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(54) **CONNECTOR ARRANGEMENT WITH A CONDUCTOR PRESS-ON MEMBER**

(57) The invention relates to a connector arrangement (97) for receiving at least one insulated conductor (101), the connector arrangement (97) comprising at least one electric contact (1) with at least one insulation displacement arrangement (3) for cutting through the insulation (103) of the conductor (101) and for electrically contacting the same, and at least one conductor insertion space (17, 17') adjacent to the at least one insulation displacement arrangement (3). In order to provide a connector arrangement (97) which allows a reliable fixation of a conductor, it is intended according to the invention that at least one conductor press-on member (75) is provided, which, at least in an operating position (99), is fixed to the connector arrangement (97) and covers the at least one conductor insertion space (17, 17'), at least in part.

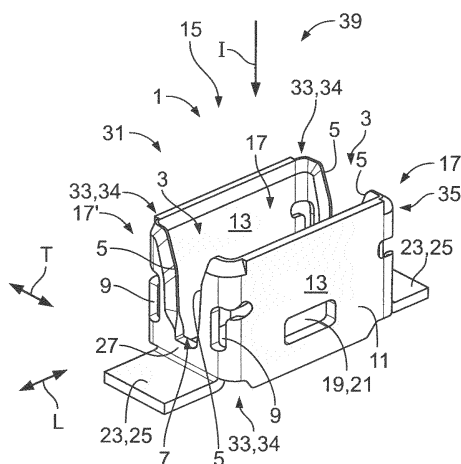


Fig. 1

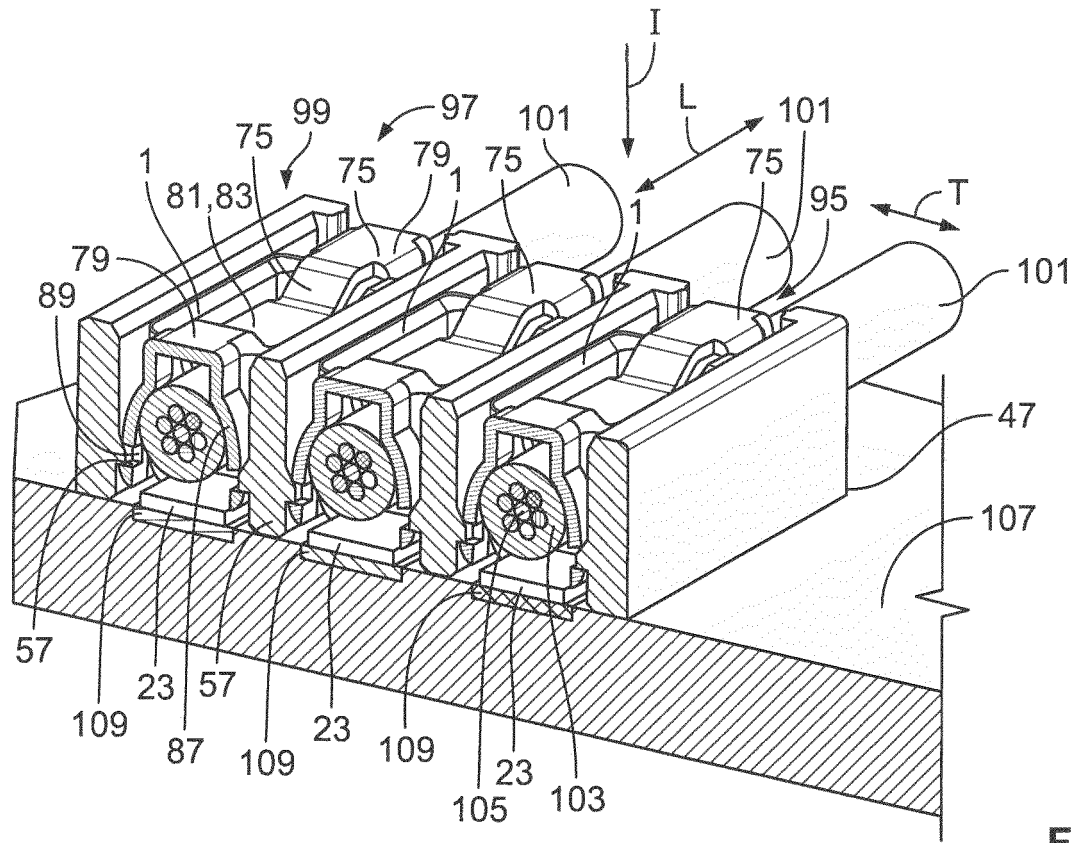


Fig. 8

Description

[0001] The invention relates to a connector arrangement for receiving at least one insulated conductor, the connector arrangement comprising at least one electric contact with at least one insulation displacement arrangement for cutting through the insulation of the conductor and for electrically contacting the same, and at least one conductor insertion space adjacent to the at least one insulation displacement arrangement.

[0002] Connector arrangements with insulation displacement arrangements are known in the prior art. Generally, the insulation displacement arrangement is open against a conductor insertion direction, along which a conductor can be inserted into the electric contact. Connector arrangements with electric contacts that comprise an insulation displacement arrangement can be used for easily connecting and contacting a conductor with the electric contact. However, the quality of the connection between the conductor and the electric contact may be negatively influenced when movement between these parts occurs or when external forces or vibrations are applied to the arrangement and/or to the conductor.

[0003] It is therefore an object of the invention to provide a connector arrangement as mentioned in the beginning, which allows a reliable mechanical and/or electrical connection between the at least one electric contact with at least one conductor.

[0004] This object is reached for the connector arrangement mentioned in the beginning in that at least one conductor press-on member is provided, which, at least in an operating position, is fixed to the connector arrangement and covers the at least one conductor insertion space.

[0005] The at least one conductor press-on member may therefore fixate a conductor when it is inserted in the conductor insertion space and keep it in position such that the conductor remains in the at least one insulation displacement arrangement.

[0006] In the following, further improvements of the invention are described. The additional improvements may be combined independently of each other, depending on whether a particular advantage of a particular improvement is needed in a specific application.

[0007] According to a first advantageous embodiment, the at least one insulation displacement arrangement may be formed monolithically with the at least one electric contact. This may provide a good electrical contact between the at least one insulation displacement arrangement and the remaining electric contact. Further, the electric contact may be quickly and cost efficiently produced, in particular by stamp-bending.

[0008] The at least one insulation displacement arrangement preferably comprises at least one cutting edge. More preferably, the at least one insulation displacement arrangement may comprise two cutting edges which are arranged opposite to each other such that a conductor can be received between both edges. The ma-

terial of the electric contact may be provided with an opening or a cutout which runs parallel to at least one cutting edge for providing elasticity of the insulation displacement arrangement in order to decrease an insertion force which is needed to insert a conductor.

[0009] The at least one electric contact may be provided with at least two insulation displacement arrangements which are spaced apart from each other in a longitudinal direction of the arrangement, the at least one conductor insertion space being arranged between the at least two insulation displacement arrangements. Such arrangement has several advantages. First, a conductor may be electrically contacted by at least two insulation displacement arrangements such that the quality of the electrical contact between the conductor and the electric contact is increased. Further, a force, for example a pulling force on the conductor is split between both insulation displacement arrangements such that each insulation displacement arrangement is exposed to a reduced force. Such electric contact may provide further conductor insertion spaces which are adjacent to both insulation displacement arrangements, but not in between them.

[0010] The above mentioned longitudinal direction of the arrangement preferably runs basically perpendicular to a conductor insertion direction. Further, the longitudinal direction of the arrangement is preferably parallel to or identical to a longitudinal direction of a conductor when such conductor is inserted in the electric contact. If such conductor is inserted in the electric contact, the conductor extends through at least one conductor insertion space.

[0011] In order to increase the stability of the electric contact, the electric contact may comprise a cage-like structure which is formed by at least two insulation displacement arrangements and at least two side walls connecting the at least two insulation displacement arrangements. The cage-like structure may in particular at least partially surround at least one conductor insertion space. The cage-like structure is preferably open against a conductor insertion direction. The cage-like structure may in other words be described as a box-shape having an overall rectangular or polygonal cross-section seen in a conductor insertion direction.

[0012] The at least one conductor press-on member may be formed monolithically with the at least one electric contact and may be plastically deformed at least in the operating position. This allows a simple design and a reduction of parts. Further, this allows the production of the electric contact and the at least one conductor press-on member during the same stamp-bending processes, if the at least one electric contact is formed as a stamp-bent part. The at least one conductor press-on member may be brought into the operating position by plastic deformation, wherein it clamps the conductor in the at least one conductor insertion space. In particular, the at least one conductor press-on member may be formed monolithically with at least one side wall. Preferably, the electric contact comprises two side walls, each with at least one conductor press-on member. The monolithically formed

conductor press-on members may for example have the shape of a finger extending from the side walls or a rectangular shape which extends along the longitudinal direction of the arrangement.

[0013] In order to achieve a good fixation of a conductor in the at least one conductor insertion space, the at least one conductor press-on member may extend beyond the at least one conductor insertion space in the longitudinal direction of the connector arrangement, at least in the operating position.

[0014] The at least one conductor press-on member may be formed as a separate part with at least one conductor fixation portion which extends into the conductor insertion space at least in the operating position. The at least one conductor press-on member which is formed as a separate part may be fixated to the remaining arrangement after a conductor has been inserted in the at least one conductor insertion space.

[0015] The at least one conductor press-on member, in particular a conductor press-on member which is formed as a separate part, may comprise at least one pair of legs which are spaced apart from each other and which extend into the at least one conductor insertion space in the operating position. Thereby, the legs of one pair are preferably spaced apart from each other in a transverse direction which runs perpendicular to the longitudinal direction and to the conductor insertion direction. Thereby, the two legs may grab and/or encompass a conductor which is arranged in the at least one conductor insertion space, for fixating the same.

[0016] In particular, the at least one conductor fixation portion may be provided with at least one pair of legs. The legs may be insertable between a conductor and at least a side wall of the electric contact.

[0017] In order to fixate the at least one conductor press-on member to the remaining arrangement, at least one leg of the at least one conductor press-on member may be provided with at least one latching member. The at least one latching member may in particular be adapted for latching the at least one conductor press-on member to the at least one electric contact and/or to a housing of the arrangement.

[0018] In a preferred embodiment, the at least one conductor press-on member may comprise at least three pairs of legs, wherein the pairs are spaced apart from each other in a longitudinal direction of the conductor press-on member. At least the outer pairs in the longitudinal direction may be provided with at least one latching member. Thereby, all legs may extend basically parallel with each other. Especially the outer pairs of legs may be used for fixating the at least one conductor press-on member to the remaining arrangement. The pair in the middle may in particular be used for pressing on a conductor which is arranged in the at least one conductor insertion space.

[0019] The at least one conductor press-on member may have a base that extends along the longitudinal direction of the conductor press-on member and connects

the three pairs of legs with each other, wherein the base has at least one region which is displaced with respect to neighboring regions in the direction in which at least one pair of legs extends. The offset region may be adapted for pressing on a conductor when it is received in the at least one conductor insertion space. In particular, at least one pair of legs may extend from said offset region. Preferably, the offset region is arranged between the two outer pairs of legs.

[0020] According to another advantageous improvement, the connector arrangement may further comprise at least one housing adapted for at least partially receiving the at least one electric contact in the operating position and the at least one electric contact may be formed as an insert for said housing. The housing may protect at least the at least one electric contact. Further, the housing may provide electrical insulation to an outside of the housing, at least partially.

[0021] The at least one housing and the at least one electric contact may each comprise at least one latching member, wherein the at least one latching member of the housing and the at least one latching member of the electric contact are complementary to each other for undetachably connecting the at least one housing and the at least one electric contact to each other at least in the operating position.

[0022] For example, the at least one latching member of the at least one housing may be formed as a latching lug and the at least one latching member of the at least one electric contact may be formed as an opening adapted for receiving the at least one latching lug. The at least one latching lug may in particular be shaped as a latching hook.

[0023] Alternatively, the at least one latching member of the at least one electric contact may be formed as a latching lug or a latching hook and the at least one latching member of the at least one housing may be formed as an opening adapted for receiving the latching member of the at least one electric contact.

[0024] The at least one housing may further comprise at least one complementary latching member for fixating the at least one conductor press-on member at least in the operating position.

