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REPLACED SHEETS		SG
☒	Description : paged1.... to paged15....	
☒	Claim(s) : paged16.... to paged20....	
☒	Drawing(s) : paged17.... to paged21....	
☒	Abstract : paged22.... to paged23....	
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

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- 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

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- 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.

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- 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

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- 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

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- 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 8 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).

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- 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.

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- 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

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- 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.

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- 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

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- 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).



- 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.

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- 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.

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- 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).



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- 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).



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- 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).

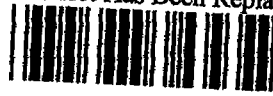
18. The connection element according to Claim 17, characterised in that, near at least one contact opening (37), the clamping spring (22) has a connector opening which is delimited by latching tabs (47) which are cut in and adapted to spread on one side.

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).



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- 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).



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- 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.



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