

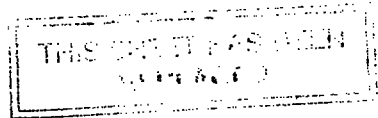
Electrical Connection Terminal Arrangement

The invention relates to an electrical connection terminal arrangement having a housing of insulating material, which has at least one insertion slit open at the edge toward one insertion side for an electric wire and at least one insulation-piercing blade contact, which is arranged in the housing and forms a contact zone, with a slit for the insulation-piercing blade open at the edge and aligned with the insertion slit for wire connection, wherein the insulation-piercing blade contact is formed on a contact spring.

Electrical connection terminal arrangements of this kind, for instance in the form of connection terminals or terminal strips, enable contacting of conductors by the so-called slit/blade insulation-piercing technique. This technique offers considerable advantages, especially in automatic wiring for apparatus, such as fixtures or luminaires, because no separate actuation of clamping devices such as screws or the like is required.

In addition to the connection terminals for connecting conductors, it is also known to provide connection terminal arrangements for electrical apparatus with insulation-piercing blade contacts of this type. One example has been described in EP 002 099. A housing made of insulating material is mounted on the laminate package of a transformer, and a plurality of insulation-piercing blade contacts ["pierce-clamp contacts"] for connecting conductors are arranged in the housing. Each of these insulation-piercing blade contacts is formed on an approximately U-shaped contact spring which is provided with two blade-clamping slits on opposite sides, the dimensions of the slits being chosen for the connection of a wire of the winding on one side and a power mains line on the other side. Basically, these are connection clamps of two lines of different diameters both of which are connected to the contact spring by the pierce-clamp blade technique.

In a number of applications it would be desirable to simplify the connection to the apparatus or to obtain even greater versatility of such connection means suitable for the automatic wiring in accordance with the pierce-clamp blade technique. This is the problem underlying the invention.



In order to solve this problem, the above-specified electrical connection terminal arrangement according to the invention is characterised in that the contact spring has in addition to the insulation-piercing blade contact at least one plug-type contact and a contact for connecting an apparatus.

The contact plug conveniently has a disconnectable conductor connection so that a contacting connection line, for, say, some additional operational means, such as a capacitor in the wiring of light fixtures, can be optionally disconnected. On the other hand, it is often advantageous to configure the contact for connecting an apparatus to enable nondetachable connection of connection means of the apparatus so that the connection means can no longer be removed from the apparatus by the user. The connection means to the apparatus can be advantageously a contact plug, although it is possible to configure it in some other way, e.g., as soldering pin or socket pin.

As a rule, the contact plug is formed by cut-out tabs in the contact spring which spread apart when the part to be connected is mounted; these tabs latch into the part to be connected and clamp it securely to the contact spring while producing a highly conductive electrical contact.

By appropriately configuring the parting lines and shaping the tabs accordingly, the plug connection can be made either disconnectable or nondisconnectable. If it is to be disconnectable, an unlatching region which is accessible from the outside with a release tool is associated with it on the contact spring, with the tabs configured to be elastically deformable for release by a pressure force acting upon the contact spring in the unlatching region. As a rule, a screwdriver is used as a release tool, as usual.

A particularly simple design is obtained if the contact spring is a leaf spring. The contact spring may be bent by 180° near the slit for the insulation-piercing blade to improve making contact with the conductor to be connected (in this context, see OS 2 330 159).

In a convenient embodiment, the housing which accommodates the contact spring comprises at least two superposed chambers which are traversed by the contact spring and one of which houses the contact plug while the other houses the apparatus connection contact, with leads for parts to be connected being associated with the chambers, and, if needed, support and guide means for the contact spring being provided, too. For reasons of space, it is usually convenient to arrange the two chambers underneath the housing portion which



encloses the insulation-piercing blade contact. In order to prevent the contact spring from yielding when the conductor is pressed into its slit for clamping by the blade, the contact spring is advantageously supported in the lowermost chamber to sustain a force acting on the slit in the longitudinal direction of the contact spring.

It is often necessary to make provisions for preventing plastic bending of the contact spring by an excessive force acting on the release tool when the contact plug is released as this could damage the connection means or even make them unusable. In order to prevent that, the contact spring is, if necessary, biased against the direction of the pressure force applied through the release tool inside the chamber associated with the contact plug. Biasing can be effected at locally delimited support spots on the walls of the chamber, with the location of the support spots depending on the particular form of the release or unlatching region which, in turn, is defined by the form of the tabs and the course of the parting lines for cutting them out.

If, as mentioned above, the apparatus-connection contact is configured as a plug-type contact, it is often advantageous to configure the apparatus connection contact and the additional contact plug so that the directions of inserting the parts to be connected are opposite and that, hence, the openings for inserting the parts to be connected are also situated on opposite sides of the housing.

The housing can have a transverse opening or recess for accommodating fastening means on the side proximal to the apparatus so that the connection terminal can be fixed also mechanically without additional means.

In particular, if it is important to use the connection means in combination with circuit boards or printed circuits, a different form of the apparatus connection contact is advantageous. In such cases, the apparatus connection contact may have at least one base pin which protrudes from the housing, is adapted for connecting a part to be connected either by soldering or by clamping, and, if necessary, may also be used for mechanically joining the connection means with the circuit board etc.

This base pin is usually notched at the contact spring and shaped accordingly. Of course, in principle it may be joined with the contact spring and in that case made from some different material, if necessary.

In order to improve the mechanical strength of the junction of the connection terminal arrangement with a circuit board and, if necessary, to

provide additional electrical connection facilities, as in the case of very high current loads, it may be convenient to bend the contact spring to have substantially U-shape with a double-walled section extending from the base of the U-shaped portion and containing the blade clamping slit, with base pins arranged at the two legs. This renders support for each contact spring at two spaced points at which both electrically conductive parts can be connected.

The additional contact plug is conveniently provided on one of the two legs of the contact spring, but it is also possible to provide contact plugs on both legs.

The possible applications of the novel connection means are practically unlimited. The connection means are suitable for any wiring in low-voltage circuits and appear interesting particularly for the automatic production of such wiring arrangements by means of a wire placement tool controlled by a robot following a program.

Since the connection means proper are provided with at least one apparatus connection contact, it is often advantageous to attach the connection means to the apparatus proper, for which purpose it may sometimes be advisable to take provisions on the connection side of the apparatus to connect the novel connection terminal arrangement securely.

One such application involves the combination with a ballast unit for gas discharge lamps, e.g. fluorescent lamps, or with a low-voltage transformer because in such apparatus the manufacturer usually provides a connection terminal, often in the form of an insulated screw connector, which is permanently arranged on the package of lamina or on a base plate. In one embodiment (widely used in the industry) of this kind of ballast circuit or transformer, plastic caps are provided as insulation of the end portion of the winding, which caps are mounted on the package of lamina close to the respective end portion of the winding. As described in this context in DE-PS 2 244 158, it is known to provide pins or tube portions, which protrude in pin-like fashion, on the insulating cap proximal to the proper connection, with the pins or tube portions having at the bottom a slit into which a wire of the winding is placed, whereupon on the pin or the tube portion there is attached a cable end sleeve by crimping, which sleeve is mechanically firmly retained on the pin or the tube portion and to which the wire of the winding is in this way electrically connected.

The novel connection means can be plugged with its instrument connection contact directly onto the connection member formed by the cable end sleeve and latched with the same in nonreleasable fashion. Such a direct connection by a plug is also applicable in any apparatus having a pin- or plug-like connection member onto which the connection means can be plugged directly.

For additional mechanical guiding and for preventing leakage paths, it is advantageous to form cooperating guide and/or retention elements on the cover cap of the aforementioned ballast unit and on the housing of the connection terminal.

In principle, in a unit of this type or a transformer, the external line connection can be established through a circuit board, which, for example, is electrically insulated and mounted on the base plate and may bear additional circuit elements associated by the manufacturer with the ballast unit or transformer. In that case, the second embodiment which was explained in the introduction and has base pins arranged on the contact spring is of interest.

Still other embodiments of the invention are recited in additional dependent claims.