[0025] The complementary latching members may further provide at least one pre-assembly position in which the at least one electric contact is not fully inserted in the at least one housing. This may help in pre-assembling the at least one housing with the at least one electric contact before connecting the at least one electric contact to other components, for example before the electric contact is soldered to a printed circuit board.

[0026] In order to provide at least one pre-assembly position, the at least one housing may comprise two openings which are spaced apart in the conductor insertion direction for providing two different positions for a complementary shaped latching lug or latching hook of the at least one electric contact.

[0027] The at least one electric contact may be provid-

ed with at least one soldering portion for soldering the electric contact to a printed circuit board and the at least one housing may comprise at least one inspection window providing an inspection channel which extends unobstructed from outside the housing to the at least one soldering portion at least in a pre-assembly position. This may help in controlling the electrical contact of the at least one soldering portion before a conductor is inserted into the at least one conductor insertion space. Thereby, a quality management is possible.

[0028] According to another advantageous improvement, the at least one conductor press-on member may comprise at least one latching member for latching the at least one conductor press-on member to the housing of the connector arrangement and/or to the at least one electric contact. As already mentioned, such latching member may in particular be provided on at least one leg of the conductor press-on member if the at least one conductor press-on member comprises such a leg.

[0029] In the following, the invention and its improvements are described in greater details using exemplary embodiments and with reference to the drawings. As described above, the various features shown in the embodiments may be used independently of each other in specific applications.

[0030] In the following figures, elements having the same function and/or the same structure will be referenced by the same reference signs.

[0031] In the drawings:

- Fig. 1 shows a first embodiment of the electric contact according to the invention in a perspective view;
- Fig. 2 shows the embodiment of Fig. 1 in another perspective view showing the bottom of the electric contact;
- Fig. 3 shows the embodiment of Fig. 1 in a front view;
- Fig. 4 shows a first embodiment of a housing according to the invention in a perspective view;
- Fig. 5 shows the housing of Fig. 4 with inserted electric contacts according to Fig. 1;
- Fig. 6 shows the housing of Fig. 5 with inserted electric contacts in a top view;
- Fig. 7 shows a first embodiment of a conductor press-on member according to the invention;
- Fig. 8 shows a first embodiment of a connector arrangement according to the invention in a perspective view with a cut perpendicular to the longitudinal direction;
- Fig. 9 shows the embodiment of Fig. 8 with a cut along a different plane;
- Fig. 10 shows a second embodiment of an electric contact in a perspective view;
- Fig. 11 shows a third embodiment of an electric contact in a perspective view;
- Fig. 12 shows a fourth embodiment of an electric contact in a perspective view;
- Fig. 13 shows the electric contact of Fig. 11 in a hous-

ing in a perspective view;

- Fig. 14 shows the arrangement of Fig. 13 in a cut view perpendicular to a transversal direction;
- Fig. 15 shows the electric contact of Fig. 12 in a housing in a perspective view with a cut perpendicular to a transversal direction;
- Fig. 16 shows the arrangement of Fig. 15 in a perspective view;
- Fig. 17 shows a fifth embodiment of an electric contact according to the invention in a perspective view;
- Fig. 18 shows a further embodiment of a connector arrangement according to the invention in a perspective view comprising a sixth embodiment of an electric contact;
- Fig. 19 shows a seventh embodiment of an electric contact according to the invention in a perspective view; and
- Fig. 20 shows an eighth embodiment of an electric contact according to the invention in a perspective view.

[0032] In the following, a preferred embodiment of an electric contact 1 for a connector arrangement (not shown yet) is described with respect to Figs. 1 to 3.

[0033] The electric contact 1 comprises two insulation displacement arrangements 3 which are spaced apart from each other in a longitudinal direction L. The longitudinal direction L of the electric contact 1 preferably also defines the direction in which a conductor (not shown yet) will extend after insertion into the electric contact 1.

[0034] Each of the insulation displacement arrangements 3 is open against a conductor insertion direction I along which a conductor can be inserted into the arrangements 3 and thereby electrically contacted with the electric contact 1. For cutting through the insulation of the conductor and for electrically contacting the same, each insulation displacement arrangement 3 is preferably provided with two cutting edges 5 which are arranged opposite to each other across a conductor receiving slot 7.

[0035] The cutting edges 5 extend towards each other along the conductor insertion direction I. Consequently, the conductor receiving slot 7 tapers in the conductor insertion direction I.

[0036] In order to reduce the force which is needed to insert a conductor into the insulation displacement arrangements 3, the electric contact 1 comprises cutting edge deformation openings 9 which may be cut out of the material 11 of the electric contact 1 in the close vicinity of each cutting edge 5 and which extend basically parallel with the cutting edges 5 along the conductor insertion direction I. The cutting edge deformation openings 9 allow elastic deformation of the cutting edges 5 away from the conductor receiving slots 7 during insertion of a conductor and thereby help to reduce the force which is needed to insert a conductor.

[0037] Alternative to the arrangement with two cutting

edges 5 for each insulation displacement arrangement 3, each insulation displacement arrangement 3 may be provided with a single cutting edge 5 and a cable support edge instead of a second cutting edge 5.

[0038] The cutting edges 5 are arranged opposite to each other across the longitudinal direction L and are thereby arranged along a transversal direction T of the electric contact 1.

[0039] Preferably, the longitudinal direction L, the conductor insertion direction I and the transversal direction T are each perpendicular to each other and form a Cartesian coordinate system.

[0040] The electric contact 1 comprises two side walls 13 which basically extend parallel to the longitudinal direction L and to the conductor insertion direction I. The side walls 13 are arranged opposite to each other along the transversal direction T. The side walls 13 connect the insulation displacement arrangements 3 with each other. Consequently, the insulation displacement arrangements 3 and the side walls 13 are arranged as a rectangular shape seen along the conductor insertion direction I and form a cage-like structure 15. The cage-like structure 15 is opened in both directions parallel to the conductor insertion direction I. The cage-like structure 15 may in other words be described as a box-shape having an overall rectangular or polygonal cross-section seen in the conductor insertion direction I.

[0041] A conductor insertion space 17 is arranged between the two insulation displacement arrangements 3 and is surrounded by the cage-like structure 15. In the conductor insertion space 17, a conductor can be received. When the conductor is received in the conductor insertion space 17, the insulation of the conductor is cut by the insulation displacement arrangements 3 and the electric contact 1 is electrically contacted with the conductor.

[0042] Two additional conductor insertion spaces 17' are arranged on both sides of the electric contact 1 along the longitudinal direction L adjacent to each insulation displacement arrangement 3. This is due to the fact that an inserted conductor extends outside the cage-like structure 15 on at least one side of the electric contact 1 in the longitudinal direction L.

[0043] Each side wall 13 is provided with an opening 19 that serves as a latching member 21 for a complementary latching member of a housing. The openings 19 have an overall rectangular shape and extend with their longitudinal sides parallel to the longitudinal direction L. Both openings 19 are arranged opposite each other across the conductor insertion space 17.

[0044] For electrically and mechanically connecting the electrical contact 1 to a printed circuit board, the contact 1 comprises two soldering portions 23. The soldering portions 23 extend away from the cage-like structure 15 in opposite directions along the longitudinal direction L. The soldering portions 23 are shaped as soldering lugs 25 for soldering the electric contact 1 as a surface mounted device (SMD).

[0045] Alternatively, the electric contact 1 may be provided with leads as soldering portions 23 for being connected to a printed circuit board by through-hole technology. The soldering lugs 25 extend away from bottom portions 27 of the insulation displacement arrangements 3. Said bottom portions 27 close the conductor receiving slots 7 in the conductor insertion direction I.

[0046] Preferably, the soldering lugs 25 extend parallel to the longitudinal direction L and parallel to the transversal direction T such that they are flush with each other and form a common bottom plane 29 of the electric contact 1.

[0047] The electric contact 1 is preferably formed as stamped-bent part 31 from electrically conductive material 11, which may be cut from sheet material. The cage-like structure 25 may be formed by bending the material 11 around three bending axes 33, such that edges 34 are formed which subdivide the insulation displacement arrangements 3 and the side walls 13. A fourth edge 35 is formed by a side wall 13 which abuts an insulation displacement arrangement 3, with which it is joined through at least one laser soldering point (not shown). The soldering lugs 25 are formed by bending material 11 away from the insulation displacement arrangements 3 in the longitudinal direction L.

[0048] An electric contact 1 formed as described above, results in a cage-like structure 15 which has an open bottom 37. This is advantageous for the reason that the two soldering lugs 25 may be bent and formed independently from each other in order to provide a desired orientation which is preferably parallel with each other and aligned in the same bottom plane 29. Another benefit of the open bottom 37 is the reduced amount of material 11 compared to a contact element 1 with a closed bottom 37.

[0049] The electric contact 1 is preferably formed as an insert 39 for being inserted in a housing of the connector arrangement.

[0050] In the following, a preferred embodiment of a housing 41 for the connector arrangement according to the invention is described with respect to Fig. 4. By way of example, the housing 41 as shown in Fig. 4 is adapted for receiving three electric contacts 1 as described with respect to Figs. 1 to 3. The housing 41 may alternatively be adapted for receiving any other number of electric contacts 1.

[0051] The housing 41 is preferably made from an electrically insulating material 43. The housing 41 comprises receptacles 45, wherein each receptacle 45 is adapted for receiving one electric contact 1.

[0052] The receptacles 45 is preferably formed identical to each other. For this reason, the receptacles 45 are, in the following, described with respect to a single receptacle 45. Further, for the description of the housing 41, the same directions will be used as for the electric contact 1 since the directions are identical when an electric contact 1 is received in a receptacle 45. This situation is described later with respect to Figs. 5 and 6.

[0053] The receptacle 45 has an overall longitudinal shape and extends along the longitudinal direction L. In the transversal direction T, the receptacle 45 is closed by receptacle side walls 47. The receptacle side walls 47 do not necessarily have to be fully closed. However, this arrangement is preferable in view of electrical insulation between electric contacts 1 in receptacles 45 which are arranged adjacent to each other. The receptacles 45 are arranged adjacent to each other in the transversal direction T in such a way that all receptacles 45 extend parallel with each other and parallel with the longitudinal direction L.

[0054] In the longitudinal direction L, the receptacle 45 is provided with conductor receiving recesses 49, which extend in the conductor insertion direction I into the material 43 of the housing 41. The two conductor receiving recesses 49 are arranged opposite to each other on both longitudinal ends of a receptacle 45.

[0055] On a top side 51 and a bottom side 53, the receptacle 45 is open in the conductor insertion direction I. The open bottom side 53 allows the insertion of an electric contact 1 into a receptacle 45, whereas the open top side 51 allows the insertion of a conductor and a conductor press-on member and thereby facilitates the assembly process of a connector arrangement. The conductor receiving recesses 49 open up into the open top side 51.

[0056] Each receptacle side wall 47 is provided with a plurality of latching members 55 and 57. The latching members 55 are adapted for entering the openings 19 in the side walls 13 of an electric contact 1. Therefore, the latching members 55 are formed complementary to the latching members 21 of the electric contact 1. Preferably, an electric contact 1 is inserted from the bottom side 53 into a receptacle 45. For this reason, the latching members 55 of the receptacle 45 are shaped as latching hooks with an inclined surface 59, which extends from the side wall 13 towards the opposite side wall 13 and towards the top side 51. This shape helps to insert an electric contact 1 from the bottom side 53 into the receptacle 45, whereby the electric contact 1 may slide along the inclined surfaces 59 of the two opposite arranged latching members 55.

[0057] In the moment that the electric contact 1 is positioned in the receptacle 45 such that the opening 19 is arranged in the same height seen in the conductor insertion direction I as the latching members 55 of the housing 41, the latching members 55 may enter the openings 19 of the electric contact 1 and fixate the electric contact 1 inside the receptacle 45.

[0058] For fixating the relative position between the electric contact 1 and the housing 41, at least in a way that prevents removal of the electric contact 1 in the conductor insertion direction I, each latching member 55 is provided with an abutment surface 61 which extends vertically parallel to the longitudinal direction L and to the transversal direction T. The abutment surface 61 may abut the material 11 of the electric contact 1 which sur-

rounds the opening 19. The latching members 55 are preferably arranged in the middle of the receptacle 45 seen in the longitudinal direction L.

