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BA ME(30) Priority: **31.01.2012 US 201261592993 P**(71) Applicant: **Corning Cable Systems LLC
Hickory NC 28602 (US)**

(72) Inventors:

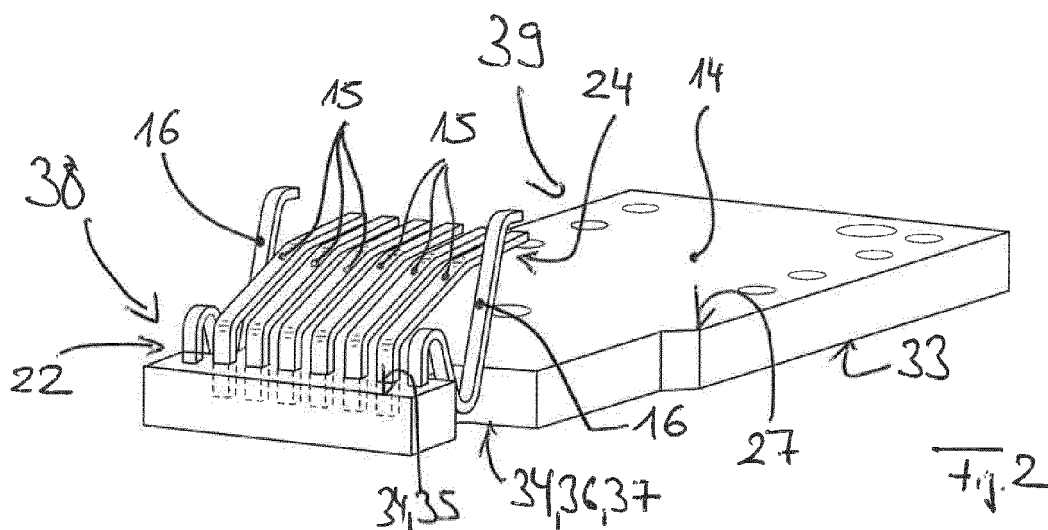
- **Wimmer, Michael
16766 Kremmen (DE)**
- **Miller, Allen Michael
Lenoir, NC North Carolina 28645 (US)**

(74) Representative: **Sturm, Christoph****Quermann Sturm Weilnau****Patentanwälte****Unter den Eichen 7****65195 Wiesbaden (DE)**

(54) **Communication adapter having asymmetrical outer contacts springs or outer contact springs extending below the top surface of a printed circuit board**

(57) A communications adapter (10) for receiving an electrical communications plug-type connector, the communications adapter (10) comprising: a housing (11), the housing (11) including an opening (25) for receiving an electrical communications plug-type connector; a printed circuit board (14), the printed circuit board (14) including electrical traces for providing a plurality of electrical paths from a first end (38) of the printed circuit board (14) to a second end (39) of the printed circuit board (14); a plurality of contact springs (15, 16), each contact spring (15, 16) having a fixed end (22) and a contact end (24) op-

posite the fixed end (22), the fixed ends (22) of the contact springs (15, 16) being mechanically and electrically connected in a generally linear arrangement to the first end (38) of the printed circuit board (14), and the contact ends (24) of the contact springs (15, 16) generally pointing towards the second end (39) of the printed circuit board (14). The plurality of contact springs (15, 16) include first, inner contact springs (15) that are symmetrical along a first spring central axis of the respective first contact spring (15), and second, outer contact springs (16) that are asymmetrical along a second spring central axis of the respective second contact spring (16).

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Description

[0001] The invention relates to a modular communications adapter for receiving an electrical communications plug-type connector as defined in the preamble of claim 1 or claim 12.

[0002] The invention deals with electrical contact arrangement for telecommunication and data processing technology, has high-frequency electrical contacts electrically and mechanically connected with printed circuit board, where electrical contacts include contact area.

[0003] The connection for high frequency data transmission refers to the RJ45 specification (IEC 60603-7). The RJ45 specification describes the faces of the RJ45 communications plug and the RJ45 communications adapter. The RJ45 specification requires eight (8) contact pins for data transmission. The RJ45 communications plug has eight (8) relatively stiff contacts separated by separators and the RJ45 communications adapter has eight (8) relatively flexible contact springs to connect with the relatively stiff contacts of the RJ45 communications plug. The aim is to use short contact springs within the RJ45 communications adapter for a good high frequency data transmission. On the other hand this contact spring needs a mechanical flexibility.

[0004] The RJ45 communications adapter is also compatible to a RJ11 communications plug having only six (6) contacts. The insertion of a RJ11 communications plug into a RJ45 communications adapter causes more movement of the outer contact springs of the RJ45 communications adapter, because they do not encounter a contact of the RJ11 communications plug and are pressed down much more by the separators of the RJ11 communications plug. For this reason the outer contact springs have to be more flexible than the others. If the outer contact springs of a RJ45 communications adapter would not have a higher appropriate flexibility, the insertion of a RJ11 communications plug would destroy them. No safe connection could be realized. This case has to be avoided.

[0005] A modular communications adapter as defined in the preamble of claim 1 or claim 13 is disclosed in the prior art document US 6,530,810 B2.

[0006] Against this background, the present invention is based on the object of providing a novel modular communications adapter.

[0007] The object of the invention is according to a first aspect of the invention achieved by a communications adapter according to claim 1.

[0008] The outer contact springs are asymmetrical along the spring central axis of the same, while the inner contact springs are symmetrical along the spring central axis of the same. This provides an appropriate flexibility for the outer contact springs in order to avoid that the outer contact springs become damaged in case a communications plug becomes inserted into the communications adapter which is not of the same type. Especially, outer contact springs of a RJ45 communications adapter

will not be damaged when inserting a RJ11 communications plug into the same.

[0009] In accordance with an advantageous development of the present invention, each inner contact spring has a first length and each outer contact spring has a second length longer than the first length, wherein the first length and the second length being measured along the respective contact spring from an intersection of the respective fixed end of the respective contact spring and a surface of the printed circuit board to the respective contact end of the respective contact spring. This provides a further improved flexibility for the outer contact springs.

