 19, upon insertion through the opening 32 of the contact spring 21, has spread the associated leg part 30 of the clamping spring 22 inward, in such a way that it acts as a locking part and while simultaneously making contact prevents retraction of the conductor 19. The conductor 19 then rests flush against the upper wall part 26 of the contact spring 21, so that a satisfactory, large-area contact is assuredly made.

If the clamping is to be loosened, then a tool is introduced through the aperture 48 of the contact spring 21, (Fig. 25) through an opening 51 provided in the housing 1 next to the associated connection terminal, so as to press the inwardly spread leg part 30 resiliently downward, thereby releasing the conductor 19.

On the opposite side, the housing 1 has a centrally disposed, especially circular-cylindrical socket 52, located in a vertical plane, for an electrolyte capacitor 53 shown in Fig. 4. the electrolyte capacitor 53 is equipped with two conventional solder lugs 54 on its face end, which once the electrolyte capacitor 53 is inserted into the socket 52 protrude through the apertures 31, which are exposed to the outside via corresponding housing recesses, of the two associated contact springs 21 and are both pressed against and firmly locked to the upper wall part of

- 13 -

the contact spring 21 by the legs 30 of the clamping spring 22 that are spread inward obliquely upon insertion. The thus-formed plug connectors for the solder lugs 54, like the opposed plug connectors for the conductors 19, are oriented with their (horizontal) insertion direction at right angles to the (vertical) insertion direction of the slit blade insulation piercing contacts of the connection terminals 5. They enable an especially space-saving, favorable arrangement of the capacitor 53, as well as of wires that extend below the wires 7 contacted in the connection terminals 5, and thus do not hinder the automatic placement and contacting of the wires 7 in the slit blade insulation piercing contact of the connection terminals 5.

Laterally next to the socket 25, on the front face end at the bottom in the housing 1, two further through channels 56 for conductors are formed, which in the manner visible at 44 in Fig. 3 are electrically conductively connected to the contact spring 21 via the tabs 38 and the locking tabs 41 of the contact and clamping springs 21, 22, respectively, via a plug connection.

A grounding strap 59, inserted from below through a corresponding slit 58 in the cover 3 (Fig. 9), which is retained between the inwardly spread-apart locking tabs 47 (Fig. 3), makes it possible to connect the contact spring 21, associated with the grounding line, to a metal housing part or to its own ground connection.

The grounding strap 59 is shown in detail in Figs. 19-21. It has a narrow insertion lug 61, which is slightly pointed at the end at 62 and which, on the adjoining widened portion 63, is provided with two cut-loose locking tabs 64, which are bent slightly laterally out of the plane of the grounding strap 59, as shown particularly in Fig. 20. They make it possible for the

- 14 -

grounding strap 59 to be locked in detent fashion in a slitlike opening of the bottom of the apparatus.

Alternatively, as shown in Fig. 4, a cut-loose grounding tab 66 may also be provided directly in the metal bottom part 65 of an apparatus, such as an electric light fixture or luminaire, and this grounding tab is bent upward at a right angle and mounted on the connection structure during installation in such a way that it protrudes inward through the opening 58 in the cover 3 and is locked in the manner already described, while simultaneously making contact, at the locking tabs 47 of the clamping spring 22.

As can be learned from Figs. 6, 7, for instance, chambers 67 are formed, side by side, in the housing 1 below the connection terminals 5; they are separated from one another by formed-on parallel partitions 68. Each of the chambers 67 receives on contact spring 21 with the inserted clamping spring 22, in the manner visible from Figs. 3 and 4. The inserted contact springs 21 then, with their fastening protrusion 35 (Fig. 14), each fit over one transversely extending end wall 69 of the housing and protrude into a transverse channel 71, located inside the base 2 in front of the end wall 69, and this channel is also closed off at the bottom by the cover 3 mounted in place.

A shunt resistor for the capacitor 53 may be located in the channel 71, for example; it is formed as a cylindrical circuit element with metal connection caps mounted on its ends and is shown at 73 in Fig. 4. The shunt resistor 73 is inserted in such a way that its two connection caps are held in electrically highly conductive connection with the fastening protrusions 35 of adjacent contact springs 21.