[0059] Between the latching members 55 and the conductor receiving recesses 49, each side wall 47 is provided with two latching members 57. The latching members 57 may be arranged in the same height seen in the conductor insertion direction I as the latching member 55 on each side wall 47. However, this is not mandatory. The latching members 57 are intended to fixate a conductor press-on member in each receptacle 45. Preferably, the conductor press-on members are inserted from the top side 51 into the housing 41 such that each receptacle 45 receives one conductor press-on member.

[0060] To facilitate the insertion of a conductor press-on member along the conductor insertion direction I, each latching member 57 is provided with an inclined surface 63 which extends from the side wall 47 towards the opposite side wall 47 and towards the bottom side 53. On the opposite side of the latching member 57, the latching member 57 may be provided with a abutment surface 65 which extends parallel to the abutment surface 61 of the latching members 55 in order to prevent removal of a conductor press-on member from the receptacle 45 against the conductor insertion direction I. Preferably, each side wall 47 is provided with two latching members 57 which are arranged opposite to the latching members 57 of the opposite side wall 47.

[0061] The housing 41 is preferably adapted for contributing to the fixation of a conductor. Therefore, each receptacle 45 is provided with ribs that are arranged in the conductor receiving recesses 49 and follow the shape of said recesses 49. The ribs 67 may press in or onto the insulation of a conductor, when a conductor is inserted in the conductor receiving recesses 49.

[0062] In the following, the housing 41 as described with respect to Fig. 4 is described with inserted electric contacts 1 with respect to Figs. 5 and 6. Thereby, the electric contacts 1 correspond to the electric contact 1 as described with respect to Figs. 1 to 3.

[0063] For the sake of brevity, only one receptacle 45 with one electric contact 1 is described in detail. Since all receptacles 45 and all electric contacts 1 are identical, the description may be applied to any of the receptacles 45 and electric contacts 1.

[0064] In the inserted state of the electric contact 1 in the receptacle 45, the latching members 55 of the housing 41 are latched together with a latching member 21 of the electric contact 1. In other words, the latching members 55 are arranged inside the openings 19 of the electric contact 1. Thereby, the electric contact 1 is fixated in the receptacle 45.

[0065] Preferably, the housing 41 does not extend farther than the bottom plane 29 of the electric contact 1 in the conductor insertion direction I. Preferably, the bottom plane 29 defines a common bottom plane of both the electric contact 1 and the housing 41. This may guarantee that the soldering portions 23 of the electric contact 1 can

be connected to corresponding portions of a printed circuit board without being spaced apart from said printed circuit board by the housing 41.

[0066] Conductor insertion spaces 17' are arranged between each conductor receiving recess 49 and each insulation displacement arrangement 3, further to the conductor insertion space 17 which is arranged between the two insulation displacement arrangements 3 of the electric contact 1. When the electric contact 1 is inserted in the receptacle 45, the soldering portions 23 are accessible from the bottom side 53 of the housing for allowing soldering of the portions 23 to corresponding portions of a printed circuit board. Moreover, the soldering portions 23 are accessible from the top side 51 of the housing 41 for inspection of the soldering portions prior to and/or after soldering the portions 23 to corresponding portions of the printed circuit board. Thereby, the housing 41 provides inspection window 69 such that an inspection channel 71 extends unobstructed and in a straight line from each soldering portion 23 to the outside 73 of the housing 41 at least in the direction of the top side 51. Preferably, each inspection channel 71 extends parallel to the conductor insertion direction I. An inspection channel 71 is indicated by the dashed line in Fig. 5.

[0067] In the inserted state, the soldering portions 23 are arranged in the height of the latching members 57 in the longitudinal direction L. Consequently, the latching members 57 are arranged at the height of the conductor insertion spaces 17'.

[0068] A preferred embodiment of a conductor press-on member 75 is shown in Fig. 7. The conductor press-on member 75 of the preferred embodiment is formed such that it may function together with an electric contact 1 and a housing 41 as described with respect to Figs. 1 to 6.

[0069] The conductor press-on member 75 basically extends along a longitudinal direction L which is identical to the longitudinal direction L as used for the description of the electric contact 1 and the housing 41 when the conductor press-on member 75 is inserted in the housing 41 and arranged in the operating position. Therefore, for the description of the conductor press-on member 75, the same directions will be used as for the description of the electric contact 1 and the housing 41.

[0070] The conductor press-on member 75 comprises a base 77 which basically extends along the longitudinal direction L.

[0071] The conductor press-on member 75 comprises three conductor fixation portions 79 and 81. Thereby, the conductor fixation portions 79 are arranged opposite to each other in the longitudinal direction L and the conductor fixation portion 81 is arranged in the middle of the conductor press-on member 75 between the two conductor fixation portions 79.

[0072] In the region of the conductor fixation portion 81, the base 77 comprises an offset region 83, which is displaced in the conductor insertion direction I. The conductor fixation portion 81 is provided with two legs 85

which extend from the base 77 in the conductor insertion direction I. The legs 85 are spaced apart from each other in the transversal direction T. The conductor fixation portion 81 is adapted for at least partially encompassing a conductor between the legs 85.

[0073] The conductor fixation portions 79 are each provided with a pair of legs 87, which basically extend from the base 77 along the conductor insertion direction I and which are spaced apart from each other in the transversal direction T. The legs 87 are intended to partially encompass a conductor between each pair of legs 87 and further to fixate the conductor press-on member 75 to the housing 41. Therefore, each leg 87 of the conductor fixation portions 79 is provided with a latching member 89 which is formed complementary to the latching member 57 of the housing 41.

[0074] Consequently, the latching members 89 are formed as openings which extend through the legs 87 in the transversal direction T for receiving the latching members 57. For fixing the conductor press-on member 75 to the housing 41, the legs 87 which comprise the latching members 89 project further into the conductor insertion direction I than the legs 85.

[0075] For facilitating the insertion of the conductor press-on member 75 into the housing 41 when a conductor is present in the housing 41 and in the electric contact 1, the free ends of the legs 85 and 87 taper in the conductor insertion direction I. The longitudinal ends 91 and 93 of the conductor press-on member 75 are each provided with a conductor clamping portion 95 which extends from the base into the conductor insertion direction I. The conductor clamping portions 95 are intended to press onto the insulation of a conductor in the operating position and thereby additionally clamp the conductor and fixate it to the arrangement.

[0076] The conductor press-on member 75 and at least one electric contact 1 may form a connector arrangement according to the invention. This is described in the following.

[0077] Figs. 8 and 9 show a connector arrangement 97 according to the invention in an operating position 99. Fig. 8 shows the arrangement 97 in a cut view, wherein the arrangement is cut in the region of the latching members 57 of the housing 41 and thereby consequently in the region of the latching members 89 of the conductor press-on members 75. The cut extends perpendicular to the longitudinal direction L.

[0078] In Fig. 9, the same arrangement 97 is shown, whereas a cut extends through the arrangement in the region of the latching members 55 and therefore consequently through the openings 19 of the electric contact 1.

[0079] In both figures, the connector arrangement 97 is shown with a conductor connected to each of the electric contact 1. Therefore, the connector arrangement 97 is shown with three conductors 101. Each conductor 101 comprises an insulation 103 and an electrically conducting portion 105.

[0080] The connector arrangement 97 as described

with respect to Figs. 8 and 9 comprises the electric contacts 1, the housing 41 and the conductor press-on members 75. The conductors 101 are not part of the connector arrangement 97. However, for the sake of clarity, the connector arrangement 97 is described with respect to the conductors 101.

[0081] Just by way of example, the connector arrangement 97 is shown on a printed circuit board (PCB) 107 with soldering spots 109. The soldering portions 23 of the electric contacts 1 may be soldered to the soldering spot 109 of the printed circuit board 107 for electrically contacting the electric contacts 1 to circuits of the printed circuit board 107.

[0082] In the following, the embodiment of the connector arrangement 97 is described with respect to a single electric contact 1 for the sake of clarity and brevity.

[0083] In the operating position 99, the electric contact 1 is inserted in the housing 41, in other words, received in the receptacle 45. This was already described in detail with respect to Figs. 5 and 6. Further, the conductor press-on member 75 is fixated to the connector arrangement 97 by being fixated to the housing 41. The conductor press-on member 75 is fixated by the mating of the complementary latching members 57 and 89. Thereby, all legs 85 and 87 protrude into the receptacle 45 and are arranged between the conductor 101 and the two side walls 47 of the receptacle 45.

[0084] The legs 85 and 87 at least partially encompass the conductor 101 and thereby fixate it to the connector arrangement 97. In the operating position 99, the conductor fixation portion 81 is arranged in the cage-like structure 15 and thereby in the conductor insertion space 17. Due to the offset region 83, the conductor 101 is pressed in the conductor insertion direction I by the conductor fixation portion 81.

[0085] The two other conductor fixation portions 79 secure the conductor 101 in the transversal direction T. Further, the conductor 101 is pressed by the conductor clamping portions 95 towards the ribs 67 of the housing 41. When the conductor 101 is received in the arrangement and extends through the conductor insertion spaces 17 and 17', the insulation portion 103 of the conductor 101 is cut by the cutting edges 5 of the insulation displacement arrangements 3 and the conducting portion 105 is electrically connected with the electric contact 1.

[0086] In the regions of the conductor clamping portions 95, the conductor press-on member 75 extends beyond the conductor insertion spaces 17 and 17' in the longitudinal direction L. In other words, the conductor clamping portions 95 are arranged at the height of the ribs 67 in the longitudinal direction L.

[0087] It should be noted that the connector arrangement 97 and the components of the arrangement 97 as described with the foregoing figures can be used for two different types of connections. In a first type, the conductors 101 may be cut at an outside 73 of the housing on one end of the housing 41 in the longitudinal direction L and can extend from the opposite end away to be con-

nected to other components. In the second type, the same connector arrangement 97 may be used for a so-called daisy chain connection. This means, both ends of the conductor 101 in the longitudinal direction L may be connected to other components. This is possible due to the fact that the connector arrangement 97 is shaped similarly on both sides seen in the longitudinal direction L. In other words, the connector arrangement 97 is symmetrical with respect to a plane which may extend perpendicular to the longitudinal direction L through the connector arrangement 97 in the region of the cage-like structure 15.

[0088] Fig. 10 shows another embodiment of an electric contact 1 which can be used for the connector arrangement 97 as described with respect to Figs. 1 to 9. For the sake of brevity, only the differences to the electric contact 1 as described with respect to Figs. 1 to 3 are described.

[0089] The electric contact 1 comprises a continuous bottom plate 111, which connects the two soldering lugs 25 in the longitudinal direction L. The continuous bottom plate 111 extends along the bottom plane 29 of the electric contact 1. The bottom plate 111 also closes the cage-like structure 15 in the conductor insertion direction I.

[0090] The electric contact 1 comprises two bending edges 113, which extend parallel to the longitudinal direction L and which are arranged between the bottom plate 111 in the region of the cage-like structure 15 and the side walls 13. The electric contact is formed by stamp bending and can be formed by first bending the side walls away from material that forms the bottom plate 111 and thereby forming the edges 113. Afterwards, the cage-like structure 15 is shaped by bending wing portions 115 on each side wall 13 towards each other such that the cage-like structure 15 is basically closed. The wing portions 115 comprise the cutting edges 5 at their free ends.

[0091] When the cutting edges 5 are arranged opposite to each other in the transversal direction T, the two adjacent wing portions 115 form an insulation displacement arrangement 3. A conductor receiving slot extends along the conductor insertion direction I between the two wing portions 115. Since the wing portions 115 are preferably not fixated to the soldering portions 23 or the bottom plate 111, the insulation displacement arrangements 3 of the second embodiment may comprise sufficient elasticity such that cutting edge deformation openings 9 do not necessarily have to be provided. However, in an alternative embodiment which is not shown, the second embodiment of the electric contact 1 may also be provided with said openings.

[0092] The embodiments of the invention and its components as described with respect to Figs. 1 to 10 were related to a connector arrangement 97 with a conductor press-on member 75 that is formed as a separate part. In the following, embodiments will be described, wherein the conductor press-on member is formed monolithically with the electric contact.