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

- Fig. 1, a perspective view of the housing of connection means according to the invention in the form of a simple, single-phase apparatus connection terminal or clamp-type connector;
- Fig. 2, a perspective view of connection means according to the invention in the form of a two-pole apparatus connection terminal or clamp-type connector;
- Fig. 3, a perspective schematic, partial view of two connection terminals of Fig. 1, combined with a ballast unit for gas discharge lamps;
- Fig. 4, a side view of a cover cap of the ballast unit of Fig. 3;
- Fig. 5, a lateral section along line V-V of Fig. 3 of the arrangement of Fig. 3, on a different scale;
- Fig. 6, a lateral section along line VI-VI of Fig. 7 of the connection clamp according to Fig. 1, on a different scale;
- Fig. 7, a rear view of the connection clamp of Fig. 1, with the contact spring omitted and on a different scale;

- Figs. 8 and 9, a plan view and a side view, respectively, of the contact spring of the connection clamp of Fig. 1, on a different scale;
- Fig. 10, a perspective schematic view, parts shown in detail, of another embodiment of the connection means according to the invention in combination with an electrical ballast unit for gas discharge lamps;
- Fig. 11, a front view of the connection means of Fig. 10 with some of the contact springs omitted;
- Fig. 12, a plan view of the connection means of Fig. 11, in a section taken along the line XII-XII of Fig. 11;
- Figs. 13 and 14, plan views of the connection means of Fig. 11;
- Fig. 15, a lateral sectional view of a contact spring of the connection means of Fig. 10, taken along line XIV-XIV of Fig. 12, on a different scale;
- Fig. 16, a lateral sectional view of the contact spring of Fig. 14, taken along line XV-XV of Fig. 14; and
- Fig. 17, a side view of the contact spring of Fig. 14.

The novel connection terminal arrangement, which is shown in the form of a single-pole connection terminal particularly in Figs. 1, 3 and 6 and 7, has a housing 1 made of insulating material and having substantially rectangular cross section, which on two opposite sides has two parallel moulded base ledges 2 and is provided with fastening means in the form of a continuous longitudinal slot of rectangular cross section situated near the flat bottom surface 3. As can be recognized in Fig. 3, the connection terminal is mounted with its bottom face on the base plate 5 of, say, an electrical ballast unit 6 and secured to it by means of a tab 7 bent upward from the base plate, with the tab protruding through the longitudinal slit 3 and, if necessary, bent slightly downward on its free end.

The two side walls 8 of the housing 1, which is open at the top on the side of wire insertion, bear on their inside two facing ribs 9 which are located approximately in the middle between the two front faces 10 of the housing and between them define a slightly wedge-shaped or parallel-sided insertion slit 11 (Figs. 1 and 11) widened at its top by insertion ramps 12.

Two oppositely disposed narrow grooves 14 (Figs. 1, 6) extend from below over the entire height of the housing into the ribs 9 and accommodate the two legs 16 of an insulation-piercing blade contact, which legs delimit a blade-clamping slit 15 open at the edges, with the blade contact arranged on a contact spring 17 (Figs. 8 and 9) of spring steel or spring bronze or some other conductive spring material, and with the contact spring configured as a leaf spring or small spring blade. All sides of the narrow blade-shaped contact spring 17 are embedded, in the manner shown in Fig. 6, in the insulating material of the housing, except for the cutting sections which are provided on the legs 16 and face the blade-clamping slit 15, with the two legs 16 delimited by, and guided to move in, the grooves 14. Near the blade-clamping slit 15, the contact spring is bent 180° at 18 (see Figs. 6 and 9) and, on the bent part on both sides of the blade-clamping slit 15, is provided with two notched latching tabs 19 which protrude obliquely beyond the plane of the bent portion and serve for permanent fixing of the contact spring 17 in the housing 1. The bent-back portion doubles the cutting edges which delimit the blade-clamping slit so that there is a total of four pairwise facing contact points for the clamped conductor.

As can be recognized particularly from Figs. 1, 5 and 6, the housing 1 has on both sides of the ribs a groove-like indentation 20, 21 of essentially rectangular or slightly wedge-like converging cross section, with each of the indentations adjoining the ribs 9 and, hence, the insertion slit 11 and opening next to the insertion slit 11 toward the housing's 1 upper side for conductor insertion. The two groove-like indentations 20, 21 are in alignment with one another and with the insertion slit 11. They are delimited on top by a chamfered portion 22 for insertion. Especially Fig. 3 shows that the depth of the two groove-like indentations 20, 21 exceeds the depth of the insertion slit 11 but the groove-like indentation 21 opening toward the front face is deeper than the other groove-like indentation 20 toward the rear. The width of the groove-like indentations 20, 21 is substantially greater than that of the insertion slit 11.

The dimensions of the various parts are chosen so that when an insulated line 22 is pressed through the insertion slit 11, the insulation is cut open in the blade-clamping slit 15 by the legs 16 of the insulation-piercing blade contact in the manner shown in Fig. 5, and, at the same time, gas-tight contacting takes place between the insulation-piercing blade contact and the

metal conductor of the line 22, the conductor being deformed at the point of clamping. The pressed-in line 22 is with its insulation at the same time firmly clamped between the two ribs 9 in the insertion slit 11. The connected line 22, retained in this way, extends through the groove-like indentation 21, whereas its severed end 23 lies in the other groove-like indentation 20 (Fig. 5). The width and depth of the groove-like indentations 20, 21, as well as their axial length, are dimensioned so that shock protection is automatically obtained for the line and in particular for its severed end 23. This means that the standardized feeling finger in the test for shock protection cannot pass to the bared, severed front face of the end 20 of the line 22 at the depth of the respective groove-like indentation 20. The metallic insulation-piercing blade contact at the contact spring 17 itself is fully protected toward the outside by its legs 16 in the grooves 14 of the housing 1 of insulating material. It is located at a depth such that absolute protection against accidental contact exists even in the region of the insertion slit 11.

Two superposed chambers 24, 25 are formed in the housing 1 underneath the above-described housing portion containing the blade-clamping slit 15 and the groove-like indentations 20, 21 and are of substantially rectangular cross section and open onto the flat vertical back of the housing. The two chambers 24, 25 are traversed by the plate-shaped, vertically inserted contact spring 17 which is seated with its lower edge on the bottom of an indentation 26 provided on the bottom of the second chamber 25. In this way, the contact spring 17 is properly supported in the housing in the axial direction against the effect of the pressure force exerted upon insertion of the conductor into the blade-clamping slit 15 so that the contact spring 17 cannot yield axially. At the same time, it is guided in the grooves.

In the zone under the blade-clamping slit 15 and the folded-back portion at 18, the contact spring 17 is provided with three plug-type connection points 27, 28 and 29 as shown particularly in Figs. 8 and 9. The two plug-type connection points 27, 28 in side-by-side relationship serve to connect electric lines, whereas the plug-type connection point 29 underneath and situated on the plane of symmetry relative to the blade-clamping slit 15 is designated for connecting the terminal to an appropriately configured electrically conductive connection part of an apparatus, such as the ballast unit 6 (Fig. 3). This connection part may also be a connecting wire; and, quite generally, a line can be connected nondetachably to the plug-type connection point 29.

The plug-type connection points 27, 28 are of identical shape. Each of them has two substantially T-shaped tabs which are defined by rectangular apertures and punched separation lines 32, 33, 34 extending at right angles to each other and which are slightly inclined inwardly near the crossbar at 35 within a substantially triangular region.

Similarly, two substantially T-shaped tabs 38 which are laterally exposed by lateral rectangular recesses 36 and separation lines 37 are formed at the apparatus connection point at 29, face each other and between them define a narrow gap 39 which is aligned with the blade-clamping slit 15 and has an approximately square widened portion in the middle. The two tabs 38 are likewise stamped to be outwardly inclined from the plane of the contact spring 17 but toward the other side relative to the upper tabs in the region 35, as can be seen in Fig. 9.

Fig. 6 shows that the upper two plug-type connection points 27, 28 are situated approximately on a center axis of the chamber 24 and point toward two horizontal insertion openings 36 in the end wall of the chamber, which are followed by insertion channels 38 of circular cross section, flaring in the form of a funnel toward the front of the terminal. Between the insertion channels there is provided a rectangular aperture of the chamber end wall, which issues toward the front face of the contact spring 17 and facilitates insertion of a releasing tool, e.g., a screwdriver, to press it on the T-shaped tabs of the plug-type contacts 27, 28 at the separating line 33 so that a conductor locked inbetween can be released.

Lest the contact spring be excessively bent by the pressure force exerted by the releasing tool, it can be locally supported on the side facing the wire insertion openings 36 by four support strips 40 moulded on the corners of the chamber 24 and rest on the front faces of these support strips.