Instead of the shunt resistor 73, some other circuit element, such as a fine-wire fuse, or fuse for feeble currents,

- 15 -

could also be provided, which could optionally be replaceable through a lateral opening in the base 2 and the cover 3.

Parallel cylindrical support prongs 75 are formed on the inside, in the manner shown particularly in Figs. 3, 8, of the cover 3 that on its outside has detent feet 74 acting as fastening elements; in the installed state, these prongs protrude through the central hole 36 (Fig. 18) of the respective contact and clamping springs and on the face end support the two tabs 27 of the contact spring 21 that form the clamping contacts 16. This support prevents the contact springs 21 from deflecting downward when a conductor 19 is inserted into the insulation piercing slits 14.

The cover 3 also has lengthwise ribs 76 formed onto its inside and springs 77 parallel to them that are disposed in such a way that in the installed state the lengthwise ribs 27, in addition to the partitions 68 of the housing 1, axially support the contact springs 21, while the springs 77 engage corresponding grooves 78 on the face ends of the partitions 68, in order to protect the arrangement from leakage paths between adjacent contact springs 21.

The socket 52 (Figs. 1, 4) laterally formed onto the housing and forming a receiving and connection region for the capacitor 53, is closed, in applications in which no capacitor 53 is used, by a cap-shaped closure element 80 (Figs. 2, 3), which is inserted into the socket 52 and guided in it by a cylindrical protrusion 81. Two detent hooks 82 are formed onto the inside of the closure element 80 and fit over corresponding housing parts 84 at the socket 52. The closure element 80, which in the mounted state covers the two contact springs 21, which are partly exposed on their face ends in the socket 52, in a way protected again

- 16 -

shock hazard is also provided on its inside with a formed-on plate 85, which on the inserted state protrudes into a corresponding slitlike opening 86 above the two associated contact springs 21, as can be seen particularly in Fig. 3.

A contact bridge 87 (Figs. 12, 13), made of resilient sheet brass, is located on the underside of the plate 85 and on its side has two parallel cut-loose contact prongs 88, which as can be seen from Fig. 13 are curved obliquely downward and bent on the ends. A likewise notched detent tab 89 engages a central opening 90 of the plate 85 and keeps the contact bridge 87 stationary.

It can be seen particularly in Fig. 3 that in the inserted state of the closure element 80, the two contact prongs 88 of the contact bridge 87 are pressed with initial stress at the top onto the adjacent contact springs 21 exposed at the top in the opening 86; the consequence is that via the contact bridge 87, a secure electrical connection is established between these two contact springs 21 and hence the associated connection terminals 5.

When the connection structure is use for wiring, a fixture or luminaire with gas discharge lamps, the closure element 80 thus makes it possible to connect not only the power supply network conductors L and N but also the grounding conductor (on the contact spring 21 opposite the slit 58 in the cover 3) while on the other hand a selective wiring option for the fixture exists in that the fixture can be operated either uncompensated or compensated with a capacitor parallel to the network or capacitively with a series connection capacitor, without having to provision additional wiring layouts from outside. At the same time, if necessary, an anti-interference capacitor may also be connected, which is inserted by its two connection wires simply through the insertion channels 56 (51) into the plug connections

- 17 -

that are formed by the two tabs 38 (Fig. 3, 18).

In an alternative embodiment, the closure element 80 may also be formed such that it has circuit elements on its inside, for instance a fine-wire fuse or an anti-interference capacitor, whose connection elements are arranged for insertion into the recesses 31 of the two contact springs 21 exposed on the socket 52. The arrangement may also be such that these circuit elements are secured to the housing 1 inside the socket 52, while the closure element 80 merely retains them and covers them from the outside.

The embodiment of the receiving and connection region in the form of the socket 52 is not limited to the connection of a capacitor 53 with a cylindrical cup. Instead, it is adapted to the particular form of circuit element to be connected and spatially attached.

