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(54) **AN ELECTRICAL CONNECTOR WITH PLUG CONTACT ELEMENTS OF PLATE MATERIAL**

ELEKTRISCHER VERBINDER MIT BLECH ALS STECKKONTAKTMATERIAL

**RACCORD ELECTRIQUE POSSEDANT DES ELEMENTS DE CONTACT CONSTITUES D'UN
MATERIAU EN PLAQUES**

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**DE-A- 1 540 643 US-A- 3 288 915
US-A- 3 371 152 US-A- 4 881 905**

- **Molex Full Line Catalog No. 870 (1977), pp. 1 and 7**

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Description

Background of the Invention

[0001] The invention relates to an electrical connector in accordance with the preamble of claim 1.

[0002] An electrical power connector provided with contact elements having a contact end designed as a plug contact of the type mentioned above is known from US-A-4,881,905.

[0003] Plug contact elements are usually made by pressing, flattening or another suitable mechanical processing from stiff, solid electrically conducting material. Embodiments of plug contacts are also known which are made up of two or more solid parts, each having, for example, a circular-sector-shaped cross section. These known plug contacts have the common characteristic that they form a stiff entity.

[0004] It has been found that such stiff plug contacts have a number of disadvantages which, in particular, weigh heavily in producing connectors having reduced dimensions for which there is a still growing requirement in view of the current trend for scale reduction (miniaturisation) of electronic components.

[0005] In contrast to a plug contact element made up of stiff solid material, plug contacts formed from plate material, have certain flexible properties. The two plate parts can be moved in the direction towards and away from one another and can also be displaced with respect to one another. This results in a self-aligning action on making contact to a further contact element having a contact end designed, for example, as socket contact when the two contact ends are not exactly in line with one another. In particular, in the case of connectors having relatively large numbers of plug contacts, for example 80 or more, this self-aligning action has a beneficial effect on achieving as low as possible an insertion force for the making of connector contact. Moreover, this self-aligning action promotes the contact reliability between the contact elements which are to make contact.

[0006] In the plug contact element known from US-A-4,881,905 the two oppositely spaced elongated plate parts are joined to the base part in a cantilevered manner. That is to say, the free ends of the plate parts are not in physical contact with one another. When contacting a further contact element, i.e. a socket contact element, the plate parts are deflected towards each other which produces a certain mechanical stress in the contact element. In order to reduce the amount of deflection and stress without affecting the thickness, length and material constant of the contact element, the width of the plate parts has to be enlarged. This however contravenes the current trend for scale reduction in the electronics field, i.e. designing small pitch miniature connectors.

[0007] The Molex 1987 General Catalogue : Molex Full Line Catalogue No. 870, discloses a press fit terminal for press fit connection to a printed circuit board. This

known terminal comprises three sections per beam : a connection section connected to a base part, an elongated section and a free end. The inner surfaces of the free ends of the beams are in physical contact. The elongated sections are curved.

[0008] DE-A-1,540,643 and US-A-3,371,152 disclose contact elements having connecting ends for wire wrap applications, comprising adjacently spaced elongated plate parts. However these plate parts are connected via an intermediate strip in longitudinal direction. For miniaturisation purposes these connecting ends have an insufficient self-aligning action on mating with a receiving contact element, due to said intermediate connecting strip.

Summary of the Invention

[0009] The object of the invention is therefore to provide an electrical connector having one or more contact elements provided with a contact end designed as plug contact, suitable in particular for miniaturisation purposes.

[0010] This object is achieved, according to the invention, in that the free ends of the plate parts are in physical contact.

[0011] In the contact element designed according to the invention, each plate part acts as a load support for the other, adjacent plate part. Thus, in the design of the invention, each plate part resembles a beam supported at both ends, in contrast to the cantilevered beams of the contact element known from US-A-4,881,905. It can be demonstrated that when contacting a further contact element, assuming the same length, width, thickness and material constant, the deflection and mechanical stress in the plate parts according to the invention are lower, in the order of magnitude of halve the values, compared to the prior art plug contact element.

[0012] Accordingly, the plate parts of the contact element according to the invention may have a smaller width compared to the prior art contact element when assuming the other variables constant. The mating socket or female contact element may also be less in width in order to accommodate lateral movements of the plug or male contact element. Hence, the plug contact element designed according to the invention has an inherent capability of producing small pitch miniature connectors, in particular so called signal connectors.

[0013] Test results have shown that the plug contact according to the invention causes significantly less wear on repeatedly making and breaking contact with a socket contact element compared with a stiff plug contact element. As an illustration, an unacceptable wear of the conducting coating layer of the socket contact occurred with the contact element according to the invention only after approximately 2000/3000 make-and-break cycles whereas this was already the case for 200/300 cycles with a stiff solid plug contact.

[0014] This lower wear of the contact faces of the

socket contact and the plug contact according to the invention can be explained, on the one hand, by the property, already mentioned, that the two plate parts of the plug contact according to the invention are compressible in the direction of one another. As a result, after introducing the free end of the plug contact into the socket contact, a contact force or normal force acts on the contact faces during the further introduction of the plug contact, which force is lower than in a comparable stiff, solid plug contact. In the latter case, this is because the normal force between the contact faces of the socket contact and the plug contact remains equal to the contact force after introducing the contact end of the relevant plug contact. It will be clear that, in the latter case, a greater normal force is exerted on the contact faces during the further introduction of the plug contact into the socket contact over a longer distance than in the case of the compressible plug contact according to the invention, which results, of course, in greater wear of the contact faces.

[0015] Because the contact element according to the invention is made of plate material without the need for a pressing or flattening processing of the contact surface as in the case of a plug contact made of solid material, the contact surface in the plug contact of the invention will be less rough than in a contact element known from the prior art, and this also has, on the other hand, a beneficial effect on the wear of the contact layer of the socket contact.

[0016] The invention provides a connector as defined in the outset and which is characterized by the characterizing features of claim 1.

[0017] Thus, damage to a socket contact is avoided as much as possible, because when the plug contact and a socket contact mate, the respective processed free ends of the plate parts do not engage the contact surface of the socket contact. A possible disturbance of the surface accuracy of the plate parts due to the mechanical action to cause the two plate parts to touch will not have a disadvantageous effect on the contact surface wear.

[0018] To facilitate the introduction of the plug contact into a socket contact, in an embodiment, the free ends of the plate parts are designed to taper towards one another, for example in conical or prismatic form.

[0019] If, however, connectors having plug contacts of greater stiffness are required for particular applications, this can be achieved, according to yet a further embodiment of the invention, in that the plate parts between the fixed and free end thereof are provided with one or more protuberances which face one another. By means of this relatively simple mechanical processing, the stiffness of the plug contact can expediently be increased to a desired value.