[0010] Preferably, each inner contact spring includes at least two bends, wherein each outer contact spring includes at least one more bend than the inner contact springs. This provides a further improved flexibility for the outer contact springs.

[0011] In accordance with an advantageous development of the present invention, each outer contact spring is wider at the fixed end than at the contact end for providing a larger elastic bending range than the inner contact springs. Preferably, each outer contact spring has multiple widths along the length of the spring, the multiple widths including a first width at the fixed end that tapers to a second width smaller than the first width, the second width tapering to a third width that is larger than the second width but smaller than the first width, the third width tapering to the final width that is smaller than the first, second and third widths. This provides a further improved flexibility for the outer contact springs.

[0012] In accordance with an advantageous development of the present invention, the printed circuit board includes a top surface and a bottom surface, wherein each outer contact spring extends below the top surface in one respective location. The longer, asymmetrical outer springs have a space in the printed circuit board where they can move into.

[0013] The object of the invention is according to a second aspect of the invention achieved by a communications adapter according to claim 12.

[0014] The printed circuit board includes a top surface and a bottom surface, wherein each second contact spring extends below the top surface in one respective location at least in a mated condition of the same. The outer springs have a space in the printed circuit board where they can move into.

[0015] Preferably, each second contact spring extends below the top surface in one respective location in a mated condition and in an unmated condition of the same.

[0016] In accordance with an advantageous development of the present invention, each location includes at least one conductive aperture for receiving the fixed end of the respective second contact spring and at least one cut-out for receiving at least one of the bends of the respective second contact spring.

[0017] The features of the first aspect of the invention and of the second aspect of the invention are preferably

used in combination with each other.

[0018] The novel communications adapter was developed for the Next Generation of applicants existing Product S500 being a RJ45 communications adapter. A main part of that communications adapter is the contact spring. According to a first aspect, a new design of the contact spring is provided. Eight (8) contact springs mounted on a printed circuit board with a first end of the contact spring, with a second free end of the contact spring is directed away from the mounting location, the second end not contacting the printed circuit board. The first aspect deals with the mechanical flexibility of the outer springs. The outer contact springs have to be more bendable than the inner contact springs. The inner contact springs have the worst crosstalk behavior and need a minimum length. According to a second aspect, the printed circuit board includes locations providing space in the printed circuit board for the second contact springs, wherein each second contact spring extends in one said locations at least in a mated condition of the same. The more flexible outer contact springs have a space in the printed circuit board where they can move into when a communications plug becomes inserted into the communications adapter. As mentioned above, the features of the first aspect of the invention and of the second aspect of the invention are preferably used in combination with each other

[0019] Additional features and advantages of the invention will be set forth in the detailed description which follows, and in part will be readily apparent to those skilled in the art from that description or recognized by practicing the disclosure as described herein, including the detailed description which follows, the claims, as well as the appended drawings, in which:

[0020] Figure 1 shows an exploded view of an exemplary embodiment of a modular communications adapter according to the present invention;

[0021] Figure 2 shows a perspective view of a printed circuit board (PCB) having an array of contact springs;

[0022] Figure 3 shows a side view of the printed circuit board (PCB) of Figure 2 further having an array of insulation displacement connector (IDC) contacts;

[0023] Figure 4 shows a front view of the printed circuit board of Figure 2;

[0024] Figures 5-7 show top views of different embodiments of printed circuit boards (PCB), wherein the PCBs of Figures 5-7 each have an array of contact springs, and whereby the PCB of Figures 6 further has an array IDC contacts;

[0025] Figure 8 shows a perspective assembly view of an RJ45 communications plug ready to insert into an embodiment of a RJ45 communications adapter;

[0026] Figures 9,10 show perspective views of RJ45 and RJ11 communications plugs, for comparison;

[0027] Figures 11, 12 show front views of the communications plugs of Figures 9 and 10;

[0028] Figures 13, 14 show front views of flat stampings of outer contact springs for the communications adapter;

[0029] Figure 15 shows a side view of a full, uninstalled outer contact spring for the communications adapter;

[0030] Figure 16 shows a partial perspective view of the contact spring of Figure 15 showing relative measurements along the length of the contact spring;

[0031] Figure 17 shows a top view of the contact spring of Figure 15;

[0032] Figure 18 shows a side view of full, uninstalled inner contact spring for the communications adapter;

[0033] Figure 19 shows a front view of the contact springs of Figure 18;

[0034] Figure 20 shows a top view of the contact spring of Figure 18;

[0035] Figure 21 shows a partial perspective view of the contact spring of Figure 18 showing relative measurements along the length of the spring;

[0036] Figures 22-24 show perspective views of the different contact springs.

[0037] Reference will now be made in detail to the present preferred embodiments of the disclosure, examples of which are illustrated in the accompanying drawings. Whenever possible, the same reference numerals will be used throughout the drawings to refer to the same or like parts.

[0038] Most important, especially a RJ11 communications plug can be plugged into a RJ45 communications adapter without damaging the RJ45 communications adapter. The communications adapter is compatible with a RJ11 communications plug and a RJ45 communications plug. There is no additional part like e.g. a stopper needed.

[0039] Outer contact springs of the communications adapter have more mechanical flexibility than inner contact springs of the communications adapter. The inner contact springs of the communications adapter are in contrast designed to allow high frequency data transmission of the communications adapter with less crosstalk.

[0040] Further on, the necessary space for the contact springs of a communications adapter can be reduced. Due to this the dimension of the communications adapter becomes smaller. The manufacturing process is to assemble all spring contacts in one line at the same time. That reduces the assembly-effort and saves money.

[0041] A modular communications adapter 10 consists of a housing 11 and a support part 12. The support part 12 includes an insulation body 13 that carries a printed circuit board (PCB) 14 with a plurality of contact springs 15, 16 and a plurality of insulation displacement connector (IDC) contacts 17.

[0042] All contact springs 15, 16 of the communications adapter 10 stand side-by-side along one line.