[0093] In Fig. 11, an electric contact 1 is shown, which

comprises conductor press-on members 75 that are formed monolithically with the side walls 13. Since the electric contact 1 is provided with the conductor press-on members 75, this part forms a connector arrangement 97 according to the invention. The electric contact 1 basically comprises a cage-like structure 15 which may be shaped as the electric contact 1 which is described with respect to Fig. 10 or according to the electric contact 1 which is described with respect to Figs. 1 to 3.

[0094] The conductor press-on members 75 extend from the side walls 13 against the conductor insertion direction I from the side walls 13. Thereby, one side wall 13 is provided with two conductor press-on members 75 and the opposite side wall 13 is provided with a single conductor press-on member 75. In an operating position, which is not shown in Fig. 11, the conductor press-on member 75 may be bent down such that they protrude into the cage-like structure 15 and therefore into the conductor insertion space 17 pressing on a conductor. Thereby, the conductor press-on members 75 fixate a conductor in the conductor insertion space 17. The conductor press-on members 75 are arranged in a displaced manner along the longitudinal direction L such that the free space between the two conductor press-on members 75 on one side wall 13 lies opposite to the single conductor press-on member 75 on the opposite side wall 13.

[0095] The electric contact 1 is further provided with latching members 21 which can be used for latching the electric contact 1 to a housing. The latching members 21 are formed as latching hooks with a longitudinal portion 117 and an upright portion 119. The longitudinal portion 117 extends basically horizontally such that it is basically arranged in the bottom plane 29 of the electric contact 1. The electric contact 1 can be soldered to a printed circuit board in the region of the longitudinal portions 117. The upright portions 119 extend from the longitudinal portions 117 against the conductor insertion direction I and are provided with latching hooks 121 at their free ends.

[0096] In Fig. 12, another electric contact with integrated conductor press-on members 75 is described. For the sake of brevity, only the differences to the embodiment as described with respect to Fig. 11 are mentioned.

[0097] The electric contact 1 comprises two conductor press-on members 75, wherein each conductor press-on member 75 is formed monolithically with one of the side walls 13. Both conductor press-on members 75 are formed identical to each other.

[0098] The conductor press-on members 75 comprise a projecting portion 123 which extends away from the side wall 13 against the conductor insertion direction I and a frame portion 125 which is arranged on top of the projecting portion 123 and formed monolithically with the same. The frame portion 125 has an overall shape of a rectangular frame wherein long sides 127 of the frame portion 125 extend parallel with the longitudinal direction L and extend beyond the insulation displacement arrangements 3 in the longitudinal direction L.

[0099] Each frame portion 125 comprises two long sides 127 which are spaced apart from each other in the conductor insertion direction I and which are interconnected by short sides 129. Alternatively, the long sides 127 may have the length such that the frame portions 125 do not extend beyond the insulation displacement arrangement 3.

[0100] In the following, a connector arrangement 97 as described with respect to Fig. 11 is further described with respect to Figs. 13 and 14, wherein the connector arrangement 97 is further provided with a housing 41. Further, just by way of example, the connector arrangement 97 is provided with three electric contacts 1, wherein each electric contact 1 is provided with monolithically integrated conductor press-on members 75 as described with respect to Fig. 11. Thereby, Fig. 13 shows a perspective view on the arrangement 97 in a pre-assembly position 131, whereas Fig. 14 shows the same arrangement in a cut view wherein the cut runs parallel with the longitudinal direction L and with the conductor insertion direction I through the region of the latching hooks 121.

[0101] In the preassembled position 131, the electric contacts 1 are received in receptacles 45 of the housing 41, but the conductor press-on members 75 are not plastically deformed yet.

[0102] The housing 41 comprises a receptacle 133 for each of the upright portions 119. Each receptacle 133 is provided with a recess 135 for a latching hook 121. The receptacles 133 basically extend parallel with the conductor insertion direction I for receiving the upright portion 119, whereas the recess 135 extends from each receptacle 133 into the material of the housing 41 in the longitudinal direction L such that a latching hook 121 may be received in the recess 135. Each recess 135 is provided with an abutment edge 137 which is adapted for forming a positive fit with a latching hook 121 such that the latching hook 121 is prevented from moving in the conductor insertion direction I by the abutment edge 137.

[0103] Figs. 15 and 16 show another connector arrangement 97 with a housing 41, wherein the electric contact 1 is identical to the electric contact 1 as described with respect to Fig. 12. For the sake of brevity, only the differences to the embodiment as described with respect to Figs. 13 and 14 are mentioned.

[0104] The housing 41 is provided with a receptacle 133 for each upright portion 119. Each receptacle 133 is provided with a recess 135 for the latching hook 121 for the pre-assembly position of the arrangement 97.

[0105] However, the housing 41 differs in the one as described with respect to Figs. 13 and 14 in that the receptacle 133 is provided with two further recesses 139 and 141 that can be used for receiving the latching hook 121 in additional pre-assembly positions 131. For example, the latching hooks 121 may be received in the recesses 139 such that the housing 41 is spaced apart from the bottom plane 29 of the electric contact 1. In this position, the electric contact 1 may be soldered to a printed circuit board. After soldering and inspection of the sol-

dering sides, the housing 41 may be further pushed in the conductor insertion direction I until the latching hooks 121 are received in the recesses 135. This pre-assembly position 131 is shown in Fig. 16.

[0106] For easily connecting the housing 41 to the electric contact 1, the housing may be provided with channels 143 which allow passing of the conductor press-on members 75 during movement of the housing 41 relative to the electric contact 1.

[0107] It should be noted that a housing 41 which provides several relative positions between the housing 41 and the electric contacts 1 may also be used for the electric contact as described with respect to Figs. 11, 13 and 14.

[0108] Fig. 17 shows another electric contact 1 with monolithically integrated conductor press-on members 75 and therefore a connector arrangement 97 according to the invention.

[0109] The electric contact 1 is basically formed as the electric contact 1 as described with respect to Fig. 12 except for the latching members 21 and the length of the conductor press-on members 75. The conductor press-on members 75 do not extend beyond the insulation displacement arrangements 3 in the longitudinal direction. However, this is only exemplarily. The conductor press-on members 75 may also extend beyond the insulation displacement arrangements 3 or may alternatively be shaped as the conductor press-on member 75 as described with respect to Fig. 11.

[0110] The electric contact 1 does not comprise latching members 21 in the shape of hooks with a longitudinal end and an upright portion as described with respect to Figs. 11 and 12. Instead, the electric contact 1 is provided with two latching members 21 that are formed monolithically with the side walls 13 and extend in the shape of knobs from said side walls 13 in the transversal direction T away from the electric contact 1. The latching members 21 which are formed as knobs can be received in complementary openings in a housing (not shown).

[0111] Fig. 18 shows another embodiment of a connector arrangement 97 according to the invention. Again, for the sake of brevity, only the differences to the aforementioned embodiments are described.

[0112] The electric contacts 1 are provided with monolithically integrated conductor press-on members 75. However, the conductor press-on members 75 are arranged adjacent to the cage-like structure 15 in the longitudinal direction and are shaped as crimp barrels which extend away from a bottom plate 111 of the electric contact 1. The conductor press-on members 75 extend against the conductor insertion direction I. The bottom plate 111 extends basically longitudinal along the longitudinal direction L also forming a bottom of the cage-like structure 15. The conductor press-on member 75 can be plastically deformed in order to fixate a conductor to the arrangement 97. In an operating position (not shown) the conductor press-on member 75 are bent such that they cover the conductor insertion space 17' which is arranged

adjacent to the insulation displacement arrangement 3.

[0113] The connector arrangement 97 may comprise a housing 41 that consists of a lower portion 145 and an upper portion 147. The electric contacts 1 may be arranged between the two portions 145 and 147 such that they are fixated between them. Soldering portions 23 of the electric contacts 1 may extend out of the housing 41 in the longitudinal direction L. The connector arrangement 97 as described with respect to Fig. 18 is preferably used for a direct connection of a printed circuit board by conductors without using a daisy chain configuration. Therefore, it may be sufficient to provide the electric contacts 1 with conductor press-on members 75 on only one side of the electric contact 1 in the longitudinal direction L.

[0114] If a daisy chain configuration is intended for an electric contact 1 as described with respect to Fig. 18, then an electric contact 1 may be provided with conductor press-on members 75 on both sides of the cage-like structure 15 in the longitudinal direction L. Such embodiments are described with respect to Figs. 19 and 20.

[0115] Fig. 19 shows a first embodiment of an electric contact 1 which can be used for the connector arrangement 97. The electric contact 1 is provided with two pairs of conductor press-on members 75 which extend from the bottom plate 111 of the electric contact 1 against the conductor insertion direction I. All conductor press-on members 75 can be plastically deformed in order to fixate and cover a conductor when such conductor is present in the electric contact 1.

[0116] In Fig. 20, another embodiment of an electric contact 1 is shown which is similar to the one as described with respect to Fig. 19. The only difference is the shape of the electric contact 1 in the region of the insulation displacement arrangements 3. Instead of a cage-like structure 15 with side walls 13, the electric contact 1 is provided with a pair of U-shapes 149 which are formed monolithically with the electric contact 1. The U-shapes are arranged such that bottom portions 151 of the U-shapes 149 are offset with respect to the bottom plate of the electric contact 1 against the conductor insertion direction I and wherein legs 153 of the U-shapes 149 connect the bottom portions 151 with the bottom plate 111. The legs 153 of the U-shapes 149 basically extend parallel with the conductor insertion direction I, wherein two legs 153 that are arranged adjacent to each other and opposite to each other in the transversal direction T form a conductor receiving slot 7 in between them and are provided with cutting edges 5 for receiving a conductor.

REFERENCE NUMERALS

[0117]

1	electric contact
3	insulation displacement arrangement
5	cutting edge
7	conductor receiving slot
9	cutting edge deformation opening

11 material of the electric contact
 13 side wall
 15 cage-like structure
 17, 17' conductor insertion space
 19 opening inside wall
 21 latching member
 23 soldering portion
 25 soldering lug
 27 bottom portion of the insulation displacement arrangement
 29 bottom plane of the electric contact
 31 stamped-bent part
 33 bending axis
 34 edge
 35 edge
 37 bottom of the cage-like structure
 39 insert
 41 housing
 43 insulating material
 45 receptacle
 47 receptacle side wall
 49 conductor receiving recess
 51 top side
 53 bottom side
 55 latching member for the electric contact
 57 latching member for the conductor press-on member
 59 inclined surface
 61 abutment surface
 63 inclined surface
 65 abutment surface
 67 rib
 69 inspection window
 71 inspection channel
 73 outside
 75 conductor press-on member
 77 base
 79 conductor fixation portion
 81 conductor fixation portion
 83 offset region
 85 leg
 87 leg
 89 latching member
 91 longitudinal end
 93 longitudinal end
 95 conductor clamping portion
 97 connector arrangement
 99 operating position
 101 conductor
 103 insulation portion
 105 conducting portion
 107 printed circuit board
 109 soldering spots
 111 continuous bottom plate
 113 bending edge
 115 wing portion
 117 longitudinal portion
 119 upright portion

121 latching hook
 123 projecting portion
 125 frame portion
 127 long side
 5 129 short side
 131 pre-assembly position
 133 receptacle
 135 recess
 137 abutment edge
 10 139 recess
 141 recess
 143 channels
 145 bottom portion
 147 top portion
 15 149 U-shape
 151 bottom portion
 153 leg of the U-shape
 I conductor insertion direction
 20 L longitudinal direction
 T transversal direction

Claims

- 25 1. Connector arrangement (97) for receiving at least one insulated conductor (101), the connector arrangement (97) comprising at least one electric contact (1) with at least one insulation displacement arrangement (3) for cutting through the insulation (103) of the conductor (101) and for electrically contacting the same, and at least one conductor insertion space (17, 17') adjacent to the at least one insulation displacement arrangement (3), **characterized in that**

30 at least one conductor press-on member (75) is provided, which, at least in an operating position (99), is fixed to the connector arrangement (97) and covers the at least one conductor insertion space (17, 17').

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- 40 2. Connector arrangement (97) according to any of claim 1, **characterized in that** the at least one electric contact (1) is provided with at least two insulation displacement arrangements (3) which are spaced apart from each other in a longitudinal direction (L) of the arrangement (97), the at least one conductor insertion space (17, 17') being arranged between the least two insulation displacement arrangements (3).