The apparatus terminal 29 which is likewise configured as a plug-type connection point, is situated in the centre of the lower chamber 25 (Fig. 6) which, on the other side of the contact spring 17, is faced by an opening 42 of rectangular cross section issuing to the front of the housing and facilitating the insertion of, say, a testing tip to check the operational condition of the connected apparatus. The opening 42 is delimited by housing walls with a length chosen so that the contact spring 17 is accommodated to be protected toward the outside. The chamber 25 has an insertion funnel 43 flaring toward the back of the housing to facilitate mounting the terminal on an apparatus.

Finally, the longitudinal slit 3 in the form of a parallel channel of full length is situated under the chamber 22 and serves to secure the terminal, as explained before.

As indicated above, the connection terminal described can be used universally. Its special advantage resides on its utilisation with the ballast unit 6 as will be explained below with reference to Figs. 3 - 5.

The ballast unit 6 is provided on both sides of the package of lamina with a substantially rectangular cover cap 44 of insulating material for the winding indicated at 45 in Fig. 5. On the side of the connection shown in Fig. 3, the cover cap 44 is on its front provided with two parallel vertical moulded guide strips 45 which protrude from the plane of the front wall and are confined by parallel walls. In its lower part, each of the guide strips 45 has a substantially rectangular extension 46 on which there is seated a moulded, horizontally aligned, protruding tube 47 which on the bottom is provided with an insertion slit 48 extending over the entire length and issuing into the interior of the cover cap 44 enclosing the winding 45.

The connection wires 49 of the coil of the ballast unit 6 are run through the two insertion slits to the outside. Each of them is electrically conductively connected to a cable termination sleeve 50 which is crimped onto the respective tube portion 47 and, hence, firmly joined with the cover cap 44.

When the connection terminals are mounted on the pre-assembled ballast unit 6, each terminal is simply placed on the base plate 5 and moved toward the cover cap 44, whereupon the fastening tabs 7 enter into the longitudinal slit 3. Then the dimensionally stable, pin-like cable termination sleeve 50 is automatically introduced through the insertion funnel 43 into the chamber 25 and from it into the plug point forming the connection 29 to the apparatus and is contacted by the contact spring 17. When the terminal is pressed in this way onto the cover cap 44, the two T-shaped tabs 38 of the contact spring 17 are spread outward and into the opening 43 in the manner indicated in Fig. 5. On this occasion, they lock in form-fitting fashion onto the cable termination sleeve 50 so that a nonreleasable connection is established between the cable termination sleeve 50 and the contact spring 17. When the contact spring 17 is pushed onto the cable termination sleeve 50, the same is scraped bare by the sharp edges of the T-shaped tabs 38, which slide on it under bias and, by virtue of the central rectangular broadened part of the gap 39 (Fig. 8), are sharp, whereby any possibly present paint particles are automatically removed so that perfect contact is ensured.

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The connection terminal which is pushed onto the cover cap 44 is configured so that its back precisely embraces the associated guide strip 45 in a connection region 51 (Figs. 6, 7) of substantially rectangular cross section, as can be seen in Fig. 5. This does not only ensure form-fitting retention of the housing 1 at the cover cap 44 but also prevents the development of unacceptable leakage paths. Moreover, perfect protection against shock by contact is provided at these points.

Leads can be connected from the outside to the two plug-type contacts 27, 28 as shown in Fig. 5 for a line 51 the insulation of which is held in the respective insertion channel 38, whereas its conductor 52 passes through the contact spring 17 in one of the triangular regions 35 (Fig. 8) and is latched by the T-shaped tabs which spread in spring-like fashion and are inclined toward the inside.

The clamping can be disengaged in the above-described manner by inserting a release tool through the recess 39 (Fig. 7).

The connection terminal described may also be configured in a natural way as a two-pole or multi-pole connection terminal, as shown by the second embodiment described below a two-pole version of which is shown in Fig. 2, and a seven-pole version, in Figs. 10 to 14.

Components identical with those of the embodiment of Fig. 1 are characterised by identical reference numbers in the description of the embodiment shown in Figures 10 - 13 but the letter "a" was added. It is not necessary to explain once more both the structure and the function of these components which were characterised in the same way; in this respect, reference is made to the preceding description.

While in the embodiment of Fig. 1 the apparatus connection at 29 is configured as a plug-type contact and the connection terminal can be used together with a ballast unit 6 in the manner indicated in Fig. 5, the embodiment of Figs. 10 - 14 is designated mainly for use with circuit boards, printed circuits and the like, as can be inferred especially from Fig. 10.

In the housing 1a (Fig. 2) or 1b (Figs. 10-13) of insulating material, here in the form of a clamping strip, a plurality of electrically separated insulation-piercing blade contacts are arranged in side-by-side relationship in a row in housing portions of identical design. Thus, it suffices to describe one such housing portion for an insulation-piercing blade contact:

Substantially in analogy to Fig. 1, the upper part of the housing 1a, 1b is open toward the side of conductor insertion. Each insertion slit 11a is delimited by two side walls 9a between the ribs 10a, and next to the slit, two narrow grooves 14a are provided for accommodating a matching portion of a contact spring 17a (Figs. 14-16). Near each of the insertion slits, the contact spring 17a has a blade-clamping slit 15a which is aligned with the insertion slit and is on each side bounded by a respective leg 16a. On the two sides of the insulation-piercing blade contact in housing 1a, b there are formed two elongated, groove-like recesses 20a, 21a (see Fig. 13) the length, width and depth of which are dimensioned like in the embodiment of Fig. 1.

Under the two groove-like recesses 20a, 21a in the housing 1a, b there is provided for each contact spring 17a a chamber 24a into which an insertion opening 36a and a conductor-insertion channel 38a extend from the front side of the housing (see Fig. 15). Near the conductor-insertion channel 38a there is a rectangular aperture 39a for introducing a release tool (Fig. 2).

As can be inferred particularly from Figs. 15 to 18, the contact spring 17a is bent substantially to the shape of a U; it has two legs 60a, 61a joined by a crosspiece 62a followed, in turn, by a flat double-wall region 63a which is arranged as an extension of the leg 60a and encloses the blade-clamping slit 15a. It is ensured in this way that also in this embodiment the conductor connected by the slit-blade insulation-piercing technique is contacted at four different points.

Figs. 14, 15 show that the contact spring 17a, which, as a whole, has the form of an h, is pushed from above into the housing 1a, 1b, with its first leg 60a traversing the chamber 24a and its second leg 61a received in a transverse slit 64a provided in the bottom of the groove-like recess 20a. Two guide grooves 65a (Fig. 12), which laterally guide the leg 61a, cooperate with the transverse slit 64a in the side walls of the respective chamber 24a.

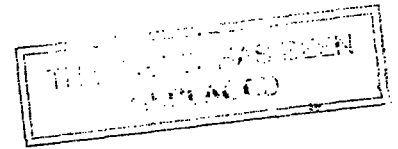
As shown in Figs. 15, 17, the other leg 60a is in its upper part provided with strip-like wall portions 67a which are bent back under a right angle toward the leg 61a, serve to stabilize this part of the contact spring 17a, and, after assembly, bear laterally against the walls of the chamber 24a in the manner illustrated in Fig. 12, with their free longitudinal edges having associated support points 40a preventing inadmissible deformation of the contact spring 17a subjected to a release tool which was introduced through the aperture 39a, as explained above.

Within chamber 24a, in the leg 60a of the contact spring 17a there is formed a plug-type contact 27a which is aligned with the conductor insertion opening 36a. The plug-type contact 27a is configured like the plug-type contact 27 of Fig. 8 so that it suffices to cite the respective identical reference numbers. There are again two substantially T-shaped notched tabs 270a which are separated from one another by a transverse separation line 33a and which, in the manner shown in Fig. 15, are embossed to be inclined inward at an angle relative to the plane of the leg 60a. Latching tabs indicated at 19a (Figs. 15, 17) serve to provide stationary locking of the contact springs 17a inside the housing 1a, b.

Each of the two legs 60a, 61a is at its lower extremity provided with a pin 70a, 71a which protrudes beyond the underside of the housing and is slightly beveled on one side.