An alternative option for providing a capacitor 530 or other circuit element, such as a resistor, is suggested in Fig. 26. The capacitor 530, in this case essentially block-shaped, is inserted into the space surrounded by the lower part 23 of two adjacent contact springs 21; its two connection wires 95 are bent upward in a U, such that between the top of the capacitor 530 and the inside of the upper wall parts 26 of the contact springs 21, they are clamped with an initial tension that is required for making good contact.

For mechanical retention of the capacitor 530, the partitions 68 of the housing 1 (Fig. 7) and the ribs 76 of the cover 3 (Fig. 8) are suitably recessed or shaped, while the support prongs 75 for the two contact springs 21 are omitted, and the axial support of the slit blade insulation piercing contacts 16 is provided directly by the inserted capacitor 530.

- 18 -

When the novel connection structure is used in automatic production of wiring layouts, to enable easy identification of the various connection terminals 5, they are provided with a code, which for instance may be a dot code provided on the face end, as suggested in Fig. 1 at 100 for one connection terminal 5.

The connection structure may also be formed such that it directly enables the looping through of wires, as may sometimes be needed in the production of wiring layouts. To that end, between adjacent connection terminals 5, for instance, at least one through channel 96 (Fig. 5) may be formed, although it is also possible to provide corresponding devices in the base 2 or other housing parts.

Finally, embodiments in which in addition to or instead of at least one of the plug contacts at 30, 32, a screw-type clamp connection is provided on the connection side, or in which the plug connection is joined via an adapter (connecting strap or connecting line) to a screw-type clamp.

The closure means 80, 3 may be formed so as to be lockable to the housing 1, but other closure options are also possible, for instance via screw or bayonet mounts.

In a preferred embodiment, electrical connecting means 87 for bridging two plug connectors located in the receiving or connection region are associated with the closure means 80, so that with the insertion of the closure means, an internal connection of various connection points in the connection structure is brought about. Particularly in producing the wiring of fixtures or luminaires, further economy, in terms of separate connection points for wires to be placed, can be attained in this way.

Advantageously, insertion channels 49, 50; 56 for the

- 19 -

conductive parts to be connected are associated with the plug connectors in the housing 1, and in these channels these parts, optionally including an applied insulation 20, can be received over part of their length, thus assuring satisfactory insulation, protected against shock hazard, in the contact region without requiring additional provisions. To make it easier to insert the conductive part to be connected, one such insertion channel 50 may be formed as widening in funnellike fashion toward the outside.

Depending on the design of the apparatus and the associated wiring, it may be advantageous if at least one plug connector at 47 is formed with an insertion direction oriented parallel to the insertion direction of the slit blade insulation piercing connector 16. The connection structure can have at least two plug connectors 31; 32 that are accessible from opposite sides of the housing 1, so as to assure the most space-saving possible arrangement of one or more devices or wires to be connected.

In the practical embodiment, the contact means of the connection structure can have at least one contact spring 21 of electrically highly conductive material, in which the slit blade insulation piercing connector 16 and the plug connector or connectors 31, 32, 47 are formed. In this way, with relatively simple means, particularly good contacting at the slit blade insulation piercing can be attained, if this slit blade insulation piercing connector 16 is formed by two parallel contact spring parts 27, unjoined over their length, in which two slit blade insulation piercing slits 14 aligned with one another are located, wherein that both contact spring parts 27 are laterally guided in the housing 1. Each of the two contact spring parts in fact produces two separate connectors, so that the connected conductor is contacted via a total of four separate connectors.