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- 50 3. Connector arrangement (97) according to claim 2, **characterized in that** the at least one electric contact (1) comprises a cage-like structure (15), which is formed by the least two insulation displacement arrangements (3) and at least two side walls (13) connecting the at least two insulation displacement arrangements (3).

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4. Connector arrangement (97) according to any of claims 1 to 3, **characterized in that** the at least one conductor press-on member (75) is formed monolithically with the at least one electric contact (1) and is plastically deformed at least in the operating position (99). 5
5. Connector arrangement (97) according to any of claims 1 to 4, **characterized in that** the conductor press-on member (75) extends beyond the at least one conductor insertion space (17, 17') in a longitudinal direction (L) of the connector arrangement (L), at least in the operating position (99). 10
6. Connector arrangement (97) according to any of claims 1 to 5, **characterized in that** the at least one conductor press-on member (75) is formed as a separate part with at least one conductor fixation portion (79, 81) which extends into the conductor insertion space (17, 17') at least in the operating position (99). 15
7. Connector arrangement (97) according to claim 6, **characterized in that** the at least one conductor press-on member (75) comprises at least one pair of legs (85, 87) which are spaced apart from each other and extend into the at least one conductor insertion space (17, 17') in the operating position (99). 20
8. Connector arrangement (97) according to claim 7, **characterized in that** the at least one conductor press-on member (75) comprises at least three pairs of legs (85, 87), wherein the pairs are spaced apart from each other in a longitudinal direction (L) of the conductor press-on member (75), and wherein the legs (85, 87) basically extend parallel to each other. 25
9. Connector arrangement (97) according to claim 8, **characterized in that** the at least one conductor press-on member (75) has a base (77) that extends along the longitudinal direction (L) of the conductor press-on member (75) and connects the three pairs of legs (85, 87) with each other, wherein the base (77) has at least one offset region (83) which is displaced with respect to neighboring regions in the direction in which at least one pair of legs (85, 87) extends. 30
10. Connector arrangement (97) according to any of claims 1 to 9, **characterized in that** the connector arrangement (97) further comprises at least one housing (41) adapted for at least partially receiving the at least one electric contact (1) in the operating position (99) and **in that** the at least one electric contact (1) is formed as an insert (39) for said housing (41). 35
11. Connector arrangement (97) according to claim 10, **characterized in that** the at least one housing (41) and the at least one electric contact (1) each comprise at least one latching member (21, 55), wherein the at least one latching member (55) of the at least one housing (41) and the at least one latching member (21) of the at least one electric contact (1) are complementary to each other for undetachably connecting the at least one housing (41) and the at least one electric contact (1) at least in the operating position (99). 40
12. Connector arrangement (97) according to claim 11, **characterized in that** the complementary latching members (21, 55) further provide at least one pre-assembly position (131) in which the at least one electric contact (1) is not fully inserted in the at least one housing (41). 45
13. Connector arrangement (97) according to any of claims 10 to 12, **characterized in that** the at least one electric contact (1) is provided with at least one soldering portion (23) for soldering the electric contact (1) to a printed circuit board (107) and **in that** the at least one housing (41) comprises at least one inspection window (69) providing an inspection channel (71) which extends unobstructed from outside (73) the housing (41) to the at least one soldering portion (23) at least in a pre-assembly position (131). 50
14. Connector arrangement (97) according to any of claims 1 to 13, **characterized in that** the at least one conductor press-on member (75) comprises at least one latching member (89) for latching the at least one conductor press-on member (89) to the housing (41) of the connector arrangement (97) and/or to the at least one electric contact (1). 55
15. Connector arrangement according to claim 14, **characterized in that** at least one leg (85, 87) of the at least one conductor press-on member (75) is provided with the at least one latching member (89).

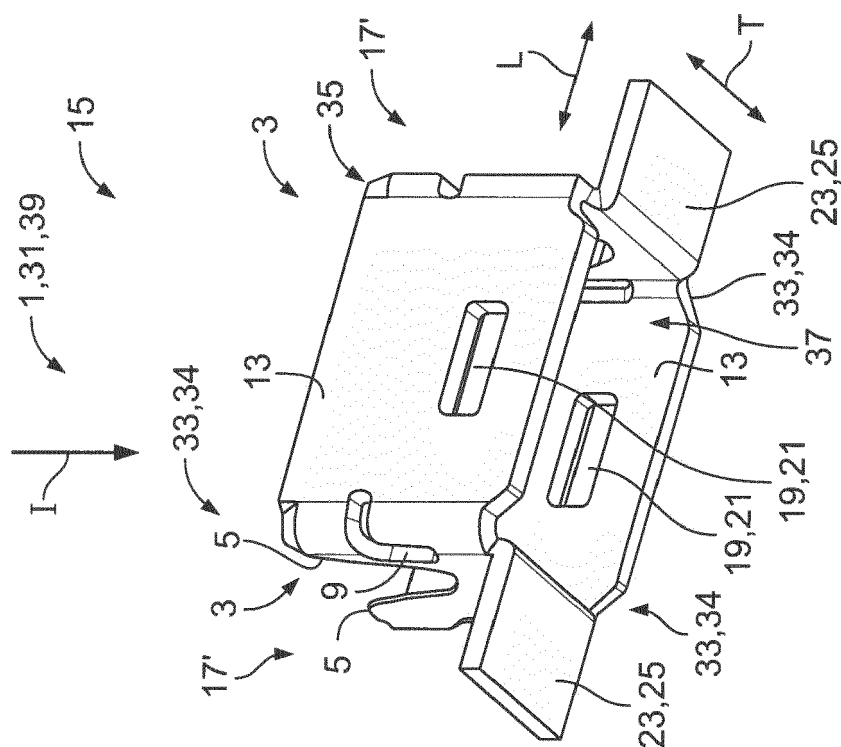


Fig. 1

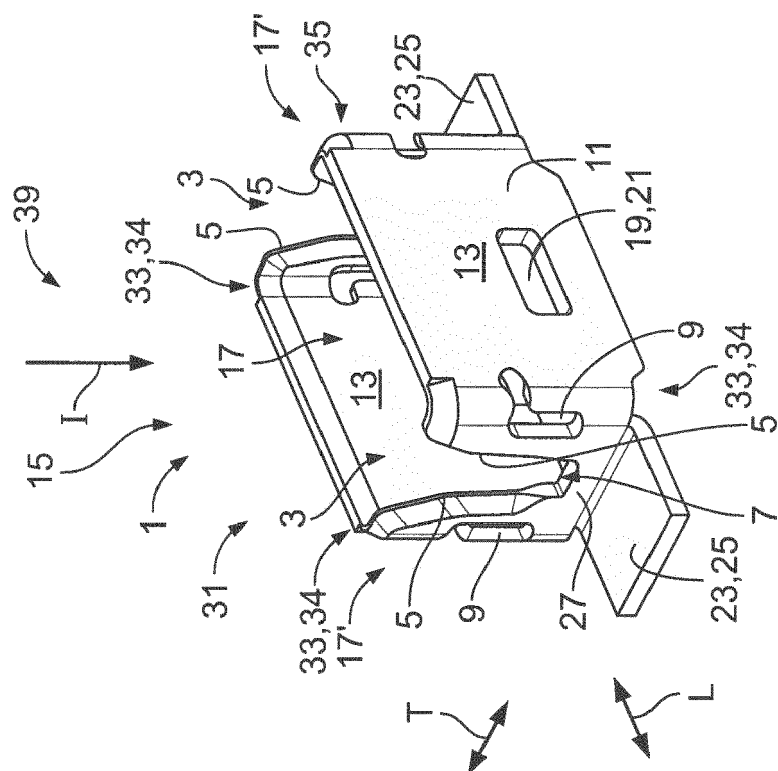


Fig. 2

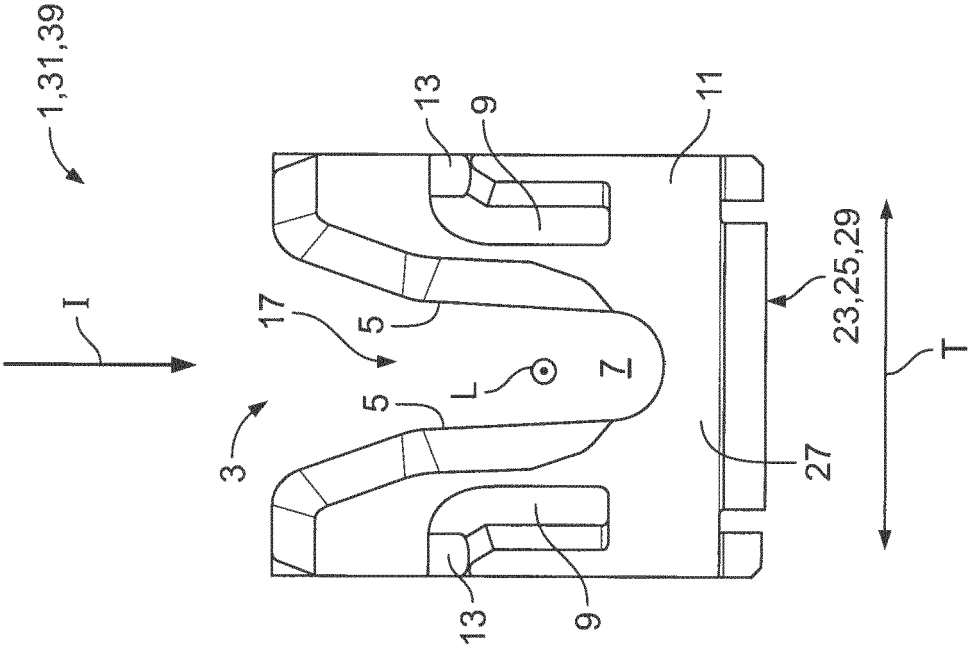


Fig. 3

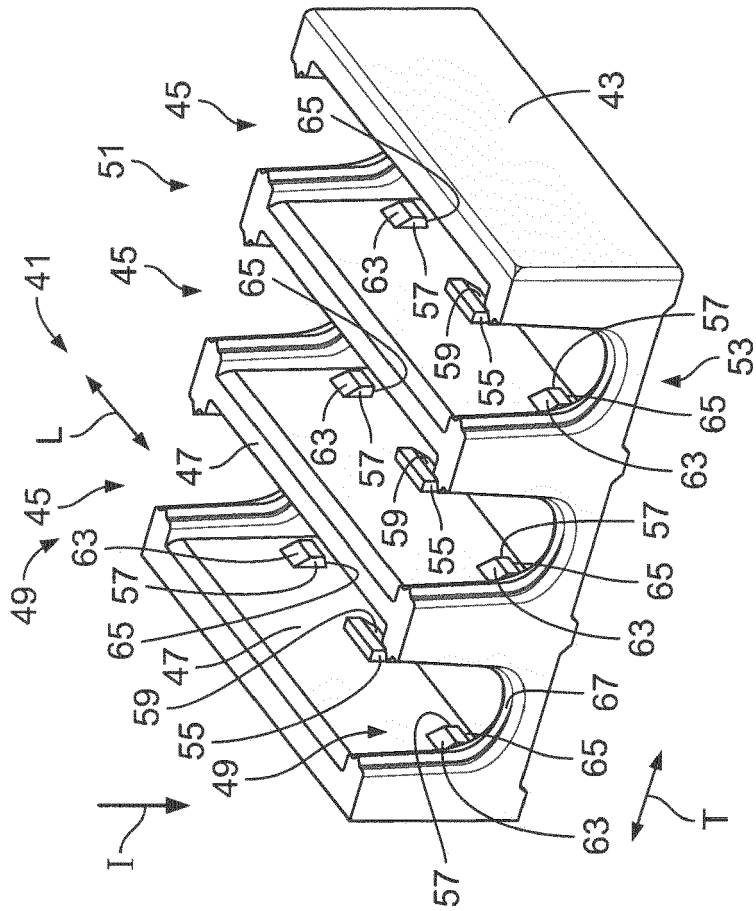
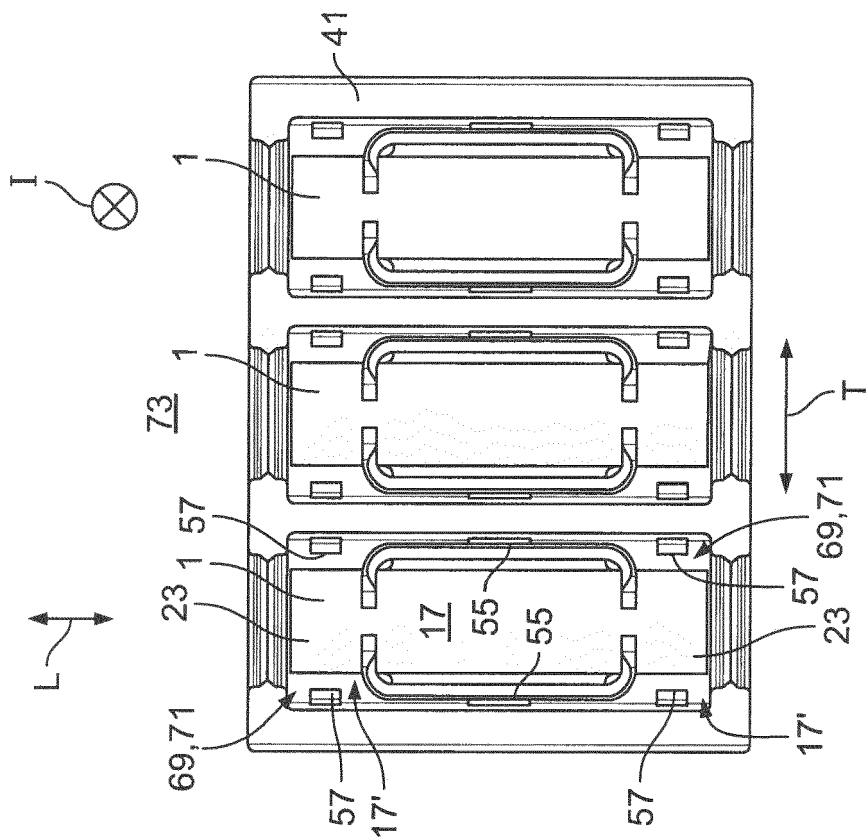


