

CLAMPING DEVICE FOR CONNECTING A CONDUCTOR WITHOUT
STRIPPING THE INSULATION

TECHNICAL FIELD

The invention relates to a clamping device for connecting an electrical conductor without stripping the insulation.

PRIOR ART

The invention relates to a clamping device as is described in the document DE 199 56 750 A1. The known clamping device has a housing and an actuating part which can be moved between a receiving position and a contact position, which actuating part has a duct for receiving the conductor to be clamped. There is also provided a blade contact consisting of a rear web and two spring legs which are angled thereon on the longitudinal side and are located at a distance from one another. These spring legs comprise end sections which are bent towards one another, which adjoin one another along a slot and which have contacting blades on their front edges extending into one another towards the slot. When the actuating part is transferred into the contact position, the contacting blades penetrate into the duct of the actuating part and contact the conductor accommodated therein whilst cutting through its insulation. A second contact piece is provided for guiding the current path from the blade contact out of the housing, which is electrically connected to the blade contact. In the known design the separate contact piece is designed as a separately fabricated contact pin which is joined together with the blade contact to form a one-piece component. The fabrication of this

component is expensive because the pin contact must be fastened to the rear web of the blade contact by means of soldering, welding, riveting or pressing techniques. Such joined contact points also give rise to concerns that the security of the contact will be impaired by corrosive, thermal or mechanical influences.

A clamping device in similar design is also known from the utility model specification DE 203 12 123 U1. The actuating part of this clamp is pivotally mounted between the receiving position and the contact position in the clamping housing, the insulated conductor accommodated in the duct of the actuating part being inserted between the contact blades of the blade contact when the actuating part pivots into the contact position. The current path inside the clamp is continued via a power rail which is joined to the rear web of the blade contact in an electrically contacting manner.

A clamping device of the previously specified type is further deduced from the document DB 2 129 630A. Here, cut-and-clamp contacts, each configured as flat blades which are interconnected via a web, are provided for cooperation with two different, movably mounted, actuating parts. Said cut-and-clamp contacts protrude from this web in the same direction whilst a further contact is angled in the opposition direction from this web.

The document US 2004/0029431 A1 discloses a clamping device in a different design having one-piece contact parts which are provided with blade contacts offset by 90° with respect to one another at their one ends and plug contacts at their second ends.

THE INVENTION

The object of the invention is to provide a clamping device for connecting without stripping the insulation in which the blade contact and the second contact leading from the clamp can be contacted particularly securely and can be fabricated rationally in a stable design.

This object is achieved by a clamping device having the features of claim 1.

It is important for the invention that the blade contact and the second contact leading out from the clamping device are monolithic with one another, since they are formed on one contact element which has a common rear web for both contacts. The metal contact element consists of a flat sheet-metal stamped part according to the first fabrication step with spring legs and spring arms adjoining the rear web, which are cut freely from one another. In subsequent fabrication steps the contact blades are formed on the spring legs and the socket shape on the spring arms and the spring legs and arms are bent into their position angled from the rear web.

Advantageous embodiment features of the invention are deduced from the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is explained in further detail hereinafter for a single exemplary embodiment with reference to the drawings. In the figures:

- Fig. 1 is a perspective, partly exploded view of a clamping arrangement consisting of a plurality of clamping devices,
- Fig. 2 is a perspective reproduction of the contact element forming the current path of each of the clamping devices according to Fig. 1,
- Fig. 3 is a side view of one of the clamping devices,
- Fig. 4 is a side view of the contact element of the clamping devices and of the actuating part cooperating therewith in the receiving position and
- Fig. 5 is a view corresponding to Fig. 4 with the actuating part located in the contact position.

METHOD FOR IMPLEMENTING THE INVENTION

Figure 1 shows in detail the clamping arrangement 10 formed from a number of like modules 12. Each of the modules 12 by itself constitutes a clamping device having a housing 14. The inner region of the housing 14 comprises a specially configured interior 16 which is open on one side of the housing 14, whereby an opening 16.1 is formed in the relevant housing side wall 16.2 by means of a contoured recess. The special shape of the housing opening 16.1 and the interior 16 serve to accommodate a contact element 18 which is described in further detail hereinafter with reference to Fig. 2.