As can be recognized particularly in Fig. 15, the contact spring 17a is supported in the housing 1a, 1b in the axial direction by the crosspiece 62a of its leg 60a on the bottom of the groove-like recess 20a so that it can readily withstand the load acting in the axial direction when a conductor is clamped into the blade-clamping slit 15a. As shown in Fig. 10, the pins 70a, 71a of the contact springs are inserted into matching openings 72a of a circuit board 73a onto which the connection terminal arrangement with its housing 1a, 1b is placed. Also in this case, the circuit board 73 serves to provide electrical connection of the ballast unit indicated at 6a which, for example, can be configured as an electronic ballast unit and comprise a number of electrical components requiring proper connections for themselves. Individual slit blade insulation-piercing contacts of the connection means can be used optionally as conductor support points for further wiring of the entire light fixture.

The circuit board 73a is mounted on the mounting rail 5a of the ballast unit 6a and locked by means of at least one tab 7a provided on it, with the tab extending through a matching slit-like opening in the circuit board 73a and folded over it.



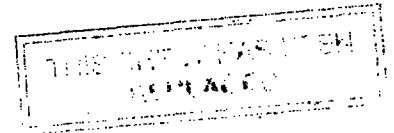
Claims:



1. An electrical connection terminal arrangement comprising a housing of insulating material, which has at least one insertion slit open at the edge on the side for inserting an electrical conductor and at least one insulation-piercing blade contact forming a contact zone inside the housing, with a blade-clamping slit open at the edge and aligned with the insertion slit for connection of a conductor, with the insulation-piercing blade contact provided on a contact spring, characterized in that the contact spring (17, 17a) bears, in addition, at least one plug-type contact (27, 28; 27a) and a contact (29, 70a, 71a) for connecting an apparatus.
2. The connection terminal arrangement according to Claim 1, characterized in that the plug-type contact (27, 28; 27a) and/or the apparatus connection contact (29, 70a) are formed on a flat part comprising the blade-clamping slit (15, 15a) of the contact spring (17, 17a).
3. The connection terminal arrangement according to Claim 1 or 2, characterized in that the plug-type contact (27, 28; 27a) is provided with detachable conductor connection means.
4. The connection terminal arrangement according to any one of the preceding claims, characterized in that the apparatus connection contact (29, 70, 71a) is arranged for non-detachable connection of a connection member of the apparatus (6, 6a).
5. The connection terminal arrangement according to any one of the preceding claims, characterized in that the plug-type contact (27, 28, 27a) is formed by cut tabs which spread apart when the connection member is inserted in the contact spring (17, 17a), with which tabs a release region, accessible by a release tool from the outside of the apparatus cooperates, if necessary, and that in that case the tabs are configured to be elastically deformable by a pressure force acting on the contact spring for release in the release region.
6. The connection terminal arrangement according to any one of the preceding claims, characterized in that the contact spring (17) is a leaf spring.

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7. The connection terminal arrangement according to any one of the preceding claims, characterized in that the contact spring (17, 17a) is folded back 180° near the slit blade insulation-piercing slit (15, 15a).

8. The connection terminal arrangement according to Claim 2, characterized in that the housing has at least two chambers (24, 25) arranged one above the other, which are traversed by the contact spring (17), one of the chambers enclosing the plug-type contact (27, 28) and the other chamber enclosing the apparatus connection terminal (29), and that both chambers (24, 25) are provided with respective openings for connection members (50, 52).

9. The connection terminal arrangement according to Claim 8, characterized in that the two chambers (24, 25) are arranged under the housing portion holding the slit blade insulation-piercing contact.

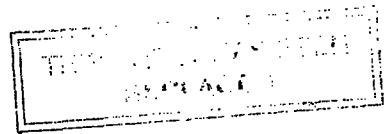
10. The connection terminal arrangement according to Claim 9, characterized in that the contact spring (17, 17a) is supported in the housing (1; 1a, 1b) to counter a force acting on the slit blade insulation-piercing slit (15, 15a) in the longitudinal direction of the contact spring.

11. The connection terminal arrangement according to any one of the preceding claims, characterized in that the contact spring (17, 17a) is supported at the plug-type contact (27, 28; 27a) against the direction of the force applied through a release tool.

12. The connection terminal arrangement according to Claims 8 and 11, characterized in that the support is provided at locally defined support spots (40) on the walls of the chamber (25).

13. The connection terminal arrangement according to any one of the preceding claims, characterized in that the plug-type contact (27, 28; 27a) and an apparatus connection contact configured as a plug-type contact are provided on facing housing sides and have opposite directions of insertion of the connection members (52, 50).





14. The connection terminal arrangement according to any one of the preceding claims, characterized in that lateral guide means are provided along the entire two sides for the contact spring (17, 17a) within the housing portion enclosing the slit blade insulation-piercing slit (15, 15a) and in at least one chamber (24, 24a) arranged underneath.
15. The connection terminal arrangement according to any one of the preceding claims, characterized in that a transverse opening (3) is provided on the housing (1) for accommodating fastening means (7) on the side of an apparatus.
16. The connection terminal arrangement according to any one of the preceding claims, characterized in that a chamber (25) of the housing (1) enclosing a connection to the apparatus is configured as a plug-type contact (29) and is provided with a matching insertion funnel (43) for the connection member (50).
17. The connection terminal arrangement according to any one of the preceding claims, characterized in that in the housing part accommodating the insulation-piercing blade contact (15, 15a) near the insertion slit (11, 11a) there is provided a groove-like recess (20, 21; 20a, 21a) on at least one side, its length, depth and width being dimensioned so that an enclosed connection wire is accommodated in an electric-shock protected manner.
18. The connection terminal arrangement according to any one of the preceding claims, characterized in that the apparatus connection terminal has at least one pin (70a, 71a) protruding from the housing (1a, b).
19. The connection terminal arrangement according to connection [sic!] 18, characterized in that the pin (70a, 71a) is notched at the contact spring (17a).
20. The connection terminal arrangement according to Claim 19, characterized in that the contact spring (17a) has substantially the form of a U, with a double-walled segment (63a) extending from the base (22a) of the U-shaped part and comprising the insulation-piercing blade contact (15a), and that the pins are notched at the two legs (60a, 61a).

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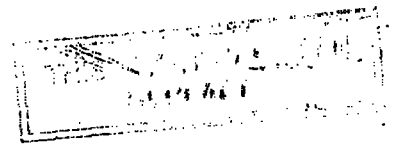
* C L M S *

21. The connection terminal arrangement according to Claim 20, characterized in that the plug-type contact (27a) is provided on one leg (60a).
22. The connection terminal arrangement according to any one of the preceding claims, combined with a ballast unit or a transformer having a cap of insulating material covering the winding, with pin-like connection members for wires of the winding arranged on the front face, characterized in that the connection terminal arrangement is plugged with its apparatus connection terminal (29) directly on the respective connection member (50) and is non-releasable latched with the same.
23. The connection terminal arrangement according to Claim 22, characterized in that cooperating guide and/or retention elements (45, 46; 51) are provided on the cover cap (44) and the housing (1a, b) of the connection terminal arrangement.
24. The connection terminal arrangement according to any one of Claims 18 through 21, combined with a ballast unit or a transformer, characterized in that a circuit board (73a) of insulating material is connected to the ballast unit system (6a) or transformer and has openings (72) for receiving the pins (70a, 71a) which are connected or contacted with connection parts of the ballast unit or the transformer.