[0043] The IDC contacts 17 stand side-by-side along two parallel lines. The parallel lines in which the IDC contacts 17 stand run perpendicular to the line in which the contact springs 15, 16 are positioned.

[0044] The insulation body 13 of the support part 12 comprises in the shown embodiment three elements, namely an upper holding element 18, a lower holding

element 19 and a compression element 20. The three elements of the insulation body 13 are made from an electrically insulating material like plastics.

[0045] The support part 12 further includes a shielding body 21. The shielding body 21 is made from an electrically conducting material like metal.

[0046] Each contact spring 15, 16 is fixed with one end 22 in the PCB 14. This end 22 is also called fixed end 22. The other, opposite end 24 of the respective contact spring 15, 16 is free to connect stiff contacts 23a of a communications plug-type connector 23. The free end 24 is also called contact end 24. The fixed ends 22 of the contact springs 15, 16 define a linear array of fixed ends 22.

[0047] The housing 11 of the communications adapter 10 comprises an opening 25 for receiving an electrical communications plug-type connector 23. When the communications plug-type connector 23 is disconnected from the communications adapter 10 and removed from the opening 25 of the housing 11, the opening 25 of the housing 11 can be covered by a dust cap 26.

[0048] The printed circuit board (PCB) 14 includes electrical traces for providing a plurality of electrical paths extending between a first end 38 of the printed circuit board 14 and a second end 39 of the printed circuit board 14.

[0049] The fixed ends 22 of the contact springs 15, 16 are fixed to the first end 38 of the printed circuit board 14. The insulation displacement connector (IDC) contacts 17 are fixed to the second end 39 of the printed circuit board 14.

[0050] The electrical traces of the PCB 14 provide electrical conductive paths between the contact springs 15, 16 and the IDC contacts 17.

[0051] In case of a RJ45 communications plug-type connector 23, the same comprises eight (8) stiff contacts 23a (see Figures 8, 9, 11) held by an insulation body 23b. The RJ45 communications adapter 10 for such a RJ45 communications plug-type connector 23 comprises eight (8) contact springs 15, 16, namely six (6) first, inner contact springs 15 and two (2) second, outer contact springs 16. When the RJ45 communications plug-type connector 23 is inserted into the RJ45 communications adapter 10, the stiff contacts 23a contact the contact springs 15, 16.

[0052] When a RJ11 communications plug-type connector 23' instead of a RJ45 communications plug-type connector 23 would become inserted into the RJ45 communications adapter 10, the outer springs 16 of the communications adapter 10 would touch the insulation body 23b' of the communications plug-type connector 23'. As a result, the outer contact springs 16 of the communications adapter 10 would be pressed down more than the inner contact springs 15. This could damage the outer contact springs 16 of the communications adapter 10. The outer contact springs 16 therefore need to be more flexible than the inner contact springs 15.

[0053] According to a first aspect of the present invention, the first, inner contact springs 15 of the communi-

cations adapter are symmetrical along a first spring central axis X1 (see Figure 19), wherein the second, outer contact springs 16 of the communications adapter are asymmetrical along a second spring central axis X2 (see Figures 13 and 14). Figures 13, 14 show front views of flat stampings of outer contact springs 16.

[0054] The second, outer contact springs 16 are asymmetrical along the second spring central axis X2 in such a way that the second, outer contact springs 16 are symmetrical in the region of the contact ends 24 of the same and asymmetrical in the region of the fixed ends 22 of the same.

[0055] As shown in Figures 13 and 14, the second, outer contact springs 16 comprise in sections which provide the fixed ends 22 of the outer contact springs 16 the thickness d2 at a first side and the thickness d1 at a second side, wherein the thickness d2 is larger than the thickness d1.

[0056] The first side with the larger thickness d2 of the outer contact spring 16 is facing away from a respective neighboring inner contact spring 15.

[0057] The second side with the smaller thickness d1 of the outer contact spring 16 is facing towards the respective neighboring inner contact spring 15.

[0058] The asymmetric design of the second, outer contact springs 16 provides an appropriate flexibility for the outer contact springs 16 in order to avoid that the outer contact springs 16 become damaged in case a communications plug becomes inserted into the communications adapter 10 which is not of the same type.

[0059] Especially, outer contact springs 16 of a RJ45 communications adapter 10 will not be damaged when inserting a RJ11 communications plug 23' into the same.

[0060] As mentioned above, the second, outer contact springs 16 are asymmetrical along the respective spring central axis X2. Figures 13 and 22 show an outer left contact spring 16 and Figures 14 and 24 show an outer right contact spring 16. Both outer contact springs 16 are asymmetrical along a respective spring central axis X2.

[0061] The outer right contact spring 16 of Figure 24 is a mirror image of the outer left contact spring 16 of Figure 22 along the respective central axes X2. Both outer contact springs 16 have about the same length. Figures 13 and 14 show front views of flat stampings of these two outer contact springs 16.

[0062] The first, inner contact springs have a first length and the second, outer contact springs 16 have a second length longer than the first length. This provides a further improved flexibility for the outer contact springs 16.

[0063] The first length and the second length is measured along the contact springs 15, 16 from an intersection of the respective fixed ends 22 and an upper or top surface 27 of the printed circuit board 14 to the respective contact ends 23.

[0064] The second length may be up to 100% longer than the first length.

[0065] The second length may be from 10% to 40%

longer than the first length. Preferably, the second length is from 20% to 30% longer than the first length. Most preferably, the second length may be from 25% to 30% longer than the first length.

[0066] Each first, inner contact spring 15 includes at least two bends 28, 29 (see Figures 18, 21, 23). Each second, outer contact spring 16 includes at least one more bend 30, 31, 32 (see Figures 15, 16, 22, 24) than the first, inner contact springs 15. This provides a further improved flexibility for the outer contact springs 16.

[0067] The contact ends 24 of the contact springs 15, 16 define a contact zone for making electrical contact with the electrical plug-type connector 23. The contact zone may include at least one bend 28, 30 on the contact springs 15, 16.