Fig. 4



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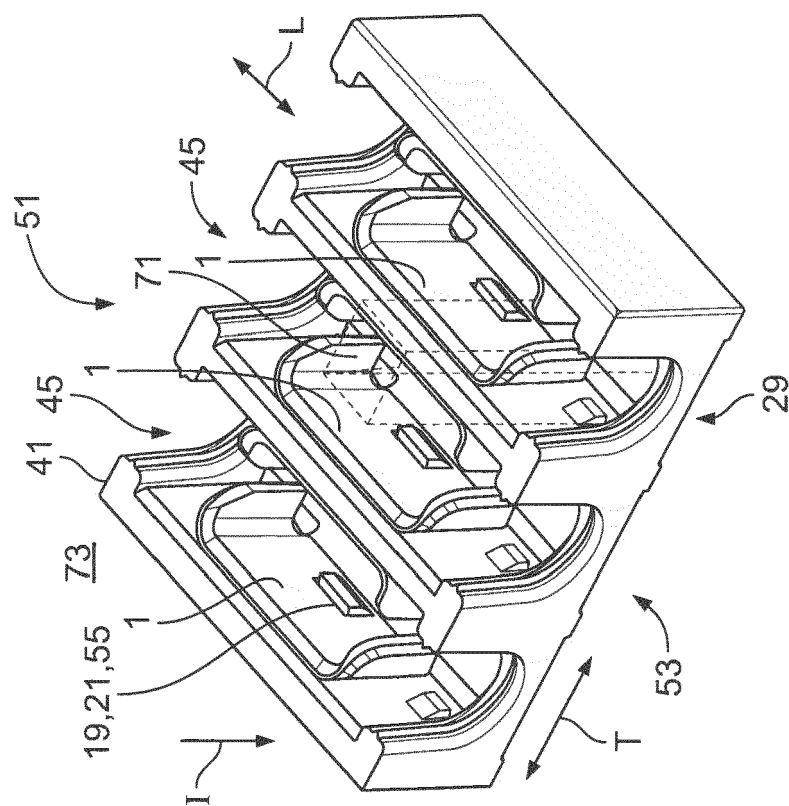
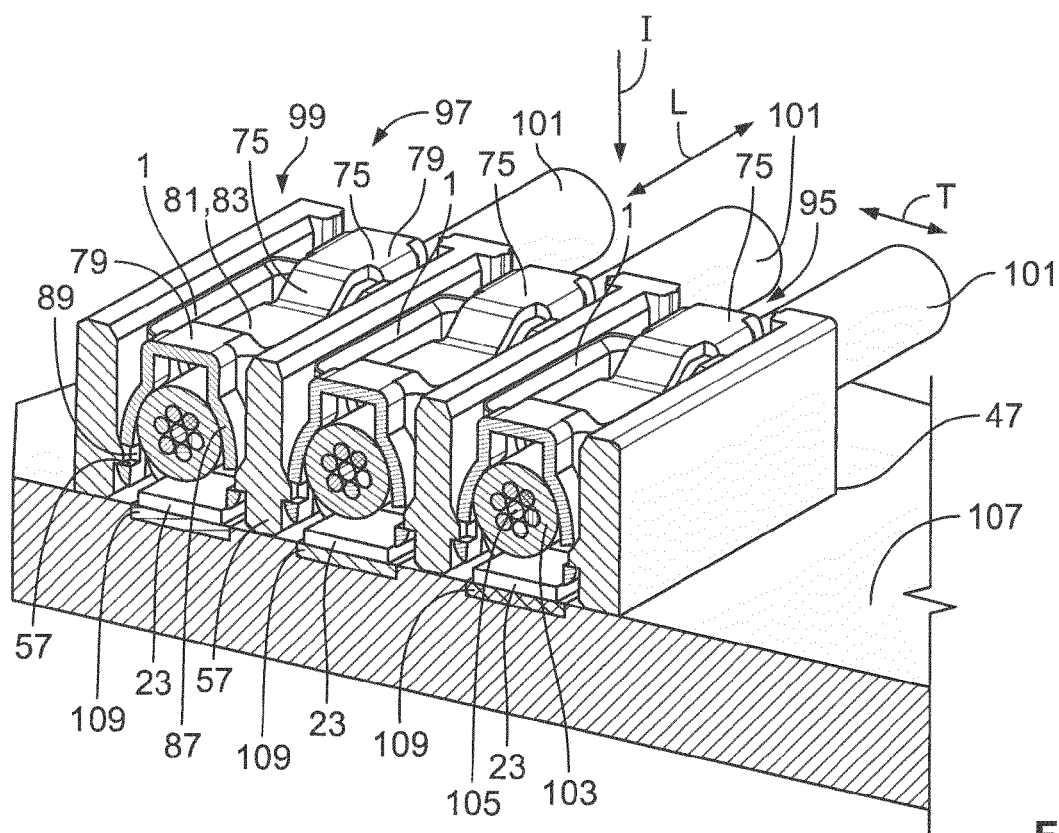
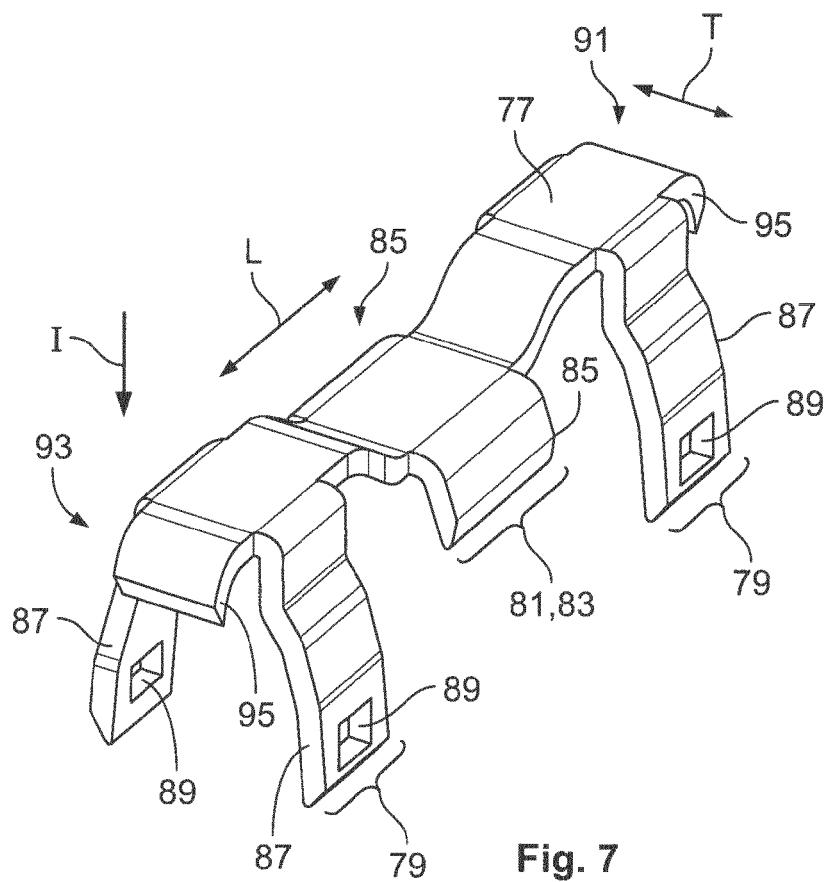