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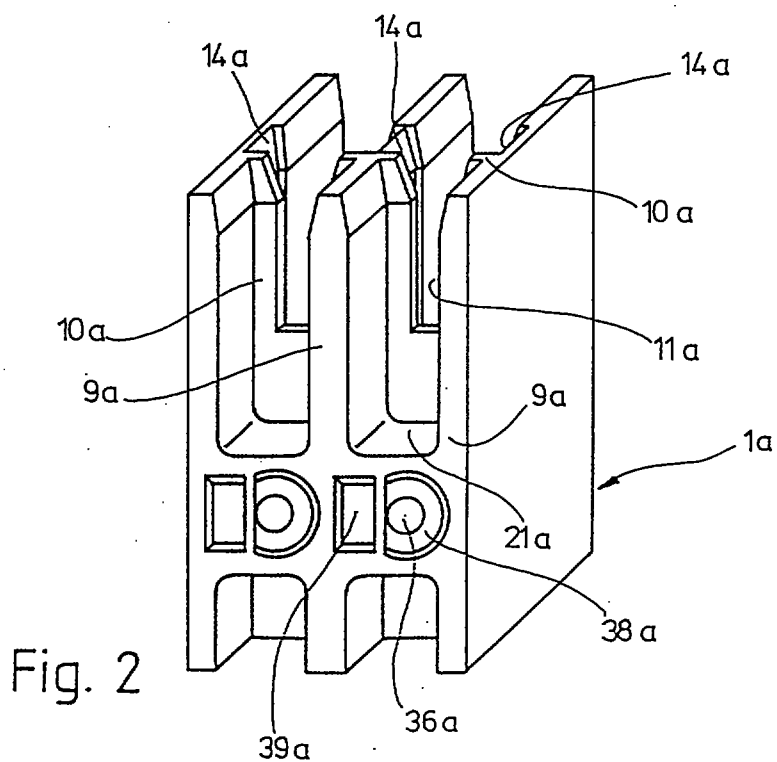
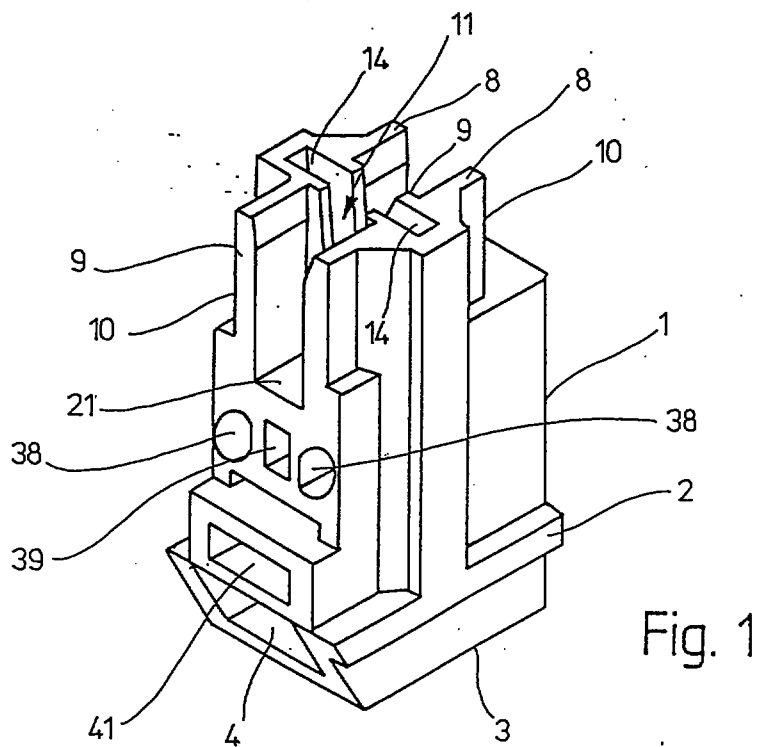
Abstract



An electrical connection terminal arrangement has a housing of insulating material in which at least one insulation-piercing blade contact is arranged, the contact being provided on a contact spring. The contact spring is additionally provided with at least one plug-type contact and one apparatus connection contact.

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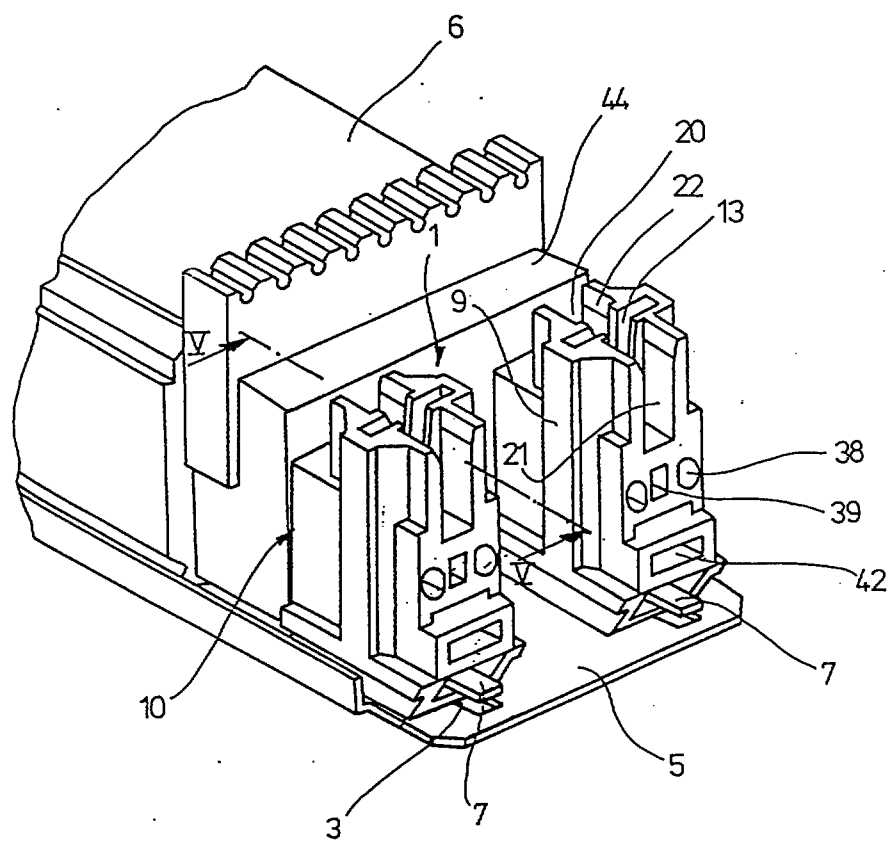