[0068] The printed circuit board 14 includes the upper or top surface 27 and on the opposite side a lower or bottom surface 33. According to a second aspect of the present invention which is preferably used in combination with the first aspect of the invention, each second, outer contact spring 16 extends below the top surface 27 in one respective location 34 at least in a mated condition of the respective outer contact springs 16.

[0069] The second, outer contact springs 16 may extend below the top surface 27 of the PCB 14 in the locations 34 in the mated condition and in an unmated condition.

[0070] Each of said locations 34 includes one conductive aperture 35 for receiving the fixed end 22 of the respective second, outer contact spring 16 and at least one cut-out 36 for receiving at least one of the bends 32 of the respective second, outer contact spring 16.

[0071] Preferably, the cut-outs 36 are provided by notches on the printed circuit board 14 (see Figures 2, 5). Each notch extends from the top surface 27 of the printed circuit board 14 to the bottom surface 33 of the printed circuit board 14, and from an edge 37 of the printed circuit board 14 between the top surface 27 of the printed circuit board 14 and bottom surface 33 of the printed circuit board 14.

[0072] Alternatively, the cut-outs 36 are provided by through holes (see Figure 6) extending from the top surface 27 to the bottom surface 33 of the printed circuit board 14.

[0073] In another alternative, the cut-outs 36 are provided by a cavity (see Figure 7) extending from the top surface 27 for a distance in the direction of the bottom surface 33 but not extending through the bottom surface 33 of the printed circuit board 14.

[0074] The communications adapter 10 is preferably designed to receive an electrical communications RJ-type connector, especially to receive a RJ 45 communications connector.

[0075] The plurality of contact springs 15, 16 include an electrically conductive material. The electrically conductive material may be one of the group selected from copper, nickel, brass, iron, steel, stainless steel, bronze, gold, platinum, silver, and combinations of the same.

[0076] Wires of a cable are connected to the IDC contacts 17. The communications adapter 10 may have at least one wire management element for managing the wires of the cable.

[0077] As mentioned above, the plurality of contact springs 15, 16 include the first, inner contact springs 15 being symmetrical along the first spring central axis X1, and the second, outer contact springs 16 being asymmetrical along a second spring central axis X2, wherein the first contact springs 15 may have a first length and the second contact springs 16 may have a second length longer than the first length. Each of the first and second contact springs 15, 16 provides a mating contact force of at least one (1) Newton in a mated condition.

[0078] Preferably, each second, outer contact spring 16 is wider at the fixed end 22 than at the contact end 24 for providing a larger elastic bending range than the first, inner contact springs 15.

[0079] Each second, outer contact spring 16 may have a first width W_0 at the fixed end 22 and a final width W_6 at the contact end 24.

[0080] Preferably, each second, outer contact spring 16 has multiple widths along the length of the same, the multiple widths preferably include a first width W_0 at the fixed end 22 that tapers to at least one second width W_1 , W_2 , W_3 being smaller than the first width W_0 . In the embodiment shown, the first width W_0 tapers successively to three different second widths W_1 , W_2 , W_3 , wherein all of said second widths W_1 , W_2 , W_3 are associated with a first bend 32 of the respective second contact spring 16 having a first radius R_1 and a first bend angle Θ_1 . The widths W_1 , W_2 are associated to a first side of the first bend 32 and the width W_3 is associated to a second side of the first bend 32. The widths W_1 is larger than the width W_2 and the widths W_2 is larger than the width W_3 . Alternatively, the widths W_1 and W_2 and/or the widths W_2 and W_3 may be the same. The or each second width W_1 , W_2 , W_3 tapers to at least one third width W_4 , W_5 that is larger than the or each second width W_1 , W_2 , W_3 but smaller than the first width W_0 . In the embodiment shown, the or each second width W_1 , W_2 , W_3 tapers successively to two different third widths W_4 , W_5 , wherein all of said third widths W_4 , W_5 are associated with a second bend 31 of the respective second contact spring 16 having a second radius R_2 and a second bend angle Θ_2 . The widths W_4 is associated to a first side of the second bend 31 and the width W_5 is associated to a second side of the second bend 31. The width W_4 is larger than the width W_5 . Alternatively, the widths W_4 and W_5 may be the same. The or each third width W_4 , W_5 tapers to the final width W_6 that is smaller than the first, second and third widths W_1 , W_2 , W_3 , W_4 , W_5 . The final width W_6 is associated with a third bend 30 of the respective second contact spring 16 having a third radius R_3 and a third bend angle Θ_3 .

[0081] The first radius R_1 and the second radius R_2 are preferably the same. The first bend angle Θ_1 is preferably smaller than the second bend angle Θ_2 . The first

bend 32 may have an included bend angle Θ_1 of about 20-30 degrees in an unmated condition and the second bend 32 may have an included bend angle Θ_2 of about 35-45 degrees in an unmated condition. The first bend angle Θ_1 may be about 23 degrees in the unmated condition and the second bend angle Θ_2 may be about 40 degrees in the unmated condition.

[0082] Each second, outer contact spring 16 comprises a first straight tapering section having length L_1+L_2 , a second straight tapering section having length L_3 , and a third straight tapering section having length L_4 . The length L_1+L_2 is smaller than the length L_3 and the length L_3 is smaller than the length L_4 .

[0083] Each first, inner contact spring 15 may have a first width W_{1-2} at the fixed end 22 and a final width W_{5-2} at the contact end 24.