[0020] An advantageous embodiment of a connector having one or more plug contacts according to the invention is that in which the two plate parts are flat and have a flat contact surface, and form the boundary of an

interspace having an essentially hollow rectangular cross section. This plug contact can be made without damaging the faces which come into contact with the contact faces of a socket contact made of flat plate material having a predetermined surface accuracy and can be provided with desired spring properties by a suitable dimensioning.

[0021] An embodiment of a connector having a plug contact according to the invention, capable in particular of absorbing tolerance differences between mating connectors, is one wherein the two plate parts have a contact surface which is curved transversely to their longitudinal direction and form the boundary of an interspace having an essentially hollow, cylindrical cross section. The radius of curvature of the two plate parts can be relatively large, so that the surface accuracy of the two plate parts is not affected, or hardly affected, by the curving thereof.

[0022] In the case of a connector having a housing provided with one or more channels for receiving a contact element, the base part comprises a flat plate part provided with means for securing the contact element in the relevant channel of the housing. Suitable means for this purpose are, for example, retention hooks which, in the assembled state act on one or more walls of the channel and provide the necessary force for securing the contact element in the relevant channel by deforming (biting into) the surface of the walls.

[0023] In the preferred embodiment of the connector according to the invention which is particularly suitable for miniaturisation purposes, the securing means consist of at least one lip-shaped member which is raised with respect to the flat plate part, which lip-shaped member has an end which is joined in a resilient manner to the flat plate part and a free end which is raised with respect to the flat plate part, which free end of said lip-shaped member acts on a wall part of the associated channel of the housing in the assembled state of the contact element.

[0024] The lip-shaped member provides an adaptive securing action. In the state of the connector where contact has not been made, relatively light forces are exerted on the relevant wall parts of the channels as a consequence of the spring action of the lip-shaped member. When the contact elements make contact, however, the base part is pressed with force against the opposite wall part of the channel by the lip-shaped member, as a result of which an adequate securing force is provided in the insertion direction of the connector. The lip-shaped member causes no, or virtually no, mechanical damage (biting into) to the walls of a channel, as a result of which the securing member is particularly suitable for use in housings having relatively thin walls.

[0025] To connect the plug contact according to the invention to an electrical wiring, it is provided, in yet a further embodiment of the connector according to the invention, with a terminal end which is optionally designed as insulation-displacement contact, as solder

end, as wire-wrap terminal pin, or for clamping (press-fit, press-in) reception thereof in an aperture of a substrate. Of course, instead of a terminal end for wiring, the plug contact may also be provided with a further contact end which may also be designed per se as a plug contact or, for example, as a socket contact.

[0026] To prevent undesired rotation of the contact element in a channel of the housing, in yet a further embodiment of the connector according to the invention, wherein the housing is provided with channels having an essentially rectangular cross section, the fixed ends of the two plate parts and the adjoining base part form an essentially U-shaped cross section, the cross-sectional dimensions of the channel and the U-shaped section being mutually matched.

[0027] In particular, in contact elements provided with a terminal end for solder mounting, the hollow plug contacts according to the invention furthermore have the advantage that the space between the two plate parts functions as a receiving reservoir for solder flux. This appreciably reduces the risk of the outside surface, which makes contact, of the two plate parts being contaminated or coated with solder flux. This is in contrast to the solid contact elements known from the prior art in which solder flux can in general easily flow along the outside contact surface. The solder flux results in a corrosive action on the contact surface of the plug contact, due to which an additional cleaning treatment of the plug contacts is necessary in the case of such solid contact elements. It will be clear that this has an unfavourable effect on the cost price of the connector.

[0028] Compared with a similarly dimensioned solid plug contact, the plug contact according to the invention has better heat dissipation properties as a result of its relatively larger plate surface, due to which the plug contact according to the invention can carry a higher electrical current than a comparable solid plug contact. As a result of its greater heat dissipation capacity, the plug contact according to the invention is also suitable, in particular, for solder assembly.

[0029] Because relatively small thicknesses of plate material can be employed, the capacitive coupling between plug contacts situated adjacently to their edges will be less than in the case of solid, for example, square or rectangular, plug contacts. A small mutual capacitive coupling between the contact elements for a given pitch makes it possible to process signals of higher frequency. In view of the present trend to an ever faster processing of, for example, digital signals, this is also advantageous.

[0030] Figure 9 illustrates in elevation plug contacts according to the invention, made from a sheet of electrically conducting material, in combination with a terminal end or further contact elements according to one or more of Figures 5 to 8 inclusive.

Detailed Description of the Embodiments

[0031] Figure 1 shows a section of a contact element according to the invention having a base part 1 in the form of a flat plate, at one end of which two elongated flat plate parts 2, 3 extend opposite one another, which plate parts are joined in a fixed manner to the base part 1 by means of an end 4 or 5, respectively, and form a plug or male contact according to the invention. The free ends 6 and 7, respectively, of the two plate parts 2, 3 are designed to taper in prism form towards one another, such that they touch one another. Between the two plate parts 2, 3 there is a hollow interspace 8 having an essentially rectangular cross section.

[0032] Figure 2 shows a plug contact according to the invention, made up of plate parts 9, 10 as in Figure 1, which plate parts 9, 10 form the boundary of a curved surface, as is shown enlarged in cross section. The two curved plate parts 9, 10 are joined in a fixed manner to the base part 1 by means of an end 11 or 12, respectively, and their free ends 13 and 14, respectively, are designed to taper conically and touching one another. As is evident from the enlarged cross section, the curved plate parts 9, 10 form the boundary of an essentially elliptical cylindrical hollow interspace 15.

[0033] Instead of the elliptical cross section 15 shown, the two plate parts 9, 10 can, of course, form the boundary of any other suitable cross section, for example, a circular or saddle-shaped cross section.

[0034] The two plate parts 6, 7 or 9, 10, respectively, have certain flexible spring properties, as a result of which they can be moved in the direction to, and away from, one another and can be displaced with respect to one another. As a result, the plug contact has a self-aligning action on making contact to a further contact element if the two contact ends do not lie precisely in line with one another or if the centre lines of the two contact elements make an angle with one another, which may occur in practice as a consequence of tolerances in the dimensions of the connector housings and/or of the contact elements themselves. The insertion force for making contact with the flexible self-aligning plug contact according to the invention is less than in a comparable solid, stiff plug contact. This is advantageous, in particular, when connectors having a plurality of contact elements, for example 80 or more, mate.

[0035] A plug contact made up of flat plate parts 2, 3 has a greater flexible action than a plug contact made up of curved plate parts, for example the plate parts 9, 10. Apart from the shape of the plate parts, the flexible properties of the plug contact according to the invention may also be affected by providing protuberances 16, 17 in the direction of the interspace 8 in one or both surfaces of the plate parts, as shown in Figure 3.