Fig. 3

Fig. 4

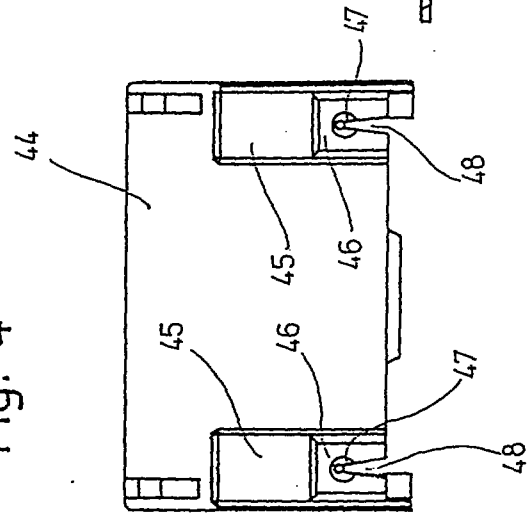


Fig. 5

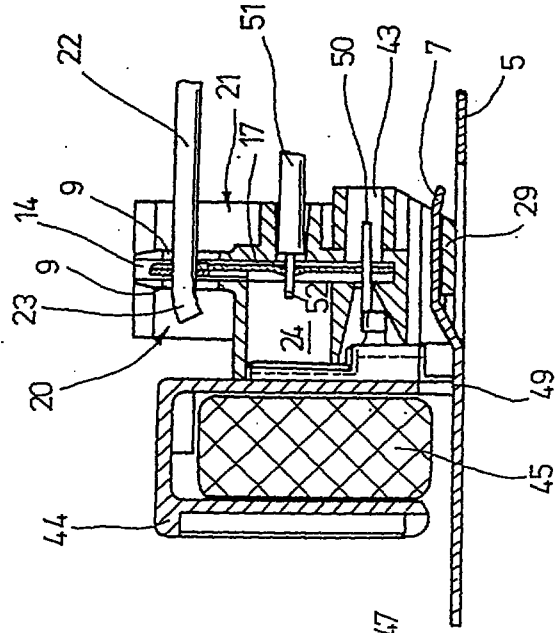


Fig. 6

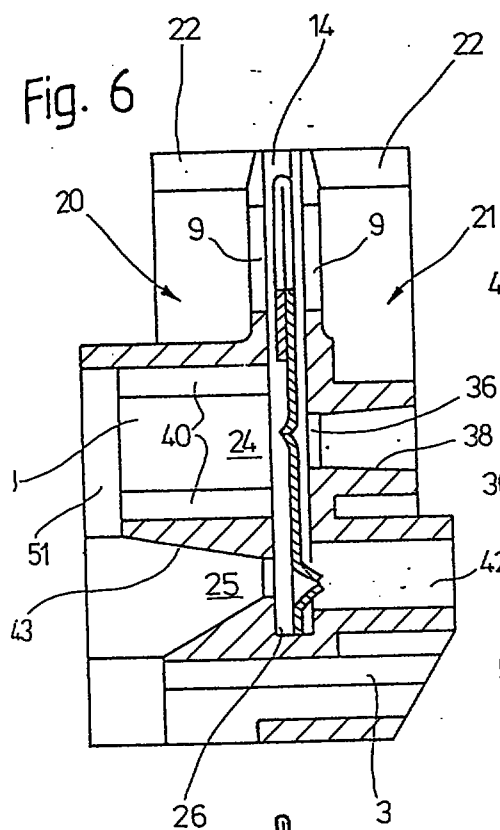


Fig. 7

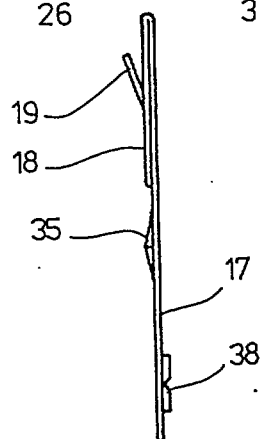
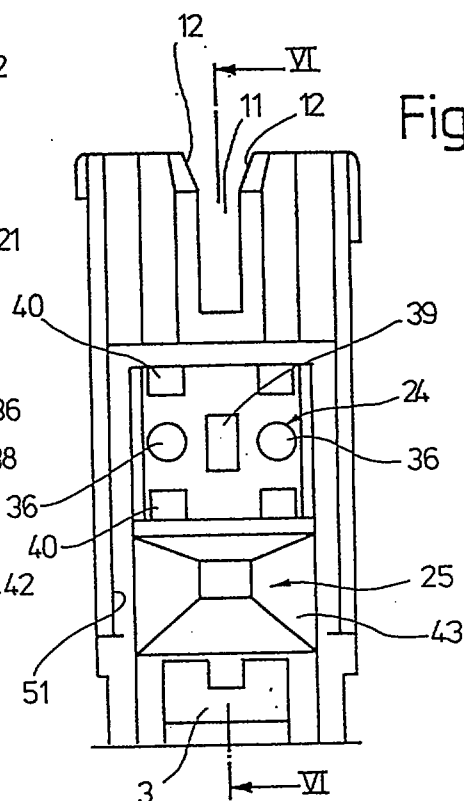