[0084] Preferably, each first, inner contact spring 15 has multiple widths along the length of the same, the multiple widths preferably include a first width W_{1-2} at the fixed end 22 that tapers to at least one second width W_{2-2} , W_{3-2} being smaller than the first width W_{1-2} . In the embodiment shown, the first width W_{1-2} tapers successively to two different second widths W_{2-2} , W_{3-2} wherein all of said second widths W_{2-2} , W_{3-2} are associated with a first bend 29 of the respective first contact spring 15 having a first bend angle Θ_{1-2} . The widths W_{2-2} is associated to a first side of the first bend 29 and the width W_{3-2} is associated to a second side of the first bend 29. The widths W_{2-2} is larger than the width widths W_{3-2} . Alternatively, the widths W_{2-2} and W_{3-2} may be the same. The or each second width W_{2-2} , W_{3-2} tapers to at least one third width W_{4-2} , W_{5-2} that is smaller than the or each second width W_{2-2} , W_{3-2} . In the embodiment shown, the or each second width W_{2-2} , W_{3-2} tapers successively to two different third widths W_{4-2} , W_{5-2} , wherein all of said third widths W_{4-2} , W_{5-2} are associated with a second bend 28 of the respective first contact spring 15 having a second bend angle Θ_{2-2} . The widths W_{4-2} is associated to a first side of the second bend 28 and the width W_{5-2} is associated to a second side of the second bend 28. The width W_{4-2} is larger than the width widths W_{5-2} . Alternatively, the widths W_{4-2} and W_{5-2} may be the same. The widths W_{5-2} is the final width W_{5-2} at the contact end 24 of the respective first contact spring 15.

[0085] It is to be understood that the foregoing description present embodiments of the disclosure, and are intended to provide an overview or framework for understanding the nature and character of the invention as it is claimed. The drawings are included to provide a further understanding of the invention, and are incorporated into and constitute a part of this specification. The drawings illustrate various embodiments of the invention, and together with the description serve to explain the principles and operations of the invention. It will be apparent to those skilled in the art that various modifications and variations can be made to the invention without departing from the spirit and scope of the invention.

Claims

1. A communications adapter (10) for receiving an electrical communications plug-type connector, the communications adapter (10) comprising:

a housing (11), the housing (11) including an opening (25) for receiving an electrical communications plug-type connector;
a printed circuit board (14), the printed circuit board (14) including electrical traces for providing a plurality of electrical paths from a first end (38) of the printed circuit board (14) to a second end (39) of the printed circuit board (14);
a plurality of contact springs (15, 16), each contact spring (15, 16) having a fixed end (22) and a contact end (24) opposite the fixed end (22), the fixed ends (22) of the contact springs (15, 16) being mechanically and electrically connected in a generally linear arrangement to the first end (38) of the printed circuit board (14), and the contact ends (24) of the contact springs (15, 16) generally pointing towards the second end (39) of the printed circuit board (14),

characterized in that

the plurality of contact springs (15, 16) include first, inner contact springs (15) that are symmetrical along a first spring central axis of the respective first contact spring (15), and second, outer contact springs (16) that are asymmetrical along a second spring central axis of the respective second contact spring (16).

2. The adapter of claim 1, **characterized in that** each first contact spring (15) has a first length, and that each second contact spring (16) has a second length longer than the first length, wherein the first length and the second length being measured along the respective contact spring (15, 16) from an intersection of the respective fixed end (22) of the respective contact spring (15, 16) and a surface of the printed circuit board (14) to the respective contact end (24) of the respective contact spring (15, 16).
3. The adapter of claim 2, **characterized in that** the second length being up to 100% longer than the first length, wherein the second length is from 10% to 40%, preferably from 20% to 30%, longer than the first length.
4. The adapter of one of claims 1 to 3, **characterized in that** each first contact spring (15) includes at least two bends (28, 29), and that each second contact spring (16) includes at least one more bend (30, 31, 32) than the first contact springs (15).
5. The adapter of one of claims 1 to 4, **characterized in that** the second, outer contact springs (16) com-

prises an outer left contact spring (16) and an outer right contact spring (16), wherein both outer contact springs (16) are asymmetrical along a respective spring central axis, wherein the outer right contact spring (16) is a mirror image of the outer left contact spring (16) along the respective central axes, and wherein both outer contact springs (16) have about the same second length.

6. The adapter of one of claims 1 to 5, **characterized in that** the printed circuit board (14) includes a top surface (27) and a bottom surface (33), wherein each second contact spring (16) extends below the top surface (27) in one respective location (34).
7. The adapter of one of claims 1 to 6, **characterized in that** each second contact spring (16) is wider at the fixed end (22) than at the contact end (24) for providing a larger elastic bending range than the first contact springs (15).
8. The adapter of claim 7, **characterized in that** each second contact spring (16) has a first width (W_0) at the fixed end (22) and a final width (W_6) at the contact end (24).
9. The adapter of one of claim 8, **characterized in that** each second contact spring (16) has multiple widths along the length of the spring (16), the multiple widths including the first width (W_0) at the fixed end (22) that tapers to at least one second width (W_1 , W_2) smaller than the first width (W_0), the or each second width (W_1 , W_2) tapers to at least one third width (W_3 , W_4) that is larger than the or each second width (W_1 , W_2) but smaller than the first width (W_0), the or each third width (W_3 , W_4) tapers to the final width (W_6) that is smaller than the first, second and third widths.
10. The adapter of claim 9, **characterized in that** the or each second width (W_1 , W_2) is associated with a first bend (32) having a first radius (R_1) and the or each third width (W_3 , W_4) is associated with a second bend (31) having a second radius (R_2), the first and second radii being the same.
11. The adapter of claim 10, **characterized in that** the first bend (32) having an included bend angle (Θ_1) of about 20-30 degrees in an unmated condition and the second bend (31) having an included bend angle (Θ_2) of about 35-45 degrees in an unmated condition.
12. A communications adapter (10) for receiving an electrical communications plug-type connector, the communications adapter (10) comprising:

a housing (11), the housing (11) including an opening (25) for receiving an electrical communications plug-type connector;