[0036] To secure the plug contact in a channel of a housing, the base part 1 is provided with securing means, for example in the form of a lip-shaped securing member 18 which extends from the face of the base part

1 and which is formed out of the face of the base part 1 in the embodiment shown. The lip-shaped securing member 18 is in this case joined in a fixed and resilient manner to the base part 1 by means of its end 19 adjacent to the plug contact, whereas the free end 20 of the securing member 18 is raised with respect to the base part 1 adjacent to a terminal end 21 joined to the base part 1, which terminal end 21 is shown partly broken away in Figures 1-3.

[0037] Figure 4 shows in cross-sectional view, a connector 22 provided with a plurality of contact elements 23 having a plug contact according to Figure 1 in the position where contact is made to a further connector 24 provided with a plurality of contact elements 25 having a contact end 26 designed as socket or female contact. In the embodiment shown, the contact element 23 has a terminal end in the form of a solder end 27 which is received in an opening 28 of, for example, a printed circuit board 29 for connection to the wiring of the board 29 by means of soldering. The contact elements 25 in the connector 24 are also provided with a terminal end in the form of a solder end 30 for connection by soldering in an opening 32 of a printed circuit board 31.

[0038] The contact element 23 extends in a channel 33 of the connector 22 by means of its base part 1 and the ends 4, 5 of the two plate parts 2, 3, which ends 4, 5 form the boundary, together with the relevant end of the base part, of a U-shaped cross section. The cross-sectional dimensions of this channel 33 are matched to the dimensions of the base part 1 and the U-shaped end formed by the ends 4, 5 or 11, 12, respectively, in the embodiment of Figure 2 in such a way that rotation of the plug contact is impeded as much as possible. The plug contact itself extends in a U-shaped space formed by walls 34, 35 and a bottom part 36 of the plastic connector housing, for receiving a section 37 of the plastic housing of the connector 24, in which section 37 channels 38 are formed for receiving the socket contacts 26.

[0039] In the position shown in which the plug contact according to the invention and the socket contact 26 mate, it can clearly be seen that the contact faces 39 of the socket contact 26 make contact to the plate parts 2, 3 or 9, 10, respectively, of the plug contact in the vicinity of their end 4, 5 or 11, 12, respectively, which is joined in a fixed manner to the base part 1.

[0040] During the insertion of the two connectors 22, 24, the socket contact 26 is opened by means of the relatively stiff free end of the plug contact, comparable to the insertion of a stiff plug contact. During the subsequent further insertion of the connectors, a lower normal force will be exerted on the contact faces of the outwardly facing surface of the plate parts 2, 3; 9, 10 than in the case of a stiff plug contact with uniform cross section as a consequence of the flexible action of the two plate parts 2, 3 or 9, 10, respectively, of the plug contact according to the invention which are able to move in the direction of one another, whereas the normal force between the contact faces of a known stiff plug contact re-

maining the same during the insertion of the connectors. The reduction in the normal force with the plug contact according to the invention contributes to a lower wear of the relevant contact faces. As a result, a larger number of make-and-break cycles can be carried out with the plug contact according to the invention than with a stiff plug contact according to the prior art before an unacceptable wear of the contact faces occurs. Tests have shown that the number of make-and-break cycles with the plug contact according to the invention can be a factor of 10 higher than with a known stiff plug contact.

[0041] The plug contacts shown in Figure 1, 2 and 3 can be provided with terminal ends 21 in the form of, for example, solder or wire-wrap pins 50-54, as shown in Figures 5a-e, the pins 53 and 54 being suitable, in particular, for surface mounting technology, or in the form of, for example, insulation-displacement contacts 55, 56, 57, as shown in Figures 6a-c or in the form of, for example, terminal ends 58, 59, 60 suitable for clamping in an opening of a substrate, as shown in Figures 7a-c, alternatively referred to as press-fit or press-in terminal ends.

[0042] In addition to terminal ends for the connection of electrical wiring, the plug contact according to the invention may, of course, also be provided with a further plug contact joined to the base part 1, or with a further contact end designed as socket contact 61, or with a further contact end, designed as contact finger 62, for making contact, for example, to a contact face at the edge of a substrate, or with a contact end 63, equipped with two contact fingers situated at a distance from one another, for making contact, for example, to contact faces on both sides of a printed circuit board, as shown respectively in Figures 8a-c.

[0043] Figures 9a-c show various contact element combinations having a plug contact according to Figure 1 viewed towards the edges of the flat plate parts 2, 3, which have been made by punching and then folding from a sheet 65 of electrically conducting material having a thickness, for example, of 0.15 mm. In Figures 9a, b and c, the tips of the beams 2 and 3 are depicted only in rough, schematic form.

[0044] The contact element according to the invention can advantageously be made as a whole by a single punching process from a sheet of electrically conducting material, the surfaces remote from the punching direction being positioned facing one another, for example, by folding. This has the advantage that any burrs extending in the punching direction at the edges of the two plate parts extend into the interspace between the two plate parts and the surfaces of the plate material facing outwards remain undamaged for making contact to a further connector for the purpose of the invention. It will be clear that this has a beneficial effect on the wear, the contact reliability and the contact resistance on making contact to a further connector.

[0045] A further electrical connector according to the invention is defined by independent claim 14.

[0046] The invention also relates to contact elements as described and claimed in independent claims 13 and 15.

[0047] The invention is explained in greater detail below by reference to some preferred embodiments.

Brief Description of the Drawings

[0048] Figures 1, 2, 3 show diagrammatically and in perspective various preferred embodiments of contact ends according to the invention designed as a plug contact.

[0049] Figure 4 shows diagrammatically a cross-sectional view of a connector having a plug contact according to the invention in the position where contact is made to a further connector.

[0050] Figures 5, 6 and 7 show diagrammatically and in perspective various embodiments of terminal ends for a plug contact according to the invention. Figures 7b and 7c are disclaimed from protection by the claims.

[0051] Figure 8 shows diagrammatically and in perspective various embodiments of a further contact end for combination with the plug contact according to the invention.

[0052] Figure 9a shows a plug contact having a solder end 50, Figure 9b shows a plug contact having a socket contact 61, and Figure 9c shows a plug contact having an insulation-displacement contact 55. The plug contact shown in Figure 9b has protuberances 40 provided near the fixed ends 4, 5 of the plate parts, which protuberances 40, like the protuberances 16, 17 shown in Figure 3, serve to increase the stiffness of the plug contact. The contact face of the plug contact is not affected by the protuberances 40.

[0053] It will be clear that the invention is not limited to the embodiments shown, but that deviations and additions which are obvious to the person skilled in the art are possible without departing from the inventive idea underlying the invention which is defined by the claims.