- 20 -

In an advantageous embodiment, the contact spring 21 can have a bottom part 24 and two opposed leg parts 25, protruding from that bottom part, which in at least one part 24, 25 form a plug contact opening 31, 32, 47 that is at least partly covered by a locking part 30, 22 that is lockable to a plugged-in part 54, 19, 59. This locking part may be formed on the contact spring itself in the form of one or more cut-loose tabs, which when a part is plugged in spread apart and are locked to it in detent fashion. It is also possible, however, for a clamping spring 22, which has locking parts 30, 47 cooperating with the respective contact opening 31, 32, 37, to be inserted into the contact spring 21. To that end, the clamping spring 22, in the region of at least one contact opening 37 of the contact spring, can have a plug opening that is defined by spreadable notched locking tabs 47 cut loose on the ends. Another option is for an essentially flat part 24 of the contact spring 21 to have a substantially L- or U-shaped region 38 forming a plug connector and pressed from outside out of the plane of this part 24; a locking part 41 optionally formed on the aforementioned clamping spring protrudes into this region. Moreover, in the region containing the bottom and leg parts 24, 25, the contact spring 21 can be formed as substantially completely closed all the way around by upper wall parts 26, with the parts 27 carrying the slit blade insulation piercing slits 14 notched at the upper wall parts 26.

In the novel connection structure, as a rule, a plurality of contact springs 21 are located in the housing 1 in their own chambers 67, which are separated from one another by insulating partitions 68 and are closed by a common cover 3. This cover may be omitted if the housing and operating state is seated directly on an insulating substrate, so that the contact means are closed

- 21 -

off from the outside in a manner protected against shock hazard from this side as well.

The cover can be located on the side of the housing opposite the slit blade insulation piercing connectors 16 and has support means 75 for parts 27 of the contact means forming the slit blade insulation piercing contacts. The cover 3 and/or the housing or the partitions 68 in it may be provided with intermeshing parts 77, 78; 76 that prevent leakage paths, and it is also possible for the housing 1 and/or the cover 3 to have at least one through channel 96 for a conductor looped through it.

As already noted at the outset, particularly in use for fixtures or luminaires, it is advantageous if the connection structure is arranged for use with a capacitor 53, 350 as the device, and the housing 1 has form-locking retaining means 52, 3 for the capacitor in the aforementioned receiving or connection region. In addition or alternatively, however, the arrangement may also be such that a capacitor, resistor or at least one other component is accommodated in the housing itself, and it is an attractive option to accommodate them in the space enclosed by the applicable contact spring.

The connection structure may also have connection points arranged for the connection of fine-wire fuses or a shunt resistor, for instance, and these connection points are either formed as plug connectors or are located inside the housing itself.

The novel connection structure is universally usable. It can in particular advantageously be used in the automatic production of the wiring of fixtures or luminaires, but its use is not limited to that field.

Various changes and modifications may be made, and any

Date : 03 FEB 1997

- 22 -

features described herein in connection with any one embodiment may be used with any of the others, within the scope of the inventive concept.

- 23 -

The claims defining the invention are as follows:

1. A connection structure for at least one electrical device, optionally a capacitor, comprising
 - a housing of electrically insulating material, said housing being formed with attachment means for attachment to a support;
 - spatially separated electrical connection points for electrically conductive parts;
 - contact means electrically conductively joined to said connection points,
 - at least one connection point being formed as a slit-blade insulation-piercing connector, and at least one other connection point being formed as a plug or push-in connector;
 - a reception region, including a socket, for said electrical device formed on said housing,
 - at least one of said connection points being located in the reception region; and
 - shock-protection means formed from portions of said electrically insulating housing protecting each of said connection points against accidental and undesired electrical contact.
2. The connection structure of claim 1, characterised in that at least one plug connector is arranged for the insertion of a solder lug or a blade connector.
3. The connection structure of claim 1, characterised in that it has two plug connectors, located side by side, which are arranged for insertion of a solder lug or blade connector and each of which is electrically conductively joined to its own slit blade insulation piercing connector.
4. The connection structure of claim 1, characterised in that it has at least one plug connector, whose insertion direction is formed at right angles to the insertion direction of the slit blade insulation piercing connector.
5. The connection structure of claim 1, wherein
 - at least one further reception region is formed on the housing for reception of a further device; and



- 24 -

at least one connection point is located in said further reception region.

6. The connection structure of claim 5, characterised by contact connectors on the housing arranged for connection of a shunt resistor.

7. The connection structure of claim 5, comprising detachable closure means covering the further reception region for insulating said further reception region with respect to the outside of the structure.

8. The connection structure of claim 7, characterised in that the closure means are formed so as to be lockable to the housing.