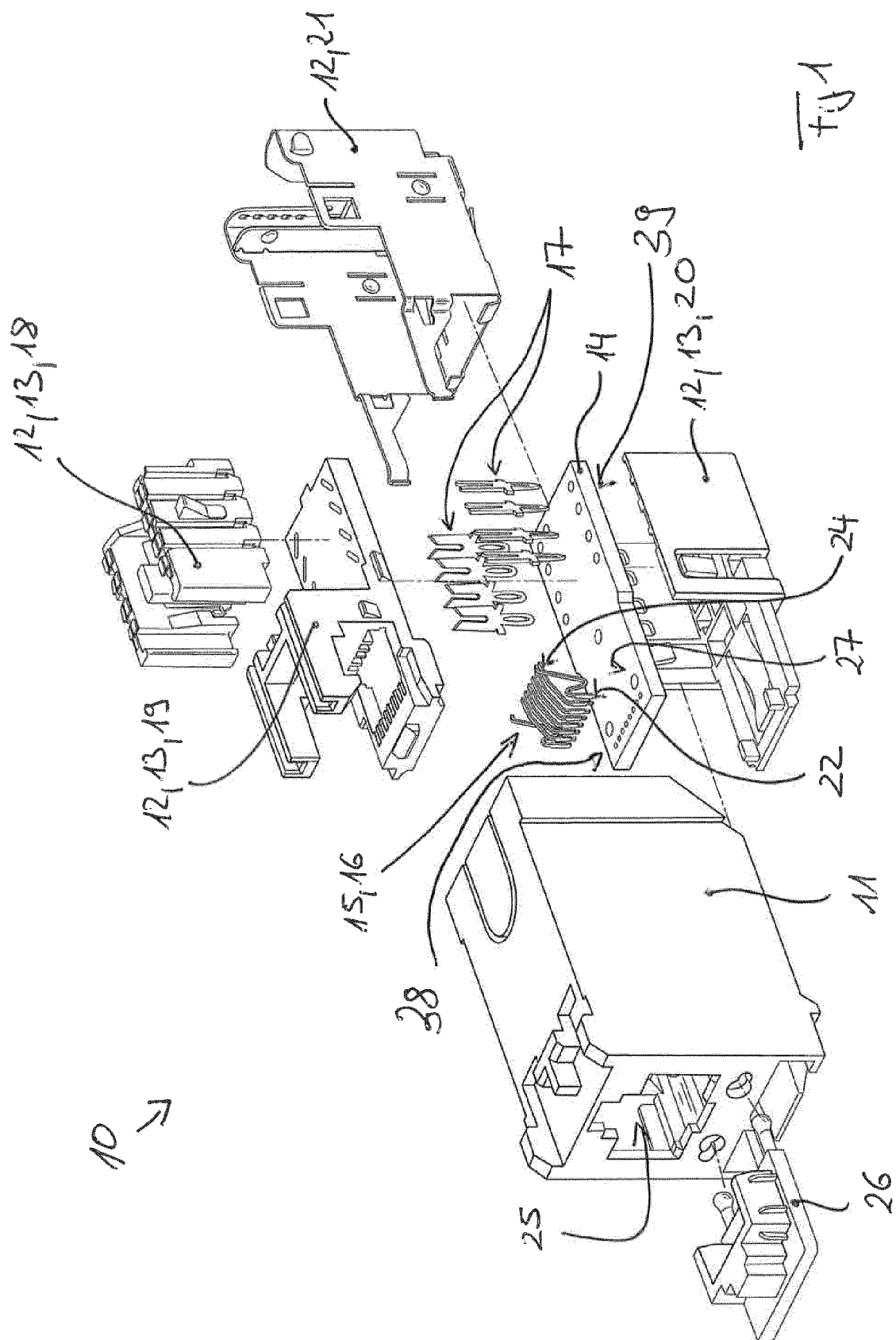
a printed circuit board (14), the printed circuit board (14) including electrical traces for providing a plurality of electrical paths from a first end (38) of the printed circuit board (14) to a second end (39) of the printed circuit board (14);