Claims

1. An electrical connector comprising a housing of electrically insulating material, provided with at least one contact element of electrically conducting material having a contact end, extending from a base part (1) and designed as a plug contact, for making contact to a further contact element, in which said contact end is made up of two oppositely spaced elongate plate parts (2, 3; 9, 10; 58; 59) extending from the base part (1) oppositely along a centre line of the contact element, each of said elongate plate parts (2, 3; 9, 10; 58; 59) having a connection section, an elongate section (2, 3; 9, 10; 58; 59) and a free end (6, 7; 13, 14) with an outwardly extending free end edge, each connection section being fixedly joined to said base part (1), said elongate sections having inner surfaces facing one another and outer surfaces for contacting said further contact element, characterized in that, in the condition of non contacting said further contact element, the outwardly extending free end edge of each free end (6, 7; 13, 14) of the plate parts are in physical contact, whereby the respective processed free ends of the plate parts do not engage the contact surface of the further contact element during insertion, and the inner and outer surfaces of said elongate sections are substantially straight seen in a direction parallel to said centre line.

2. An electrical connector according to claim 1, wherein the free ends (6, 7; 13, 14) of said plate parts (2, 3; 9, 10; 58; 59) are provided with outer surfaces which are designed to taper towards one another.

3. An electrical connector according to claim 1 or 2 wherein said base part (1) is provided with a substantially flat plate part and two walls (4, 5; 11, 12) extending from said flat plate part and each connected to one of said elongate plate parts (2, 3; 9, 10) through said connection sections, said substantially flat plate part and two walls (4, 5; 11, 12) defining an open U-shaped cross section.

4. An electrical connector according to Claim 1, wherein the plate parts, between the fixed and free end thereof, are provided with one or more protuberances which face one another.

5. An electrical connector according to Claim 1, wherein the two plate parts are flat and have a flat contact surface, and form the boundary of an interspace having an essentially hollow, rectangular cross section.

6. An electrical connector according to Claim 1, wherein the two plate parts have a contact surface which is curved transversely to their longitudinal direction and form the boundary of an interspace having an essentially hollow, cylindrical cross section.

7. An electrical connector according to Claim 2, wherein the free ends of the two plate parts are designed to taper in an approximately conical or prismatic form.

8. An electrical connector according to Claim 1, wherein the base part comprises a flat plate part provided with means for securing the contact element in a channel of the housing.

9. An electrical connector according to Claim 8, wherein the securing means comprise at least one lip-shaped member which is raised with respect to the flat plate part, which lip-shaped member has an

end which is fixedly joined in a resilient manner to the flat plate part and a free end which is raised with respect to the flat plate part, which free end of said lip-shaped member acts on a wall part of the associated channel of the housing.

10. An electrical connector according to Claim 3, wherein the housing is provided with channels having an essentially rectangular cross section for receiving a contact element, the cross-sectional dimensions of the channel and said U-shaped cross section being mutually matched to secure the contact element so as to impede rotation.

11. An electrical connector according to Claim 1, wherein the contact element is provided with a terminal end extending from the base part for the connection of electrical wiring, which terminal end is optionally designed as insulation-displacement contact, as solder end, as wire-wrap terminal pin or for the clamping reception thereof in an aperture of a substrate.

12. An electrical connector according to Claim 1, wherein the contact element is provided with a further contact end, extending from the base part, for making contact to a yet further connector, which further contact end is optionally designed as plug contact or socket contact.

13. A contact element of electrically conducting material having a contact end, extending from a base part (1) and designed as a plug contact, for making contact to a further contact element, in which said contact end is made up of two oppositely spaced elongate plate parts (2, 3; 9, 10; 58; 59) extending from the base part (1) oppositely along a centre line of the contact element, each of said elongate plate parts (2, 3; 9, 10; 58; 59) having a connection section, an elongate section (2, 3; 9, 10; 58; 59) and a free end (6, 7; 13, 14) with an outwardly extending free end edge, each connection section being fixedly joined to said base part (1), said elongate sections having inner surfaces facing one another and outer surfaces for contacting said further contact element, characterized in that, in the condition of non contacting said further contact element, the outwardly extending free end edge of each free end (6, 7; 13, 14) of the plate parts are in physical contact, whereby the respective processed free ends of the plate parts do not engage the contact surface of the further contact element during insertion, and the inner and outer surface of said elongate sections are substantially straight seen in a direction parallel to said centre line.

14. An electrical connector comprising a housing of electrically insulating material, provided with at

least one contact element of electrically conducting material having a contact end, extending from a base part (1) and designed as a plug contact, for making contact to a further contact element, in which said contact end is made up of two oppositely spaced elongate plate parts (2, 3; 9, 10; 58; 59) extending from the base part (1) oppositely along a centre line of the contact element, each of said elongate plate parts (2, 3; 9, 10; 58; 59) having a connection section, an elongate section (2, 3; 9, 10; 58; 59) and a free end (6, 7; 13, 14) with an outwardly extending free end edge, each connection section being fixedly joined to said base part (1), characterized in that, in the condition of non contacting said further contact element, the outwardly extending free end edge of each free end (6, 7; 13, 14) of the plate parts are in physical contact, whereby the respective processed free ends of the plate parts do not engage the contact surface of the further contact element during insertion, and wherein the free ends (6, 7; 13, 14) of said plate parts (2, 3; 9, 10; 58; 59) are provided with outer surfaces which are designed to taper towards one another.

15. A contact element of electrically conducting material having a contact end, extending from a base part (1) and designed as a plug contact, for making contact to a further contact element, in which said contact end is made up of two oppositely spaced elongate plate parts (2, 3; 9, 10; 58; 59) extending from the base part (1) oppositely along a centre line of the contact element, each of said elongate plate parts (2, 3; 9, 10; 58; 59) having a connection section, an elongate section (2, 3; 9, 10; 58; 59) and a free end (6, 7; 13, 14) with an outwardly extending free end edge, each connection section being fixedly joined to said base part (1) characterized in that, in the condition of non contacting said further contact element, the outwardly extending free end edge of each free end (6, 7; 13, 14) of the plate parts are in physical contact, whereby the respective processed free ends of the plate parts do not engage the contact surface of the further contact element during insertion, and wherein the free ends (6, 7; 13, 14) of said plate parts (2, 3; 9, 10; 58; 59) are provided with outer surfaces which are designed to taper towards one another.