Fig. 5



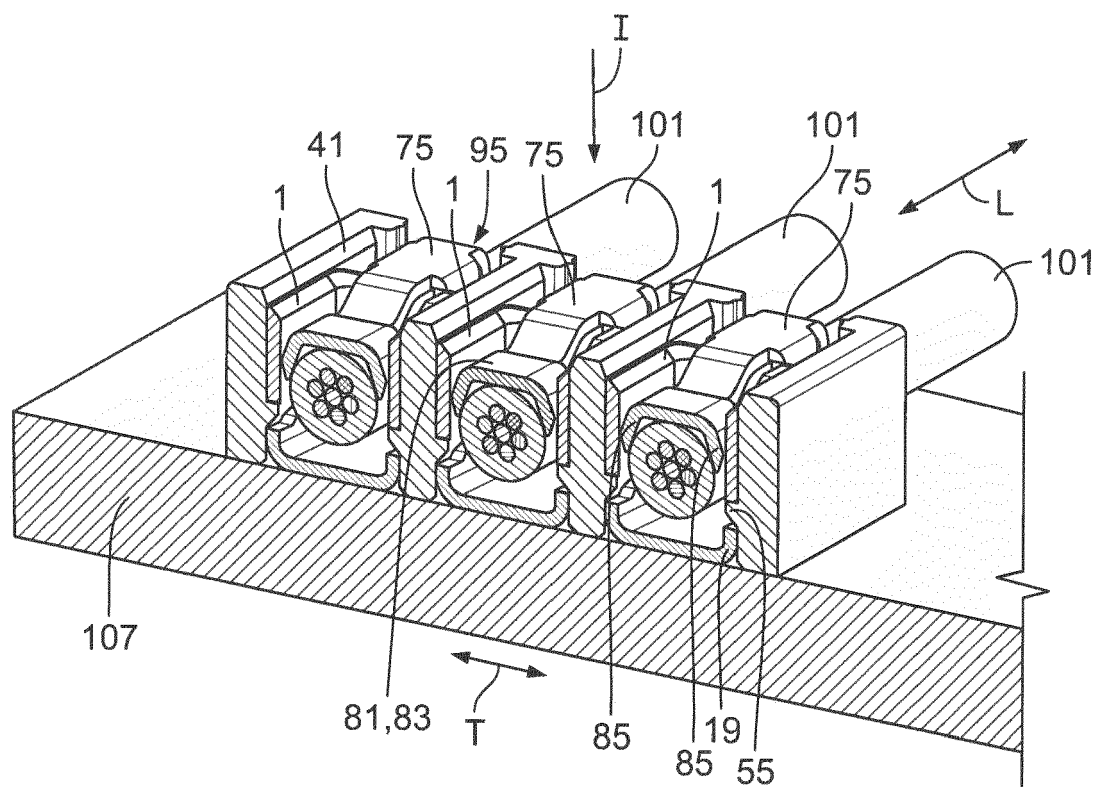


Fig. 9

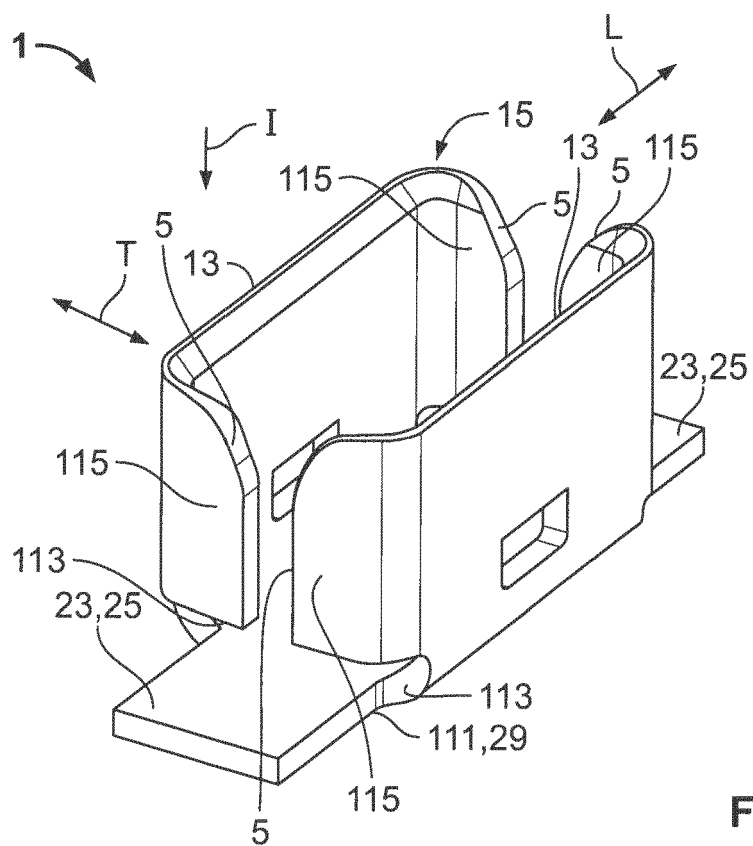


Fig. 10

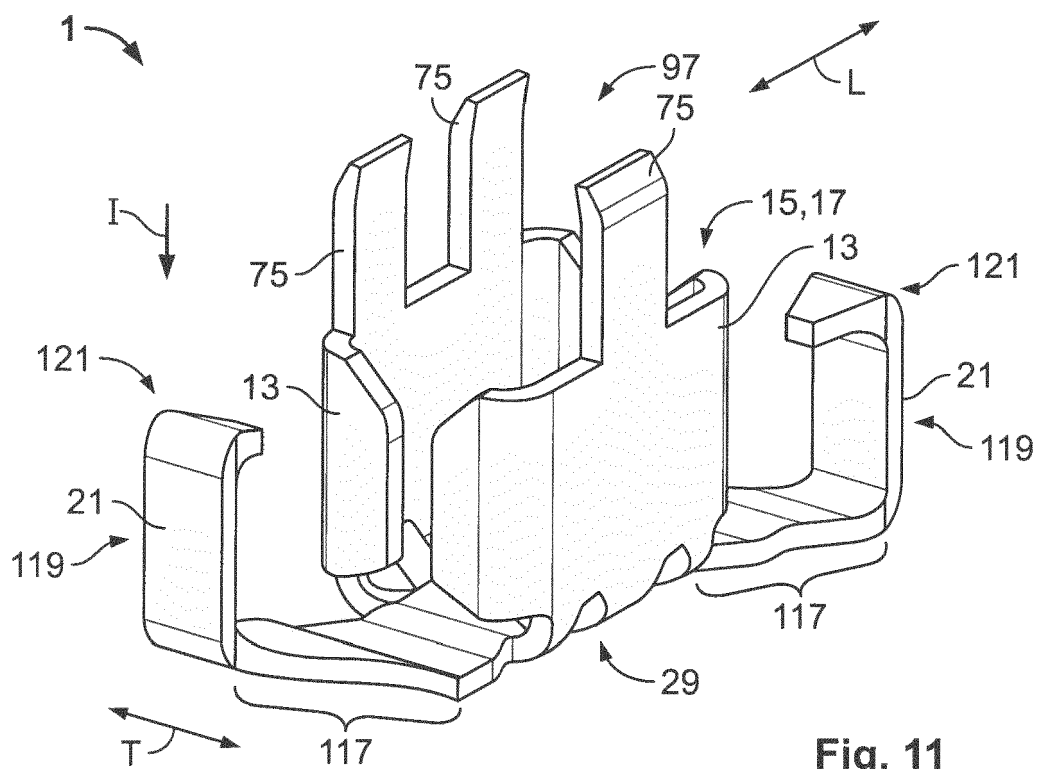


Fig. 11

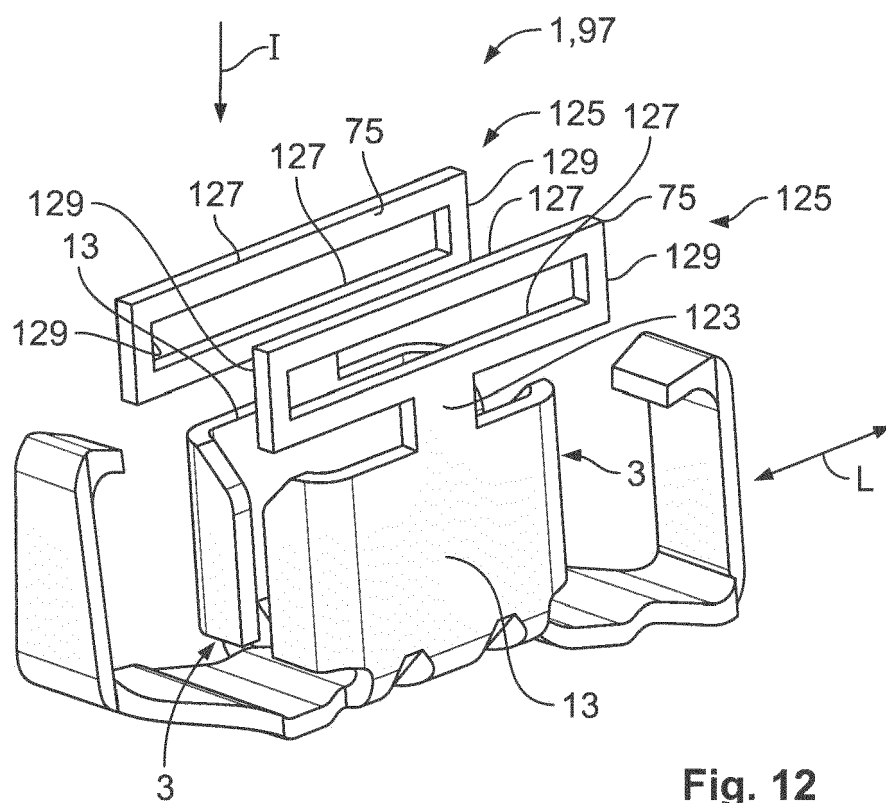
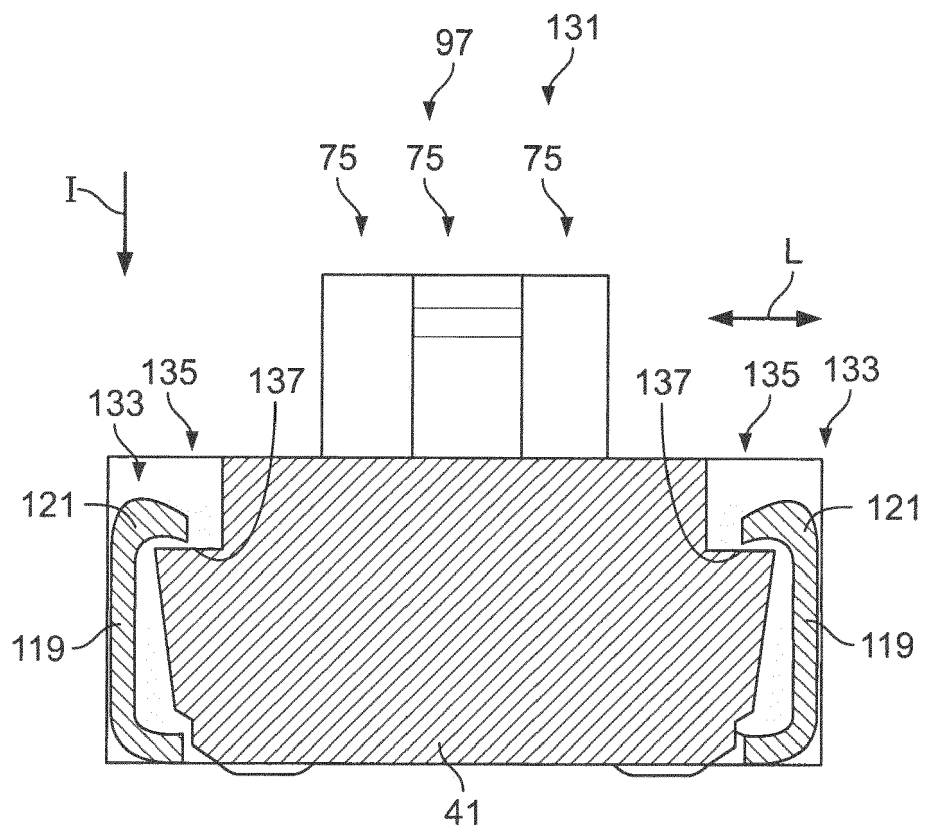
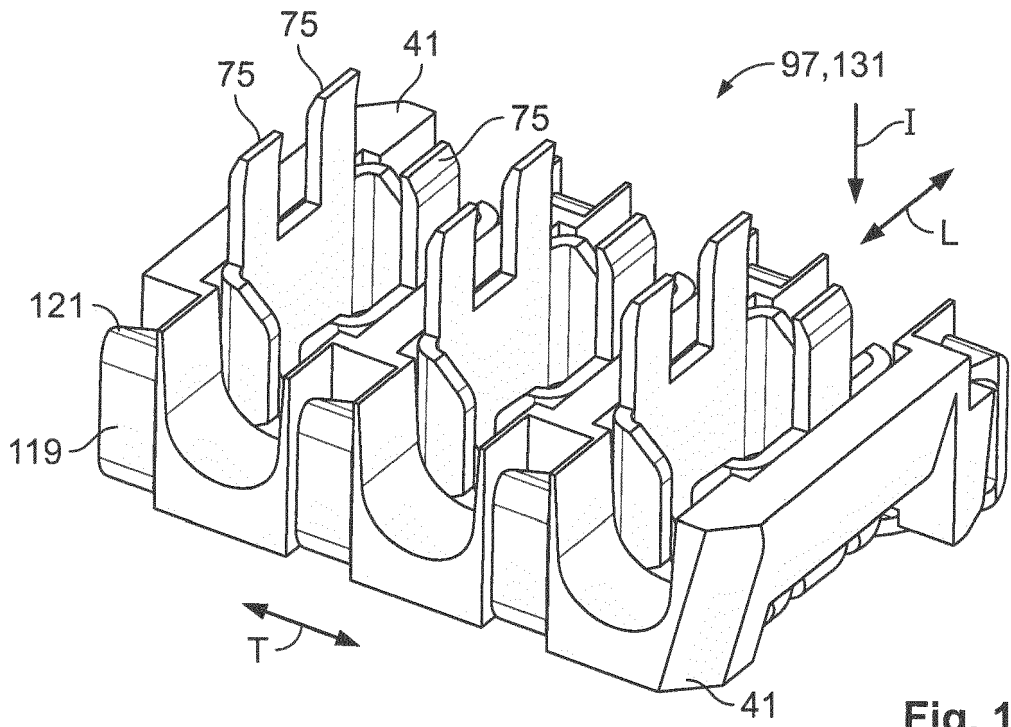