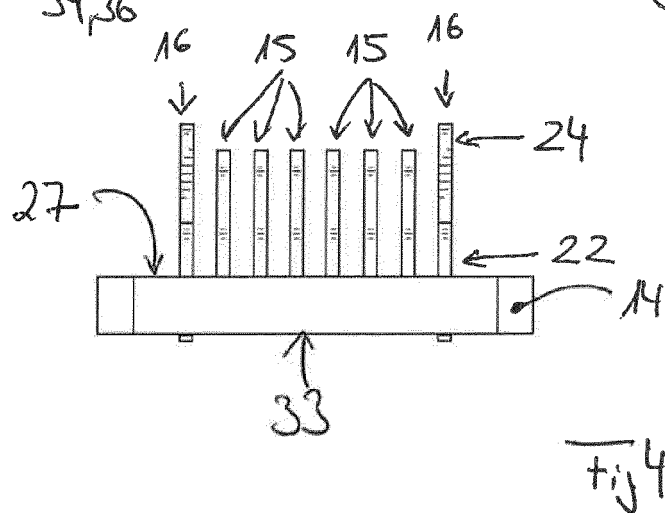
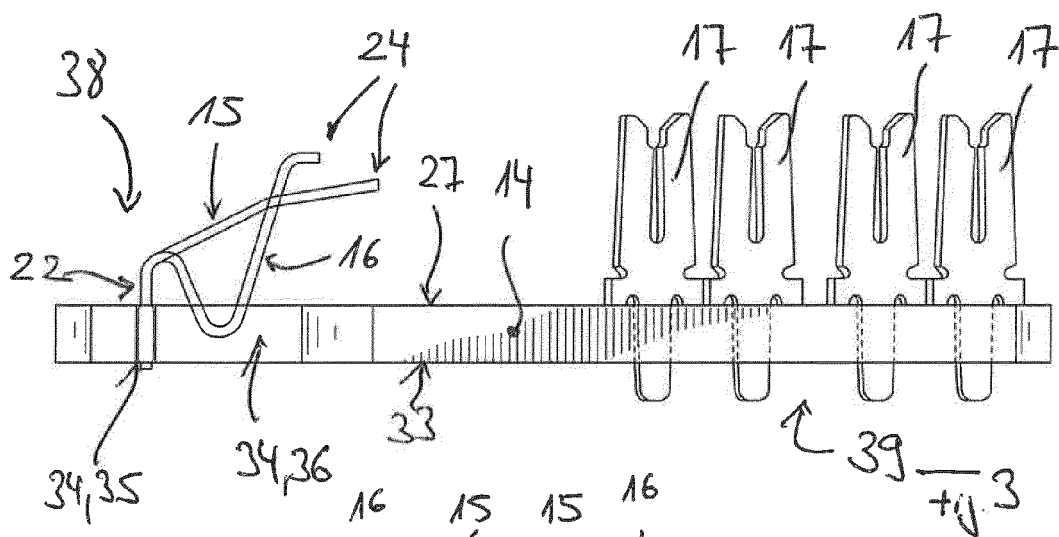
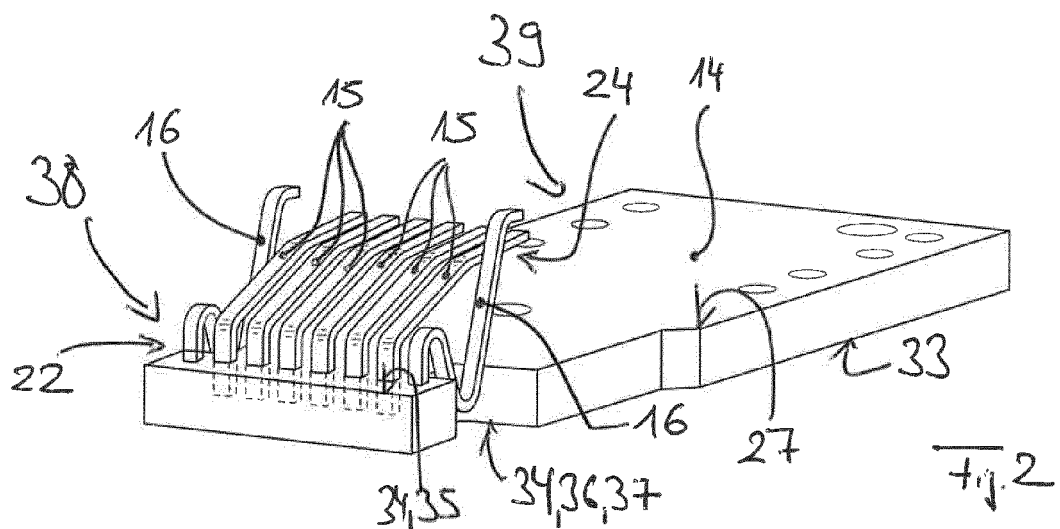
a plurality of contact springs (15, 16), each contact spring (15, 16) having a fixed end (22) and a contact end (24) opposite the fixed end (22), the fixed ends (22) of the contact springs (15, 16) being mechanically and electrically connected in a generally linear arrangement to the first end (38) of the printed circuit board (14), and the contact ends (24) of the contact springs (15, 16) generally pointing towards the second end (39) of the printed circuit board (14),