Locking pins 20 protrude laterally on the housing 14 consisting of an insulating material. These locking pins 20 are located on that side of the housing 14 on which the

housing opening 16.1 is provided. On the opposite side not shown, the housing 14 is closed and located on this side are locking openings in a corresponding arrangement to the locking pins 20. Two or more of the modules 12 can accordingly be joined together and locked and thus the clamping arrangement 10 can be formed by arranging the modules 12 in a row. In this case, the closed side wall of the housing 14 of each module 12 covers the housing opening 16.1 of the adjacent module 12. For the module arranged at the end of the row, the housing opening 16 on the housing 14 whereof is not closed by a neighbouring module, a cover part 19 is provided so that the housing opening 16.1 can be closed here.

An actuating part 22 is pivotally mounted inside the housing 14 of each module 12 or each clamping device. The actuating part 22 serves to accommodate the electrical conductor to be contacted. During the insertion of the conductor said actuating part is located in its one end pivot position in the receiving position and can be transferred from there into its second end pivot position, the contact position, by means of corresponding actuation. In this case, the actuating part 22 is turned by means of axial pins 24 in bearing openings located in the upper regions of the housing side walls 16.2. For accommodating the contacting conductor 50 (Fig. 4) the actuating part 22 is provided with a duct 26 having an insertion opening located on the upper side of the module 12. A plug-in opening 28 for an actuating tool is further formed in the actuating part 22 and is likewise accessible from the upper side of the module 12. A pusher surface 30 is furthermore located on the upper side of the actuating part 22.

As is illustrated in Fig. 2, the contact element 18 is a component formed in one piece, which is freely stamped from a metal sheet such as a steel sheet and acquires its final shape by forming, i.e. bending. The contact element 18

consists of a blade contact 18.1 and a second contact piece 18.2. The central connecting piece of the blade contact 18.1 and the second contact piece 18.2 is a rear web 32 having a section 32.1 which is lengthened over the region of the blade contact 18.1 and is allocated to the second contact 18.2. In the area of the blade contact 18.1, upwardly bent spring legs 36 adjoin the longitudinal sides of the rear web 32, their cross-section tapering away from the rear web 32. In particular, the thickness of the spring legs 36 decreases. In the area of the upper edges of the spring legs 36, contacting blades 48 are formed, extending along the front edges of end sections 44 on the spring legs 36, these end sections 44 being bent from the spring legs 36 towards one another and adjoining one another along a slot 42. At the transition point 38 between the rear web 32 and the adjoining web section 32.1, the rear web 32 is angled upwards somewhat with respect to the said section 32.1 in order to bring the spring legs 36 with their contacting blades 48 into a favourable position for contacting the relevant conductor 50. The contacting blades 48 are located on that front side of the blade contact 18.1 that lies towards the web section 32.1.

From the longitudinal sides of the web section 32.1, spring arms 34 are angled in the opposite direction to the spring legs 36 of the blade contact 18.1, i.e. downwards, converging with one another in the direction away from the web section 32.1 and being formed into a contact tube or tulip contact at their free ends. The cross-section of the spring arms 34 also tapers in the direction away from the web section 32.1, in particular they decrease in thickness in this direction. The contact tube or tulip contact 40 formed by the spring arms 34 is used for contact with a contact pin 41 (Fig. 3) located on a base element such as a printed circuit board.

The spring arms 34 of the second contact 18.2 can be angled other than in the embodiment shown from the rear web 32 or its web section 32.1 in the same direction as the spring legs 36 of the blade contact 18.1. In this case, the spring arms 34 of the second contact 18.2 leave a distance from the spring legs 36 of the blade contact 18.1. In order that the conductor 50 to be contacted can be inserted into the contacting blades 48 of the spring legs 36 of the blade contact 18.1, in this embodiment the contacting blades 48 are arranged on those edges of the spring legs 36 of the blade contact 18.1 which lie away from the side of the blade contact 18.1 adjacent to the second contact 18.2.