9. The connection structure of claim 7, further comprising electrical connection means, associated with said closure means, said electrical connection means bridging two connection points.

10. The connection structure of claim 1, further including insertion channels for said electrically conductive parts, which parts are adapted to be connected to, and associated with said plug connections,

said insertion channels being dimensioned to receive said conductive parts, optionally including insulation applied thereover.

11. The connection structure of claim 10, characterised in that at least one insertion channel is formed in widening or funnellike fashion outwardly from the housing.

12. The connection structure of claim 1, characterised in that at least two plug connectors are provided, respectively accessible from opposite sides of the housing.

13. The connection structure of claim 1, characterised in that at least one plug connector is formed with an insertion direction oriented parallel to the insertion direction of the slit blade insulation piercing connector.

14. The connection structure of claim 1, characterised in that the contact means have at least one contact spring of electrically highly conductive material, in



- 25 -

which material the slit blade insulation piercing connector and the plug connector or connectors are formed.

15. The connection structure of claim 14, characterised in that the contact spring has an essentially flat part, which flat part includes a region of substantially L or U shape forming one of said plug connectors, pressed from outside out of the plane of said flat part; and in that a locking part is provided, protruding into said one of said plug connectors.

16. The connection structure of claim 14, characterised in that the at least one contact spring has a bottom part and two opposed leg parts, protruding from the bottom part, which in at least one part form a plug contact opening that is at least partly covered by a locking part, which locking part is lockable to an element that is to be inserted into the plug contact opening.

17. The connection structure of claim 16, characterised in that the contact spring includes a clamping spring, which has said locking parts cooperating with the respective contact opening.

18. The connection structure of claim 17, characterised in that the clamping spring, in the region of at least one contact opening, has a plug opening that is defined by notched locking tabs which tabs can be spread apart on one side.

19. The connection structure of claim 14, wherein
the slit blade insulation piercing connector is formed by two parallel contact spring parts, unjoined over their length, in which two slit blade insulation piercing slits aligned with one another are located; and

the housing is formed with means for laterally guiding both contact spring parts.

20. The connection structure of claim 19, characterised in that the contact spring, in the region containing the bottom and leg parts, is formed as a substantially circumferentially closed structure, including upper wall parts; and in that, at the upper wall parts, the portions carrying the slit blade insulation piercing slits are notched.



- 26 -

21. The connection structure of claim 1, characterised in that the contact means include a plurality of contact springs, located in the housing, said housing being formed with a plurality of chambers, which are separated from one another by insulating partitions, each chamber retaining a contact spring.

22. The connection structure of claim 21, characterised in that a cover is provided common to at least one of said chambers; and in that the cover is located on the side of the housing opposite the slit blade insulation piercing connector and has support means for portions of the contact means forming the slit blade insulation piercing contacts.

23. The connection structure of claim 21, characterised in that at least one of the cover and the partitions have intermeshing parts to prevent leakage paths.

24. The connection structure of claim 21, characterised in that at least one of the housing and the cover has at least one through channel to permit a conductor being pulled through it.

25. The connection structure of claim 1, characterised in that the reception region has mechanical holding or retaining means for the device.

26. The connection structure of claim 25,
wherein said device comprises a capacitor, and
the housing has form-locking retaining means for the capacitor in the reception region.

27. The connection structure of claim 14, including at least one electric device, located in a region that is at least partially encompassed by at least one contact spring.

28. The connection structure of claim 27, characterised in that the slit blade insulation piercing connector of the contact spring is electrically connected to the electric device and is mechanically supported via said device.



* C L N S *

- 27 -

29. A connection structure substantially as described herein with reference to the accompanying drawings.

DATED this Fourteenth Day of June 1996

Vossloh-Schwabe GmbH

Patent Attorneys for the Applicant

SPRUSON & FERGUSON



* C L N S *

- 28 -

Connection Structure for at Least One Electrical Device

Abstract of the Disclosure

An electric connection structure for at least one electric device has slit blade insulation piercing connectors (5) and additional plug connectors (31) for connecting conductive parts.

(Fig. 1)