Fig. 9

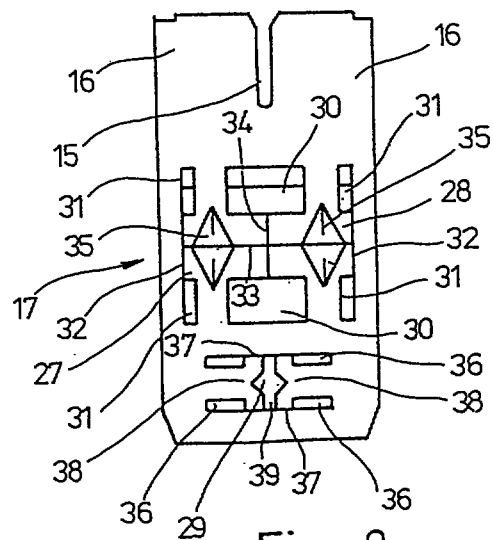


Fig. 8

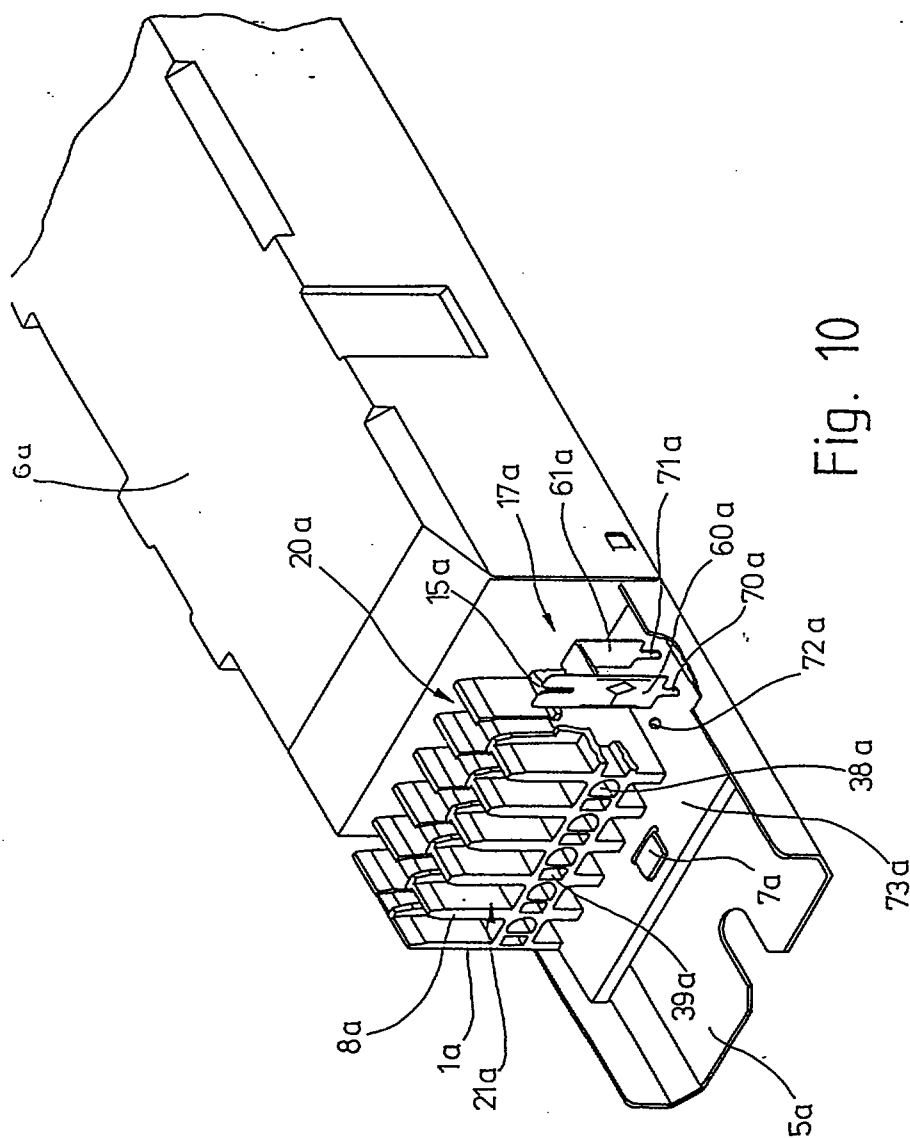


Fig. 10

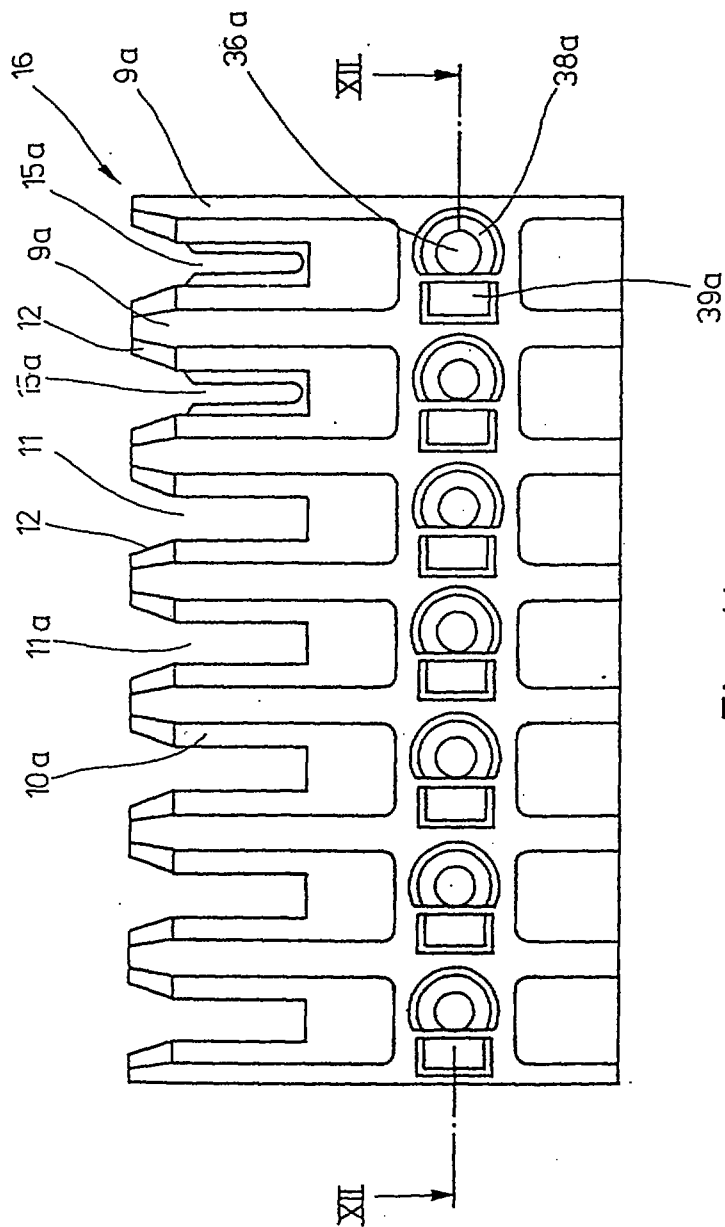


Fig. 11

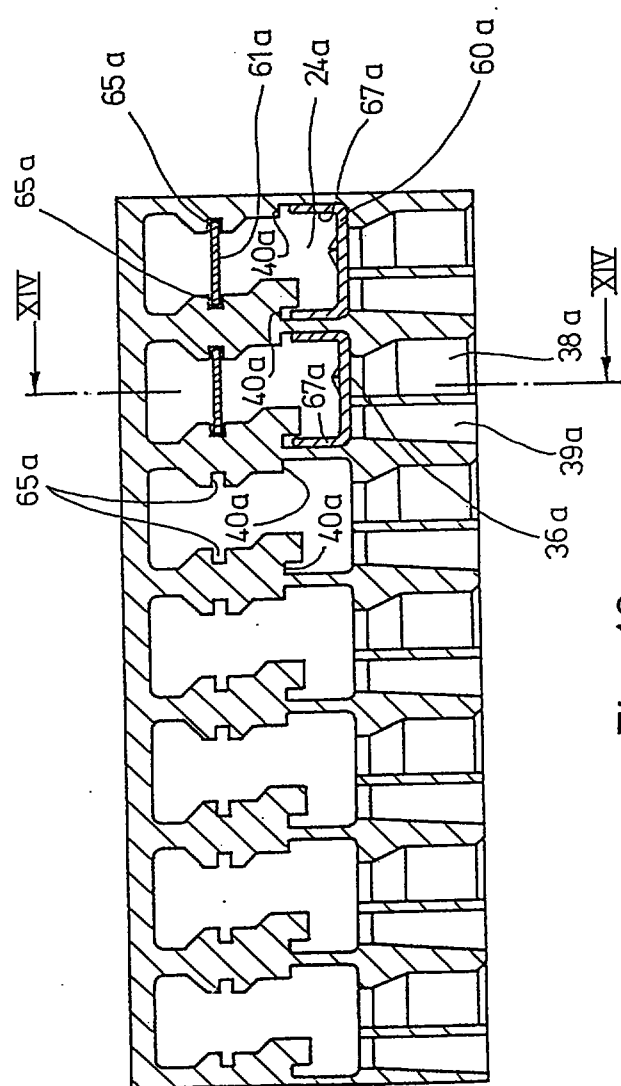


Fig. 12

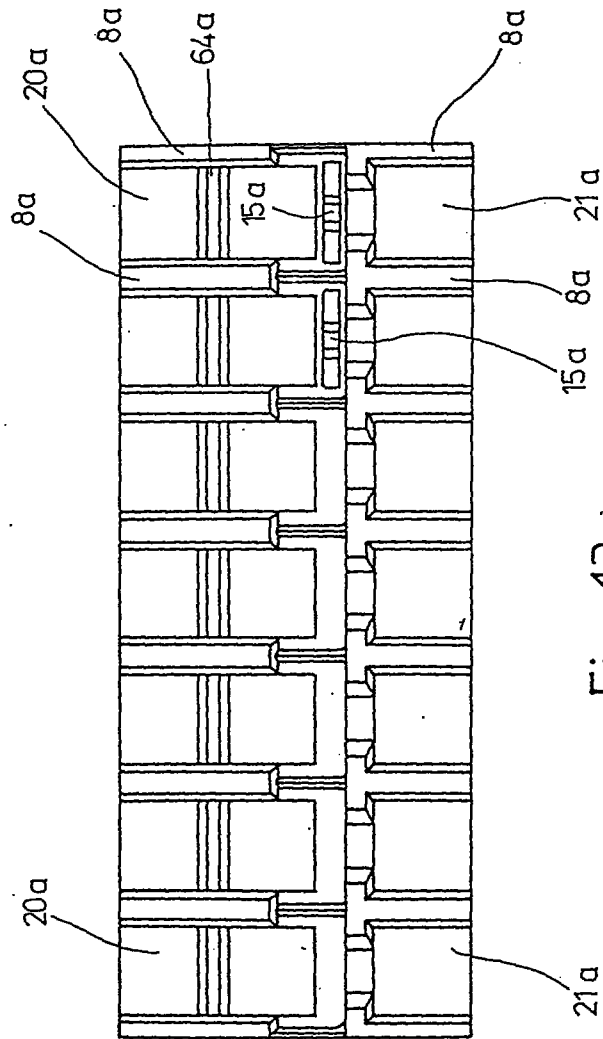
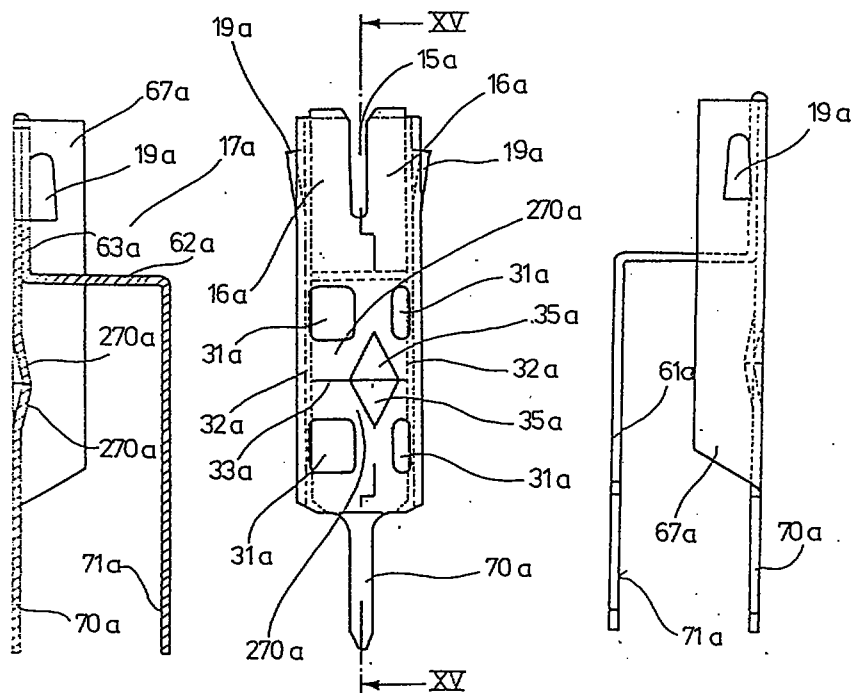
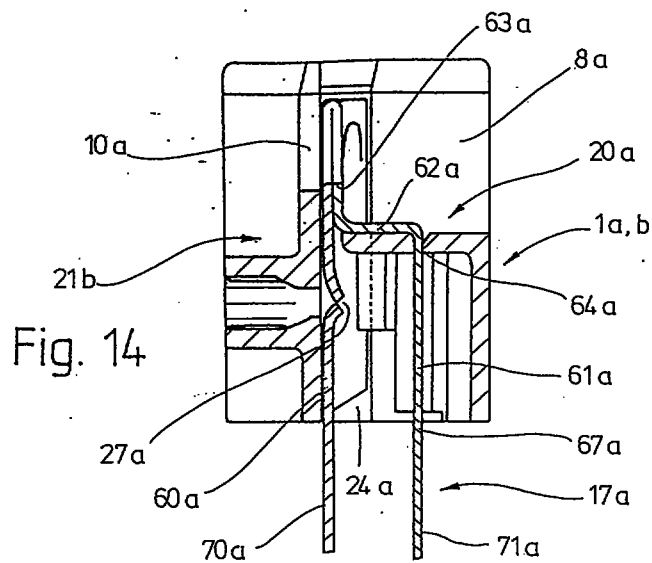
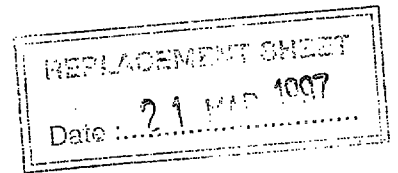


Fig. 13





ELECTRICAL CONNECTION TERMINAL ARRANGEMENT

ABSTRACT

The device has an insulating housing (1). This has an inlet slot (11) for an electric lead and at least one cut clamp contact in the housing (1), forming a contact zone. This has a clamp slit (15) aligned with the inlet slot (11) for a lead terminal. The clamp contact is formed on a contact spring. The spring (17, 17a) also has at least one plug contact (27,28,27a) and a contact (29,70a,71a) for a advice connector.