The spring legs 36 of the blade contact 18.1 are designed to be stronger than the spring arms 34 of the second contact piece 18.2. Thus, when viewed in the longitudinal direction of the rear web 32, the spring legs 36 extend over a greater length than the spring arms 34 of the second contact piece 18.2. In the area of the slot 42 the end sections 44 bent towards one another on the spring legs 36 can be separated from one another. However, the spring legs 36 of the blade contact 18.1 can be so biased that they abut against one another with their end sections 44 in the area of the slot 42 under spring tension which serves to increase the contact pressure against a clamped conductor. In the area of their end sections 44 the contacting blades 48 at the front edges of the spring legs 36 are concavely shaped and extend as far as the slot 42.

As can be seen from Figures 1 and 3, the housing 14 of the module 12 has a box-shaped upper part 14.1 and is adjoined at the bottom by a hollow base part 46 of the housing 14. The interior 16 in the housing and the opening 16.1 in the relevant side wall 16.2 of the housing 14 extend from the housing upper part 14.1 into the housing base part 46. Thus, in the mounting position the contact element 18 with the spring legs 36 of its blade contact 18.1 and with the

spring arms 34 of its second contact piece 18.2 is fitted into the interior 16 of the housing 14, whereby the blade contact 18.1 is accommodated in the housing upper part 14.1 and the second contact 18.2 is accommodated in the housing base part 46. In this case, the blade contact 18.1 is located underneath the actuating part 22 formed as a pusher. The cover part 19 is thereby adapted to the particular contour of the opening 16.1 so that a continuation 19.1 is formed thereon in the underside which covers the area of the opening 16.1 located on the base part 46.

The contacting of the conductor 50 to be clamped whilst separating the conductor insulation can be seen from the diagrams in Fig. 4 and Fig. 5. Figure 4 shows one of the modules 12 or the clamping devices in the conductor insertion position. The actuating part 22 is hereby turned upwards in the anticlockwise direction so that the pusher surface 30 is located above the housing 14. The conductor 50 is inserted into the receiving duct 26 of the actuating part 22 until its end abuts against a stop 52. The conductor 50 can have a solid core or a twisted metal core of individual wires. After inserting the conductor 50 into the duct 26 of the actuating part 22, an elongated tool is inserted into its plug-in opening 28 and/or the pusher surface 30 is acted upon and thereby turns the actuating part 22 from its conductor receiving position clockwise into its contact position shown in Fig. 5. In the contact position of the actuating part 22 its pusher surface 30 lies flush with the upper side of the housing 14.

Whilst the actuating part 22 with the conductor inserted therein is pivoted into the contact position, the conductor comes in contact with the contacting blades 48 of the blade contact 18.1. The contacting blades 48 cut through the insulation of the conductor 50 to expose the conductor core 51. Whilst the conductor core 51 is forced into the slot 42

between the end sections 44 of the spring legs 36, the spring legs 36 are expanded outwards away from one another and as a result of the spring tension a reliable electrical contact is made between the blade contact 18.1 and the conductor core 51.

In order to unclamp the conductor 50 from the module 12, a suitably elongated tool is again inserted in the plug-in opening 28 of the actuating part 22 and pivots the actuating part 22 from the contact position anticlockwise into the conductor receiving position whereby the conductor 50 comes free from the spring legs 36 of the blade contact 18.1. The conductor 50 can then be withdrawn from the conductor receiving duct 26 of the actuating part 22.

The pivotable pusher part 22 has a locking element 54. During the pivoting of the pusher part 22 between the conductor receiving position and the contact position, the locking element 54 slides in a slot 56 in one of the housing side walls 16.2, where it engages in each of the end pivot positions in a circularly expanded end of the slot 56.

When using the clamping arrangement 10 as a plug element, the conductors 50 are initially clamped on the individual modules 12 and then the clamping arrangement 10 is positioned on a corresponding number of contact pins 41 located on the relevant base component of the respective circuit. These pins 41 are then electrically connected via the contact elements 18 to the conductors 50 connected to the modules 12 or their conductor cores 51.