Patentansprüche

1. Elektrischer Steckverbinder, enthaltend ein Gehäuse aus elektrisch isolierendem Material, das mit wenigstens einem Kontaktelement aus elektrisch leitendem Material versehen ist, welches ein Kontaktelement hat, das sich von einem Basisteil (1) erstreckt und als Steckkontakt ausgebildet ist zur Herstellung eines Kontakts mit einem weiteren Kontaktelement,

wobei dieses Kontaktende aus zwei im Abstand gegenüberliegenden, länglichen Plattenteilen (2, 3; 9, 10; 58; 59) besteht, die sich vom Basisteil (1) aus gegenüberliegend längs einer Mittellinie des Kontaktelementes erstrecken, wobei jedes der länglichen Plattenteile (2, 3; 9, 10; 58; 59) einen Verbindungsabschnitt, einen länglichen Abschnitt (2, 3; 9, 10; 58; 59) und ein freies Ende (6, 7; 13, 14) mit einer sich nach außen erstreckenden freien Endkante hat, jeder Verbindungsabschnitt fest mit dem Basisteil (1) verbunden ist, die länglichen Abschnitte Innenflächen, die einander zugewandt sind, und Außenflächen zur Kontakt Herstellung mit dem weiteren Kontaktelement aufweisen, dadurch gekennzeichnet, daß in dem Zustand, in dem kein Kontakt mit dem weiteren Kontaktelement besteht, sich die freie, sich nach außen erstreckende Endkante jedes freien Endes (6, 7; 13, 14) der Plattenteile in körperlichem Kontakt befindet, wodurch die betreffenden, bearbeiteten freien Enden der Plattenteile während des Einsetzens nicht die Kontaktflächen des weiteren Kontaktelements berühren, und die Innen- und Außenflächen der länglichen Abschnitte in einer parallel zu der Mittellinie gesehenen Richtung im wesentlichen gerade sind.

2. Elektrischer Steckverbinder nach Anspruch 1, wobei die freien Enden (6, 7; 13, 14) der Plattenteile (2, 3; 9, 10; 58; 59) mit Außenflächen versehen sind, die so ausgebildet sind, daß sie aufeinander zu laufen.

3. Elektrischer Steckverbinder nach Anspruch 1 oder 2, wobei das Basisteil (1) mit einem im wesentlichen flachen Plattenteil und zwei Wänden (4, 5; 11, 12) versehen ist, die sich von dem flachen Plattenteil erstrecken und über den Verbindungsabschnitt jeweils mit einem der länglichen Plattenteile (2, 3; 9, 10) verbunden sind, wobei der im wesentlichen flache Plattenteil und die zwei Wände (4, 5; 11, 12) einen U-förmigen Querschnitt bilden.

4. Elektrischer Steckverbinder nach Anspruch 1, wobei die Plattenteile zwischen ihrem befestigten und ihrem freien Ende mit einem oder mehreren einander zugewandten Vorsprüngen versehen sind.

5. Elektrischer Steckverbinder nach Anspruch 1, wobei die beiden Plattenteile eben sind, eine ebene Kontaktfläche haben und die Begrenzung eines Zwischenraums mit einem im wesentlichen hohlen, rechteckigen Querschnitt bilden.

6. Elektrischer Steckverbinder nach Anspruch 1, wobei die beiden Plattenteile eine quer zu ihrer Längsrichtung gekrümmte Kontaktfläche haben und die Begrenzung eines Zwischenraums mit einem im wesentlichen hohlen, zylindrischen Querschnitt bilden.

den.

7. Elektrischer Steckverbinder nach Anspruch 2, wobei die freien Enden der beiden Plattenteile so ausgelegt sind, daß sie sich ungefähr kegelförmig oder prismatisch verjüngen.

8. Elektrischer Steckverbinder nach Anspruch 1, wobei der Basisteil einen ebenen Plattenteil enthält, der mit Mitteln zur Befestigung des Kontaktelements in einem Kanal des Gehäuses versehen ist.

9. Elektrischer Steckverbinder nach Anspruch 8, wobei die Befestigungsmittel wenigstens ein lippenförmiges Glied enthalten, das gegenüber dem ebenen Plattenteil erhoben ist, wobei das lippenförmige Glied ein Ende hat, das auf eine federnde Weise fest mit dem ebenen Plattenteil verbunden ist, und ein freies Ende hat, das gegenüber dem ebenen Plattenteil erhoben ist, wobei das freie Ende des lippenförmigen Glieds an einem Wandteil des zugehörigen Kanals des Gehäuses angreift.

10. Elektrischer Steckverbinder nach Anspruch 3, wobei das Gehäuse mit Kanälen mit im wesentlichen rechteckigem Querschnitt zur Aufnahme eines Kontaktelements versehen ist, wobei die Querschnittsabmessungen des Kanals und des U-förmigen Querschnitts aneinander angepaßt sind, um das Kontaktelement zur Verhinderung einer Drehung festzulegen.

11. Elektrischer Steckverbinder nach Anspruch 1, wobei das Kontaktelement mit einem Anschlußende versehen ist, das sich für den Anschluß der elektrischen Verdrahtung vom Basisteil aus erstreckt, wobei das Anschlußende wahlweise ausgelegt ist als Isolierungsverdrängungskontakt, als Lötende, als Wire-Wrap-Anschlußstift oder für seine klemmende Aufnahme in einer Öffnung eines Substrats.

12. Elektrischer Steckverbinder nach Anspruch 1, wobei das Kontaktelement mit einem weiteren Kontaktende versehen ist, das sich vom Basisteil aus erstreckt, um einen Kontakt mit noch einem weiteren Steckverbinder herzustellen, wobei das weitere Kontaktende wahlweise als Steckkontakt oder Buchsenkontakt ausgelegt ist.

13. Kontaktelement aus elektrisch leitendem Material mit einem Kontaktende, das sich von einem Basisteil (1) erstreckt und als Steckkontakt ausgebildet ist zur Herstellung eines Kontakts mit einem weiteren Kontaktelement, wobei dieses Kontaktende aus zwei im Abstand gegenüberliegenden, länglichen Plattenteilen (2, 3; 9, 10; 58; 59) besteht, die sich vom Basisteil (1) aus gegenüberliegend längs einer Mittellinie des Kontaktelementes erstrecken, wobei

jedes der länglichen Plattenteile (2, 3; 9, 10; 58; 59) einen Verbindungsabschnitt, einen länglichen Abschnitt (2, 3; 9, 10; 58; 59) und ein freies Ende (6, 7; 13, 14) mit einer sich nach außen erstreckenden freien Endkante hat, jeder Verbindungsabschnitt fest mit dem Basisteil (1) verbunden ist und die länglichen Abschnitte Innenflächen, die einander zugewandt sind, und Außenflächen zur Kontaktherstellung mit dem weiteren Kontaktelement aufweisen, dadurch gekennzeichnet, daß in dem Zustand, in dem kein Kontakt mit dem weiteren Kontaktelement besteht, sich die freie, sich nach außen erstreckende Endkante jedes freien Endes (6, 7; 13, 14) der Plattenteile in körperlichem Kontakt befindet, wodurch die betreffenden, bearbeiteten freien Enden der Plattenteile während des Einsetzens nicht die Kontaktflächen des weiteren Kontaktelements berühren, und die Innen- und Außenflächen der länglichen Abschnitte in einer parallel zu der Mittellinie gesehenen Richtung im wesentlichen gerade sind.