Fig. 12



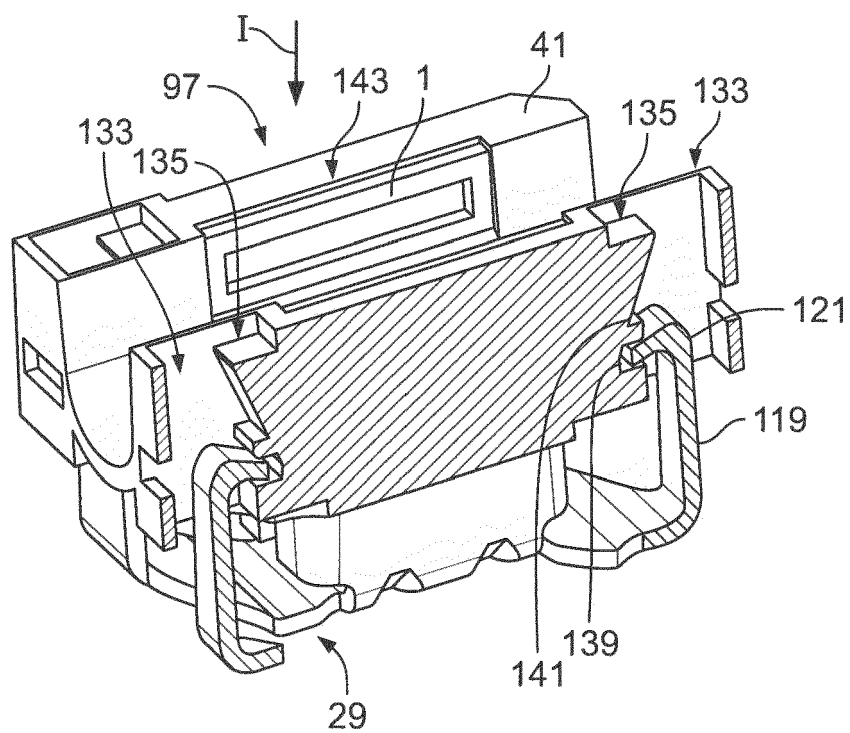


Fig. 15

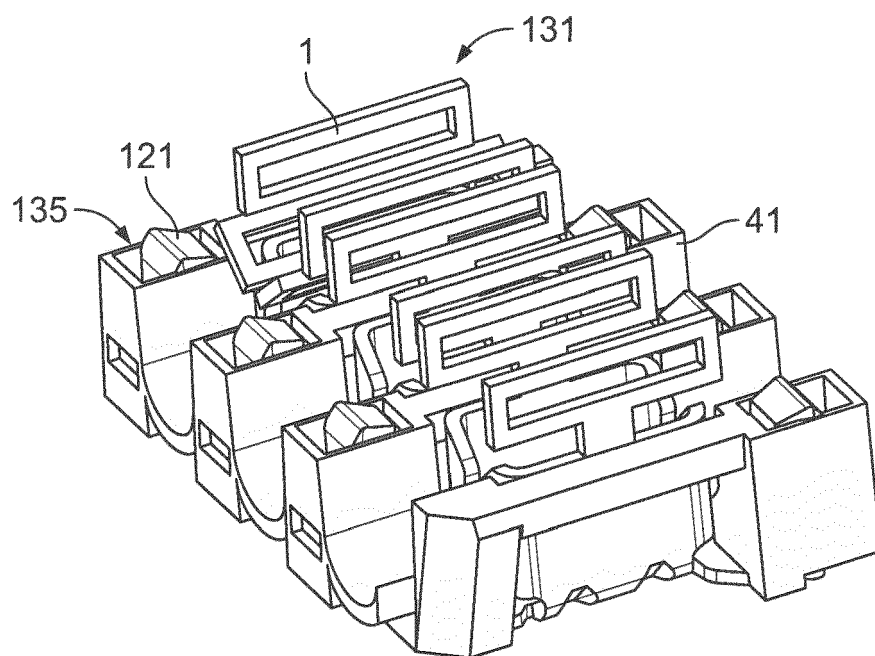
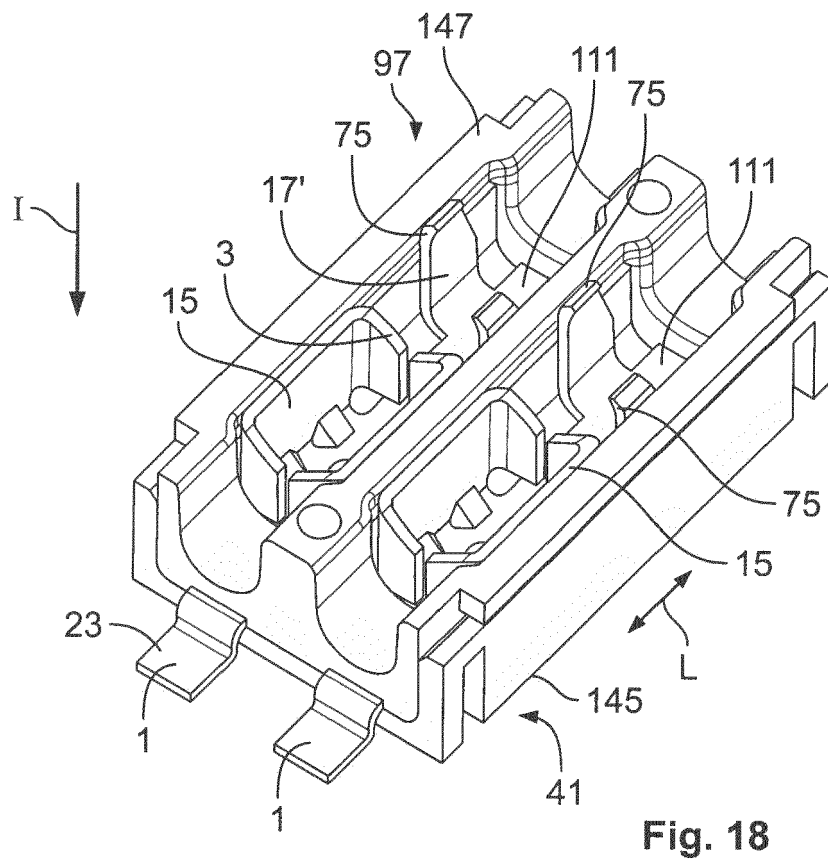
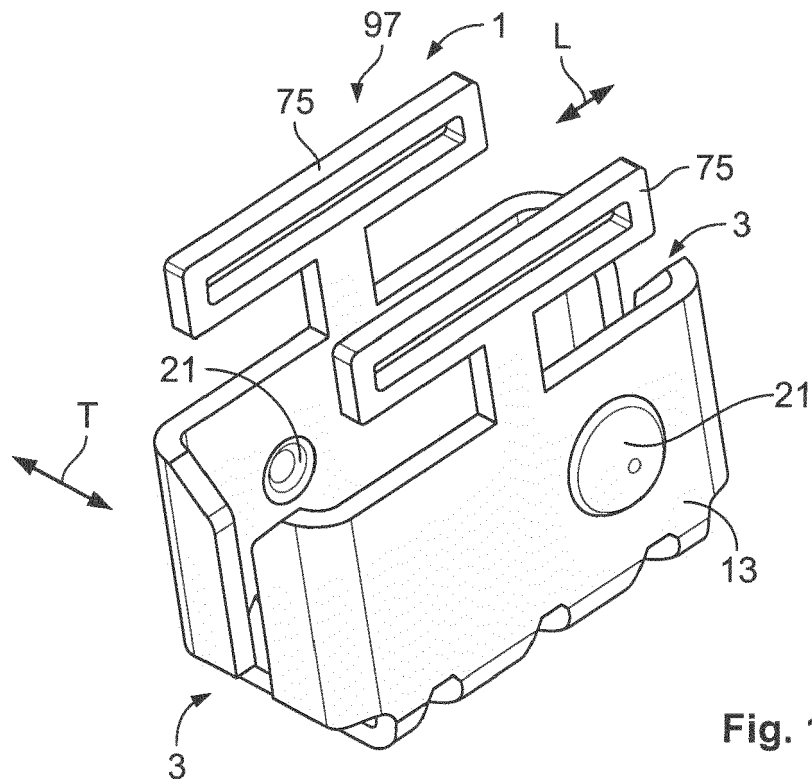


Fig. 16



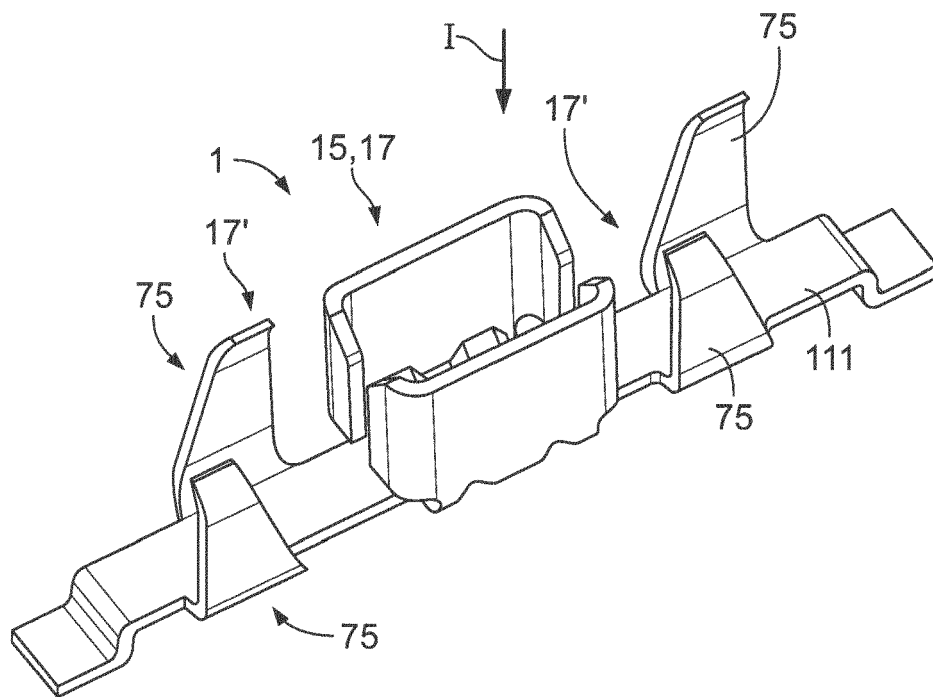


Fig. 19

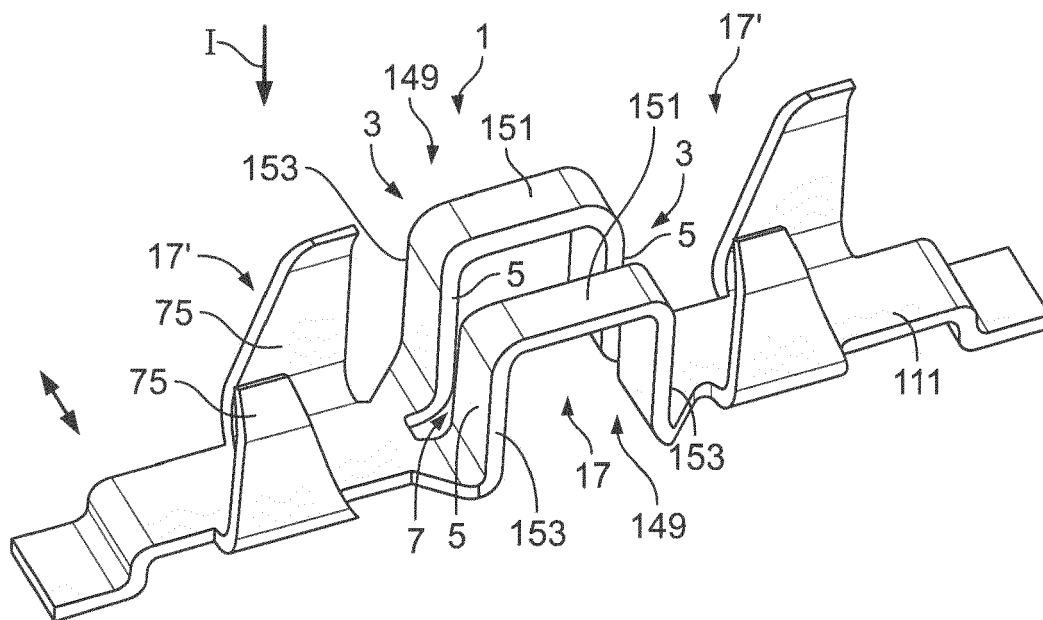


Fig. 20



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 Application Number
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		25 April 2017	Bouhana, Emmanuel
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