CLAIMS

1. A clamping device for connecting an electrical conductor (50) without stripping the insulation, comprising a housing (14) and an actuating part (22) which is movably mounted between a receiving position and a contact position, comprising a duct (26) accommodating the conductor (50) that is to be clamped, further comprising a blade contact (18.1) consisting of a rear web (32) and two spring legs (36) which are angled thereon on the longitudinal side and are located at a distance from one another, which are provided with end sections (44) which are bent towards one another and adjoin one another along a slot (42) and said spring legs (36) are provided with contacting blades (48) on their front edges which extend towards the slot (42), which contacting blades (48) penetrate into said duct (26) and contact the conductor (50) accommodated therein whilst cutting the insulation thereof when the actuating part (22) is transferred into the contacting position thereof, and comprising a second contact piece (18.2) for continuing the current path from the blade contact (18.1) out from the housing (14), which is electrically connected to the blade contact (18.1), wherein the blade contact (18.1) and the second contact piece (18.2) are configured as a monolithic contact element (18) and wherein the rear web (32) of the blade contact (18.1) has a section (32.1) which is lengthened over the connecting regions of the spring legs (36) from the longitudinal sides whereof spring arms (34) are bent and with their ends are jointly formed into a contact tube or tulip contact (40)

2. The clamping device according to claim 1, characterised in that when viewed in the longitudinal direction of the rear web (32), the spring legs (36) of the blade contact (18.1) are broader than the spring arms (34) of the second contact piece (18.2) and their cross-section tapers from the rear web (32) towards the contacting blades (48).
3. The clamping device according to claim 1 or 2, characterised in that the spring arms (34) of the second contact piece (18.2) have a cross-section which tapers from the rear web (32) to the contact tube or tulip contact (40).
4. The clamping device according to any one of claims 1-3, characterised in that the spring arms (34) of the second contact piece (18.2) are angled in the opposite direction to the spring legs (36) of the blade contact (18.1).
5. The clamping device according to claim 4, characterised in that the contacting blades (48) are located at those edges of the spring legs (36) of the blade contact (18.1) which lie to the side of the web section (32.1) and the second contact (18.2) formed thereon.
6. The clamping device according to claim 5, characterised in that the rear web (32) and the web section (32.1) of the contact element (18) are at an obtuse angle to one another.
7. The clamping device according to any one of claims 1-6, characterised in that the spring arms (34) of the second contact piece (18.2) are angled in the same direction as the spring legs (36) of the

blade contact (18.1) from the rear web (32), wherein the contacting blades (48) are located at those edges of the spring legs (36) of the blade contact (18.1) which lie away from the side of the blade contact (18.1) adjacent to which the spring arms (34) of the second contact piece (18.2) are located.

8. The clamping device according to any one of claims 1-7, characterised in that the housing (14) for accommodating the contact element (18) has an interior (16) and an opening (16.1) in one of its side walls (16.2) wherein the interior (16) and the opening (16.1) are adapted to the outline contour of the contact element (18) running around the two ends of the rear web (32).
9. The clamping device according to claim 8, characterised in that the housing (14) has an upper part (14.1) having a flat box shape and the actuating part (22) mounted therein as well as accommodating the blade contact (18.1), wherein a hollow base part (46) adjoins the under side of the housing upper part (14.1), wherein the second contact part (18.2) is accommodated and accordingly the interior (16) and the opening (16.1) of the housing (14) extend from the housing upper part (14.1) into the base part (46).
10. The clamping device according to claim 8 or 9, characterised in that this is executed as a module (12) and accordingly its housing (14) has congruent side walls (16.2) for lining up two or a plurality of such modules (12), wherein in a lined-up arrangement the opening (16.1) of the relevant side wall (16.2) of one module (12) is at least partially covered by the side wall of the

neighbouring module (12) and a cover part (19) is provided for closing the opening (16.1) of the module (12) arranged at one end of the row, which cover part (19) has the outline shape of the housing upper part (14.1) and a continuation (19.1) which closes the opening region of the housing base part (46) is formed on its underside.