Fig. 1

According to the invention there is provided an electrical connection terminal arrangement having a housing of insulating material, which has at least one insertion slit, open at an edge toward one insertion side for an electric wire and at least one slit-blade insulation-piercing connector located in the housing,

said slit-blade insulation-piercing connector having two connector legs and a slit-blade insulation-piercing slit open at the edge and aimed at the insertion slit for an electric wire connection formed between said connector legs, at least portions of said legs adjacent said insulation-piercing slit forming a contact zone,

wherein the slit-blade insulation-piercing connector is formed on a contact spring, wherein

the contact spring additionally has at least one plug-in contact;

a contact for an accessory apparatus connection; and

a groove-like indentation formed on at least one side in a portion of the housing receiving the slit-blade insulation-piercing connector adjoining the insertion slit, which is deeper and wider than said insulation-piercing slit, and positioned closely adjacent said insulation-piercing connector,

the length, depth and width of said indentation being dimensioned such that a cut end of the electric wire placed therein is received within the indentation in an electrical shock-hazard proof manner;

wherein the housing is formed with at least one chamber located beneath the groove-like indentation and having at least one access opening at a face of the housing;

wherein at least one of the plug-in contacts and the accessory apparatus connection contact is located in said at least one chamber below the slit-blade insulation-piercing connector and the slit-blade insulation-piercing slit thereof; and

wherein the plug-in contact and the apparatus connection contact are formed with opposed insertion directions of the connection parts and said access openings are located on opposite sides of the housing.

The contact plug conveniently has a disconnectable conductor connection so that a contacting connection line, for, say, some additional operational means, such as a capacitor in the wiring of light fixtures, can be optionally disconnected. On the other hand, it is often advantageous to configure the contact for connecting an apparatus to enable nondetachable connection of connection means of the apparatus so that the connection means can no longer be removed from the apparatus by the user. The connection means to the apparatus can be advantageously a contact plug, although it is possible to configure it in some other way, e.g., as soldering pin or socket pin.

As a rule, the contact plug is formed by cut-out tabs in the contact spring which spread apart when the part to be connected is mounted; these tabs latch into the part to be

connected and clamp it securely to the contact spring while producing a highly conductive electrical contact.

By appropriately configuring the parting lines and shaping the tabs accordingly, the plug connection can be made either disconnectable or nondisconnectable. If it is to be disconnectable, an unlatching region which is accessible from the outside with a release tool is associated with it on the contact spring, with the tabs configured to be elastically deformable for release by a pressure force acting upon the contact spring in the unlatching region. As a rule, a screwdriver is used as a release tool, as usual.

A particularly simple design is obtained if the contact spring is a leaf spring. The contact spring may be bent by 180° near the slit for the insulation-piercing blade to improve making contact with the conductor to be connected (in this context, see OS 2 330 159).

In a convenient embodiment, the housing which accommodates the contact spring comprises at least two superposed chambers which are traversed by the contact spring and one of which houses the contact plug while the other houses the apparatus connection contact, with leads for parts to be connected being associated with the chambers, and, if needed, support and guide means for the contact spring being provided, too. For reasons of space, it is usually convenient to arrange the two chambers underneath the housing portion which

CLAIMS

1. An electrical connection terminal arrangement having a housing of insulating material, which has at least one insertion slit, open at an edge toward one insertion side for an electric wire and at least one slit-blade insulation-piercing connector located in the housing,

said slit-blade insulation-piercing connector having two connector legs and a slit-blade insulation-piercing slit open at the edge and aimed at the insertion slit for an electric wire connection formed between said connector legs, at least portions of said legs adjacent said insulation-piercing slit forming a contact zone,

wherein the slit-blade insulation-piercing connector is formed on a contact spring, wherein

the contact spring additionally has at least one plug-in contact;

a contact for an accessory apparatus connection; and

a groove-like indentation formed on at least one side in a portion of the housing receiving the slit-blade insulation-piercing connector adjoining the insertion slit, which is deeper and wider than said insulation-piercing slit, and positioned closely adjacent said insulation-piercing connector,

the length, depth and width of said indentation being dimensioned such that a cut end of the electric wire placed therein is received within the indentation in an electrical shock-hazard proof manner;

wherein the housing is formed with at least one chamber located beneath the groove-like indentation and having at least one access opening at a face of the housing;

wherein at least one of the plug-in contacts and the accessory apparatus connection contact is located in said at least one chamber below the slit-blade insulation-piercing connector and the slit-blade insulation-piercing slit thereof; and

wherein the plug-in contact and the apparatus connection contact are formed with opposed insertion directions of the connection parts and said access openings are located on opposite sides of the housing.

2. The connection terminal arrangement of claim 1, characterized in that

at least one of the plug-in contacts is formed with a disconnectable conductor connection.

3. The connection terminal arrangement of claim 1, characterized in that

the plug-in contact for the apparatus connection is arranged for non-disconnectable connection of a connection part of the accessory apparatus.

4. The connection terminal arrangement of claim 1, characterized in that

the contact spring is a flat spring.



5. The connection terminal arrangement of claim 1, characterized in that the contact spring is folded over by 180° ; in region of the slit blade insulation-piercing slit.
6. The connection terminal arrangement of claim 1, characterized in that the contact spring is supported in the housing counter to a force acting on the slit blade insulation-piercing slit longitudinally of the contact spring.
7. The connection terminal arrangement of claim 1, characterized in that lateral guide means, which are continuous on both sides, for the contact springs containing the slit-blade insulation-piercing slit are formed in the housing part and in at least one chamber located beneath it.
8. The connection terminal arrangement of claim 1, characterized in that a transversely extending opening is formed on the housing for receiving an attachment element, optionally tab, for attaching said arrangement on a support.
9. The connection terminal arrangement of claim 1, wherein the connector legs of the contact spring, except for the contact zone, are received and embedded, in an electrical shock-hazard proof manner, in grooves formed in the housing.
10. The connection terminal arrangement of claim 1, characterized in that at least one of the plug-in contacts and the apparatus connection contact are formed on a flat part of the contact spring.
11. The connection terminal arrangement of claim 10, characterized in that the housing has at least two chambers, located one above another, which are traversed by the contact spring and of which one chamber includes the plug-in contact and the other chamber includes the apparatus connection contact, and that both chambers are formed with associated lead-ins for connection parts.
12. The connection terminal arrangement of claim 11, characterized in that the two chambers are located below the groove-like indentations of the housing.
13. The connection terminal arrangement of claim 11, characterized in that a support is provided at locally defined support points on walls of a chamber.
14. The connection terminal arrangement of claim 1, characterized in that the at least one of the plug-in contacts is formed by cut-out tabs, which spread apart when a connection part is inserted in the contact spring, said tabs being accessible to a disconnecting tool from an outside of the housing, and in that the tabs are formed to be elastically deformable in a disconnection direction by a pressure force acting in an unlocking direction.
15. The connection terminal arrangement of claim 14, characterized in that



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the contact spring is supported in the region of the plug contact counter to the direction of a force exerted by a disconnection tool.

16. The connection terminal arrangement of claim 1, in combination with
an accessory circuit system or a transformer, which has a cap of insulating material covering the system or the transformer and on which pinlike connection parts for winding wires are located on a face end,

characterized in that

the connection terminal arrangement is mounted with its apparatus connection contact directly onto the respective connection parts and is nondisconnectably locked to the accessory system or the transformer.

17. The connection terminal arrangement of claim 16, characterized in that

at least one cooperating guide element and retention element is formed on a covering cap and the housing of the connection terminal arrangement.