14. Elektrischer Steckverbinder mit einem Gehäuse aus elektrisch isolierendem Material, das mit wenigstens einem Kontaktelement aus elektrisch leitendem Material versehen ist, welches ein Kontaktende hat, das sich aus einem Basisteil (1) erstreckt und als Steckkontakt ausgebildet ist zur Herstellung eines Kontakts mit einem weiteren Kontaktelement, wobei das Kontaktende aus zwei im Abstand gegenüberliegenden, länglichen Plattenteilen (2, 3; 9, 10; 58; 59) besteht, die sich vom Basisteil (1) aus gegenüberliegend längs einer Mittellinie des Kontaktelementes erstrecken, wobei jedes der länglichen Plattenteile (2, 3; 9, 10; 58; 59) einen Verbindungsabschnitt, einen länglichen Abschnitt (2, 3; 9, 10; 58; 59) und ein freies Ende (6, 7; 13, 14) mit einer sich nach außen erstreckenden freien Endkante hat und jeder Verbindungsabschnitt fest mit dem Basisteil (1) verbunden ist, dadurch gekennzeichnet, daß in dem Zustand, in dem kein Kontakt mit dem weiteren Kontaktelement besteht, sich die freie, sich nach außen erstreckende Endkante jedes freien Endes (6, 7; 13, 14) der Plattenteile in körperlichem Kontakt befindet, wodurch die betreffenden, bearbeiteten freien Enden der Plattenteile während des Einsetzens nicht die Kontaktflächen des weiteren Kontaktelements berühren, und wobei die freien Enden (6, 7; 13, 14) der Plattenteile (2, 3; 9, 10; 58; 59) mit Außenflächen versehen sind, die so aufgebildet sind, daß sie aufeinander zu laufen.

15. Kontaktelement aus elektrisch leitendem Material mit einem Kontaktende, das sich aus einem Basisteil (1) erstreckt und als Steckkontakt ausgebildet ist zur Herstellung eines Kontakts mit einem weiteren Kontaktelement, wobei dieses Kontaktende aus zwei im Abstand gegenüberliegenden, länglichen

Plattenteilen (2, 3; 9, 10; 58; 59) besteht, die sich vom Basisteil (1) aus gegenüberliegend längs einer Mittellinie des Kontaktelementes erstrecken, wobei jedes der länglichen Plattenteile (2, 3; 9, 10; 58; 59) einen Verbindungsabschnitt, einen länglichen Abschnitt (2, 3; 9, 10; 58; 59) und ein freies Ende (6, 7; 13, 14) mit einer sich nach außen erstreckenden freien Endkante hat und jeder Verbindungsabschnitt fest mit dem Basisteil (1) verbunden ist, dadurch gekennzeichnet, daß in dem Zustand, in dem kein Kontakt mit dem weiteren Kontaktelement besteht, sich die freie, sich nach außen erstreckende Endkante jedes freien Endes (6, 7; 13, 14) der Plattenteile in körperlichem Kontakt befindet, wodurch die betreffenden, bearbeiteten freien Enden der Plattenteile während des Einsetzens nicht die Kontaktflächen des weiteren Kontaktelements berühren, und wobei die freien Enden (6, 7; 13, 14) der Plattenteile (2, 3; 9, 10; 58; 59) mit Außenflächen versehen sind, die so aufgebildet sind, daß sie aufeinander zu laufen.

Revendications

1. Un connecteur électrique comprenant un boîtier en matériau électriquement isolant pourvu de au moins un élément de contact en matériau électriquement conducteur présentant une extrémité de contact, s'étendant à partir d'une partie de base (1) et réalisée sous forme d'un contact mâle, pour établir un contact avec un autre élément de contact, dans lequel ladite extrémité de contact est composée de deux parties de plaque allongées espacées, en opposition (2, 3; 9, 10; 58; 59), s'étendant à partir de la partie de base (1), en opposition le long d'une ligne médiane de l'élément de contact, chacune desdites parties de plaque allongées (2, 3; 9, 10; 58; 59) présentant un tronçon de raccordement, un tronçon allongé (2, 3; 9, 10; 58; 59) et une extrémité libre (6, 7; 13, 14) avec un bord d'extrémité libre s'étendant vers l'extérieur, chaque tronçon de raccordement étant relié de façon fixe à ladite partie de base (1), lesdits tronçons allongés présentant des surfaces internes se faisant face l'une l'autre et des surfaces extérieures pour venir en contact avec ledit autre élément de contact, caractérisé en ce que, dans l'état d'absence de contact avec ledit autre élément de contact, les bords d'extrémité libres s'étendant vers l'extérieur de chacune des extrémités libres (6, 7; 13, 14) des parties de plaque se trouvent en contact physique, de sorte que les extrémités libres traitées respectives des parties de plaque ne viennent pas en contact avec la surface de contact de l'autre élément de contact pendant l'insertion, et que les surfaces internes et externes desdits tronçons allongés sont sensiblement rectilinéaires, vues dans une direction paral-

lèle à ladite ligne médiane.

2. Un connecteur électrique selon la revendication 1, dans lequel les extrémités libres (6, 7 ; 13, 14) desdites parties de plaque (2, 3 ; 9, 10 ; 58, 59) présentent des surfaces extérieures conçues pour s'effiler l'une vers l'autre. 5
3. Un connecteur électrique selon la revendication 1 ou 2, dans lequel ladite partie de base (1) est munie d'une partie de plaque sensiblement plane et de deux parois (4, 5 ; 11, 12) s'étendant à partir de ladite partie de plaque plane et dont chacune des parois est reliée à l'une desdites parties de plaque allongées (2, 3 ; 9, 10) via lesdits tronçons de raccordement, ladite partie de plaque sensiblement plane et les deux parois (4, 5 ; 11, 12) définissant un tronçon transversale en forme de U ouvert. 10 15
4. Un connecteur électrique selon la revendication 1, dans lequel les parties de plaque, entre leurs extrémités fixes et libres, sont pourvues d'une ou plusieurs saillies se faisant mutuellement face. 20
5. Un connecteur électrique selon la revendication 1, dans lequel les deux parties de plaque sont plates et comportent une surface de contact plate, et forment la limite d'un intervalle ayant un tronçon transversale, sensiblement creuse et rectangulaire. 25 30
6. Un connecteur électrique selon la revendication 1, dans lequel les deux parties de plaque ont une surface de contact incurvée transversalement à leur direction longitudinale et forment la limite d'un intervalle ayant un tronçon transversale sensiblement creuse et cylindrique. 35
7. Un connecteur électrique selon la revendication 1, dans lequel les extrémités libres des deux parties de plaque sont agencées pour s'effiler selon une forme approximativement conique ou prismatique. 40
8. Un connecteur électrique selon la revendication 1, dans lequel la partie de base comprend une partie de plaque plate pourvue de moyens pour fixer l'élément de contact dans un canal du boîtier. 45
9. Un connecteur électrique selon la revendication 8, dans lequel les moyens de fixation comprennent, au moins, un élément en forme de lèvres qui est soulevé par rapport à la partie de plaque plane, ledit élément en forme de lèvres ayant une extrémité reliée fixe et de manière élastique, à la partie de plaque plane et une extrémité libre qui est soulevée par rapport à la partie de plaque plane, laquelle extrémité libre dudit élément en forme de lèvres agit sur une partie de paroi du canal associé du boîtier. 50 55

10. Un connecteur électrique selon la revendication 3, dans lequel le boîtier est pourvu de canaux de tronçon transversale sensiblement rectangulaire pour recevoir un élément de contact, les dimensions en coupe transversale du canal et de la section transversale en forme de U étant mutuellement adaptées pour fixer l'élément de contact pour empêcher sa rotation.
11. Un connecteur électrique selon la revendication 1, dans lequel l'élément de contact est pourvu d'une extrémité terminale s'étendant à partir de la partie de base pour le branchement du câblage électrique, ladite extrémité terminale étant réalisée, facultativement, comme un contact à déplacement d'isolement, comme une extrémité à souder, comme une broche d'extrémité à enroulement de fil ou pour être reçu avec pincement dans une ouverture d'un substrat.
12. Un connecteur électrique selon la revendication 1, dans lequel l'élément de contact, est pourvu d'une autre extrémité de contact s'étendant, à partir de la partie de base pour établir le contact avec un autre connecteur supplémentaire, ladite autre extrémité de contact étant réalisée, facultativement, comme un contact mâle ou un contact femelle.
13. Un élément de contact en matériau électriquement conducteur présentant une extrémité de contact, s'étendant à partir d'une partie de base (1) et réalisée sous forme d'un contact mâle, pour établir le contact avec un autre élément de contact, dans lequel ladite extrémité de contact est composée de deux parties de plaque allongées espacées, en opposition (2, 3 ; 9, 10 ; 58 ; 59), s'étendant à partir de la partie de base (1), en opposition le long d'une ligne médiane de l'élément de contact, chacune desdites parties de plaque allongées (2, 3 ; 9, 10 ; 58 ; 59) présentant un tronçon de raccordement, un tronçon allongé (2, 3 ; 9, 10 ; 58 ; 59) et une extrémité libre (6, 7 ; 13, 14) avec un bord d'extrémité libre s'étendant vers l'extérieur, chaque tronçon de raccordement étant relié de façon fixe à ladite partie de base (1), lesdits tronçons allongés présentant des surfaces internes se faisant face l'une l'autre et des surfaces extérieures pour venir en contact avec ledit autre élément de contact, caractérisé en ce que, dans l'état d'absence de contact avec ledit autre élément de contact, les bords d'extrémité libres qui s'étendent vers l'extérieur de chaque extrémité libre (6, 7 ; 13, 14) des parties de plaque se trouvent en contact physique, de sorte les extrémités libres traitées respectives des parties de plaque ne viennent pas en contact avec la surface de contact de l'autre élément de contact pendant l'insertion, et que les surfaces internes et externes desdits tronçons allongés sont sensiblement rectilignes,

vues dans une direction parallèle à ladite ligne médiane.

14. Un connecteur électrique comprenant un boîtier en matériau électriquement isolant pourvu d'au moins un élément de contact en matériau électriquement conducteur présentant une extrémité de contact, s'étendant à partir d'une partie de base (1) et réalisée sous forme d'un contact mâle, pour établir un contact avec un autre élément de contact, dans lequel ladite extrémité de contact est composée de deux parties de plaque allongées espacées, en opposition (2, 3 ; 9, 10 ; 58 ; 59), s'étendant à partir de la partie de base (1), s'opposant le long d'une ligne médiane de l'élément de contact, chacune desdites parties de plaque allongées (2, 3 ; 9, 10 ; 58 ; 59) présentant un tronçon de raccordement, un tronçon allongé (2, 3 ; 9, 10 ; 58 ; 59) et une extrémité libre (6, 7 ; 13, 14) avec un bord d'extrémité libre s'étendant vers l'extérieur, chaque tronçon de raccordement étant relié de façon fixe à ladite partie de base (1), caractérisé en ce que, dans l'état d'absence de contact avec ledit autre élément de contact, le bord d'extrémité libre qui s'étend vers l'extérieur de chaque extrémité libre (6, 7 ; 13, 14) des parties de plaque se trouve en contact physique, de sorte les extrémités libres traitées respectives des parties de plaque ne viennent pas en contact avec la surface de contact dudit autre élément de contact pendant l'insertion, et dans lequel les extrémités libres (6, 7 ; 13, 14) desdites parties de plaque (2, 3 ; 9, 10 ; 58, 59) présentent des surfaces extérieures conçues pour s'effiler l'une vers l'autre.
15. Un élément de contact en matériau électriquement conducteur présentant une extrémité de contact, s'étendant à partir d'une partie de base (1) et réalisée sous forme d'un contact mâle, pour établir un contact avec un autre élément de contact, dans lequel ladite extrémité de contact est composée de deux parties de plaque allongées espacées, en opposition (2, 3 ; 9, 10 ; 58 ; 59), s'étendant à partir de la partie de base (1), s'opposant le long d'une ligne médiane de l'élément de contact, chacune desdites parties de plaque allongées (2, 3 ; 9, 10 ; 58 ; 59) présentant un tronçon de raccordement, un tronçon allongé (2, 3 ; 9, 10 ; 58 ; 59) et une extrémité libre (6, 7 ; 13, 14) avec un bord d'extrémité libre s'étendant vers l'extérieur, chaque tronçon de raccordement étant relié de façon fixe à ladite partie de base (1), caractérisé en ce que, dans l'état d'absence de contact avec ledit autre élément de contact, le bord d'extrémité libre qui s'étend vers l'extérieur de chaque extrémité libre (6, 7 ; 13, 14) des parties de plaque se trouve en contact physique, de sorte que les extrémités libres traitées respectives des parties de plaque ne viennent pas en contact avec la surface de contact de l'autre élément de contact pendant

l'insertion, et dans lequel les extrémités libres (6, 7 ; 13, 14) desdites parties de plaque (2, 3 ; 9, 10 ; 58, 59) présentent des surfaces extérieures conçues pour s'effiler l'une vers l'autre.

fig - 1 fig - 2 fig - 3

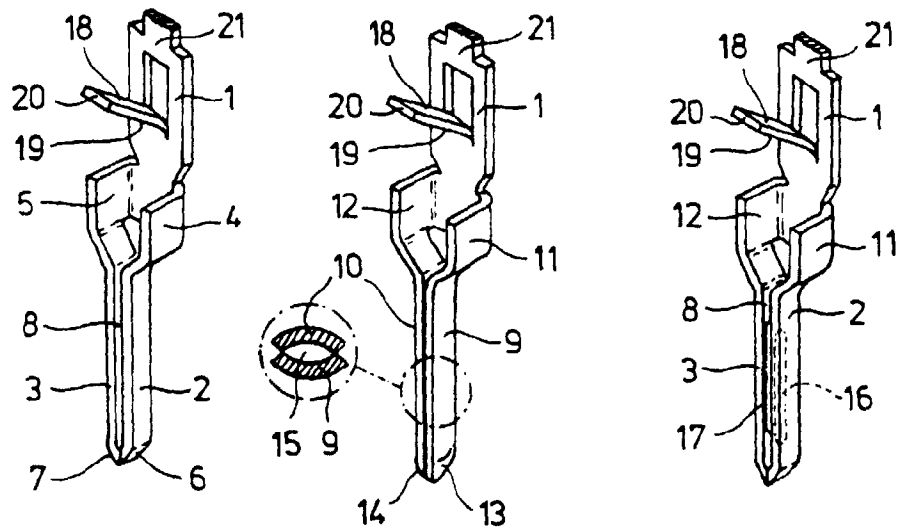
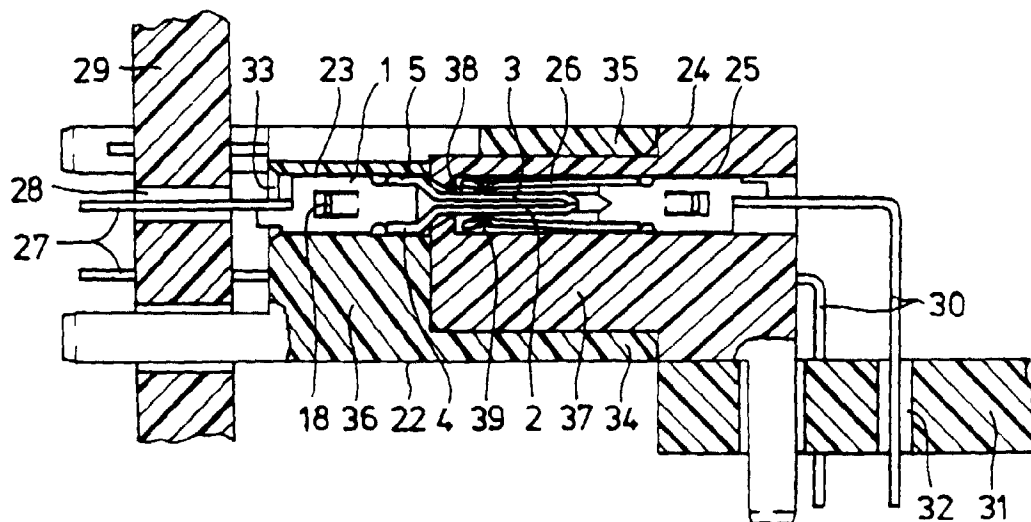


fig - 4



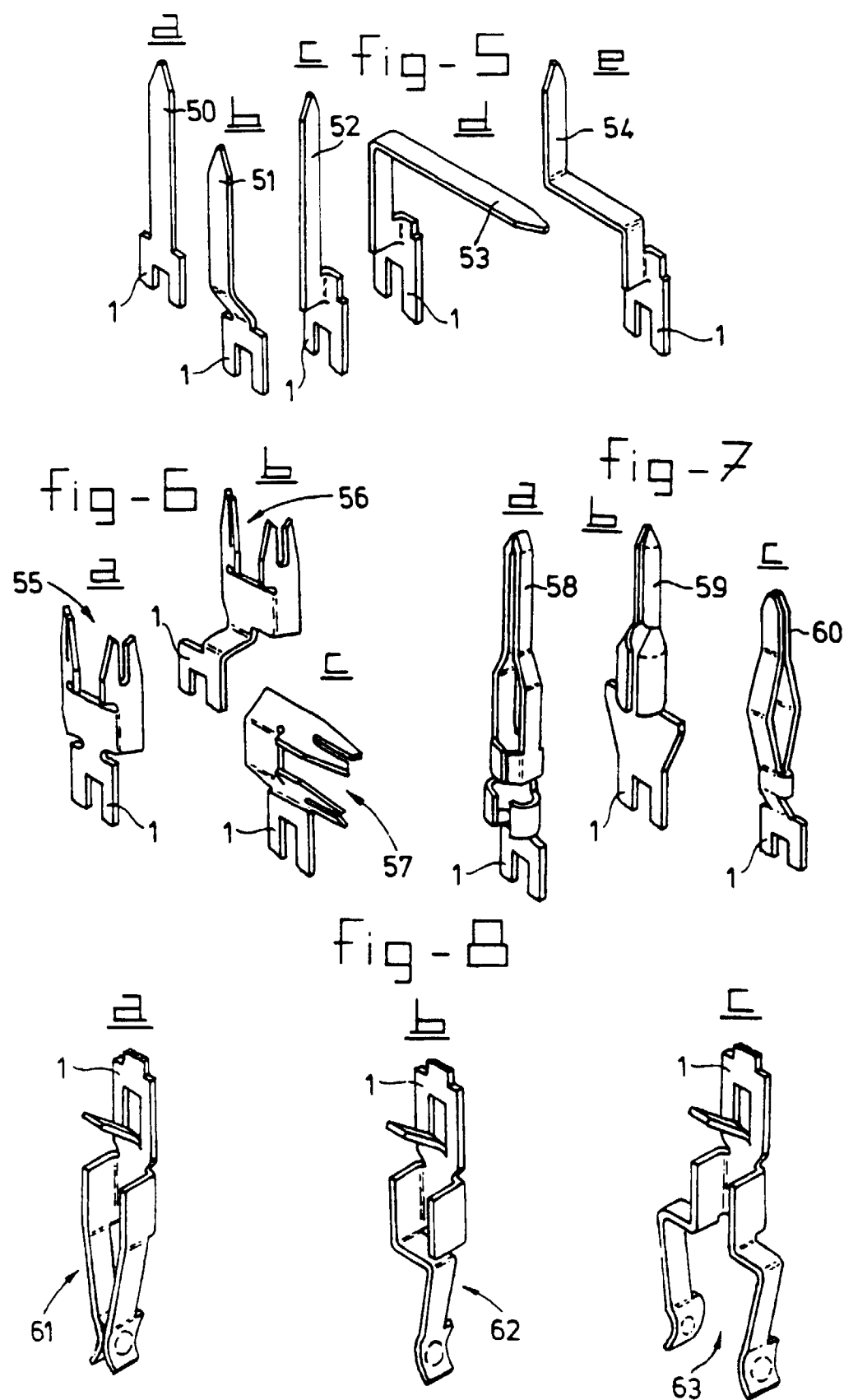


fig - 9