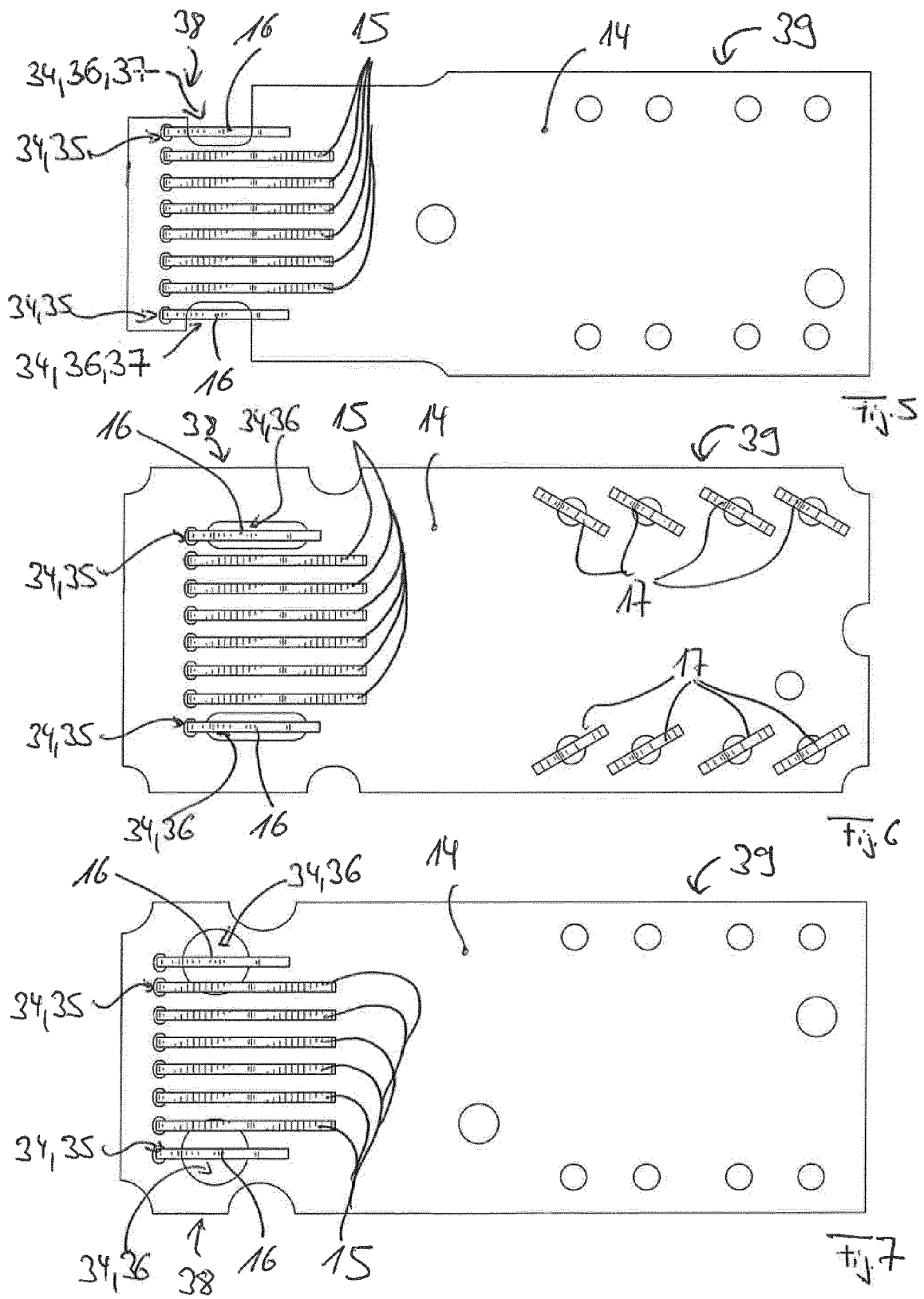
characterized in that

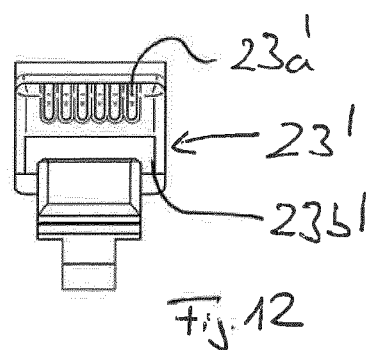
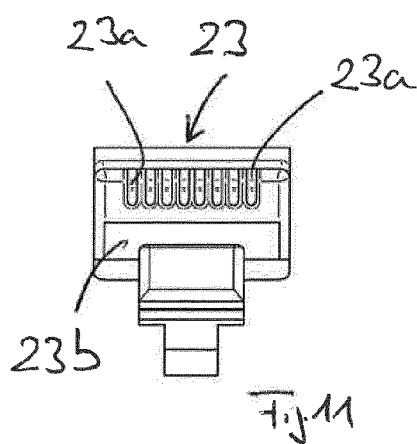
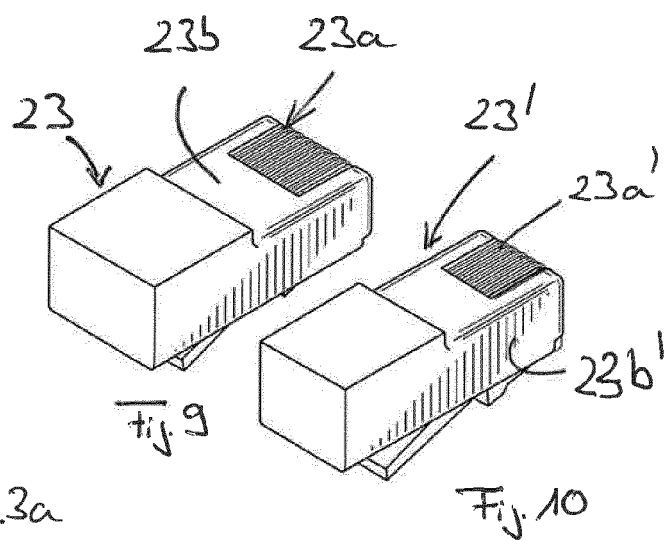
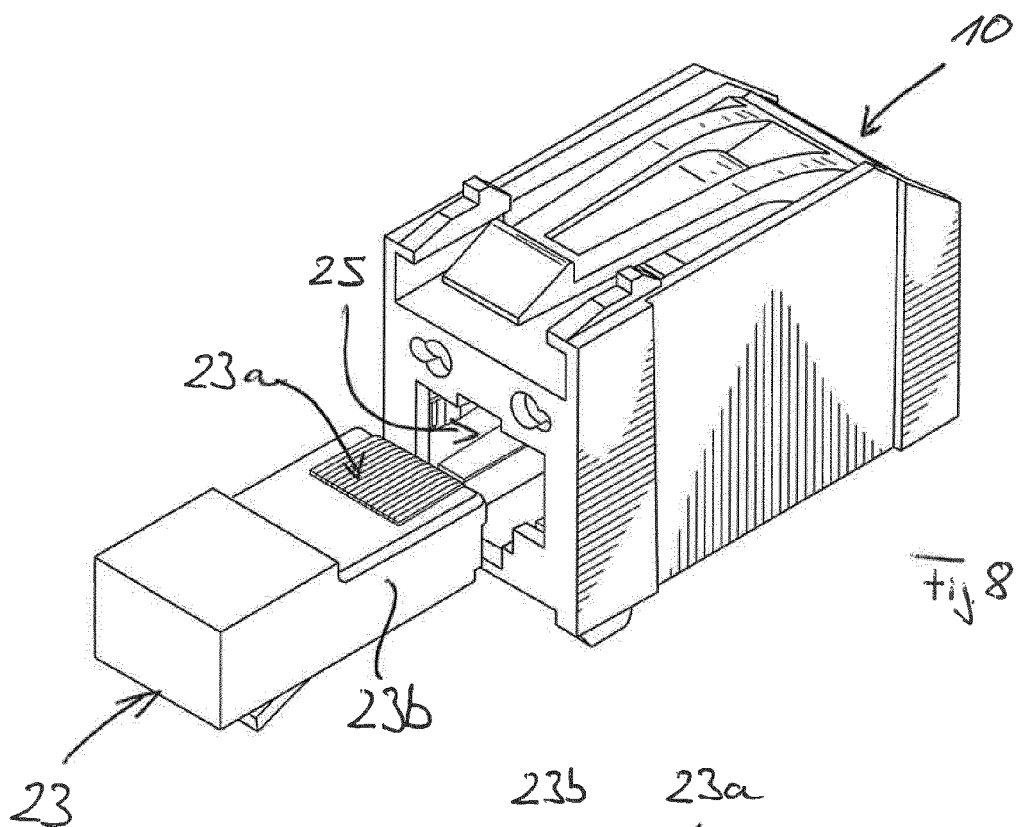
the printed circuit board (14) includes a top surface (27) and a bottom surface (33), wherein each second contact spring (16) extends below the top surface (27) in one respective location (34) at least in a mated condition of the same.

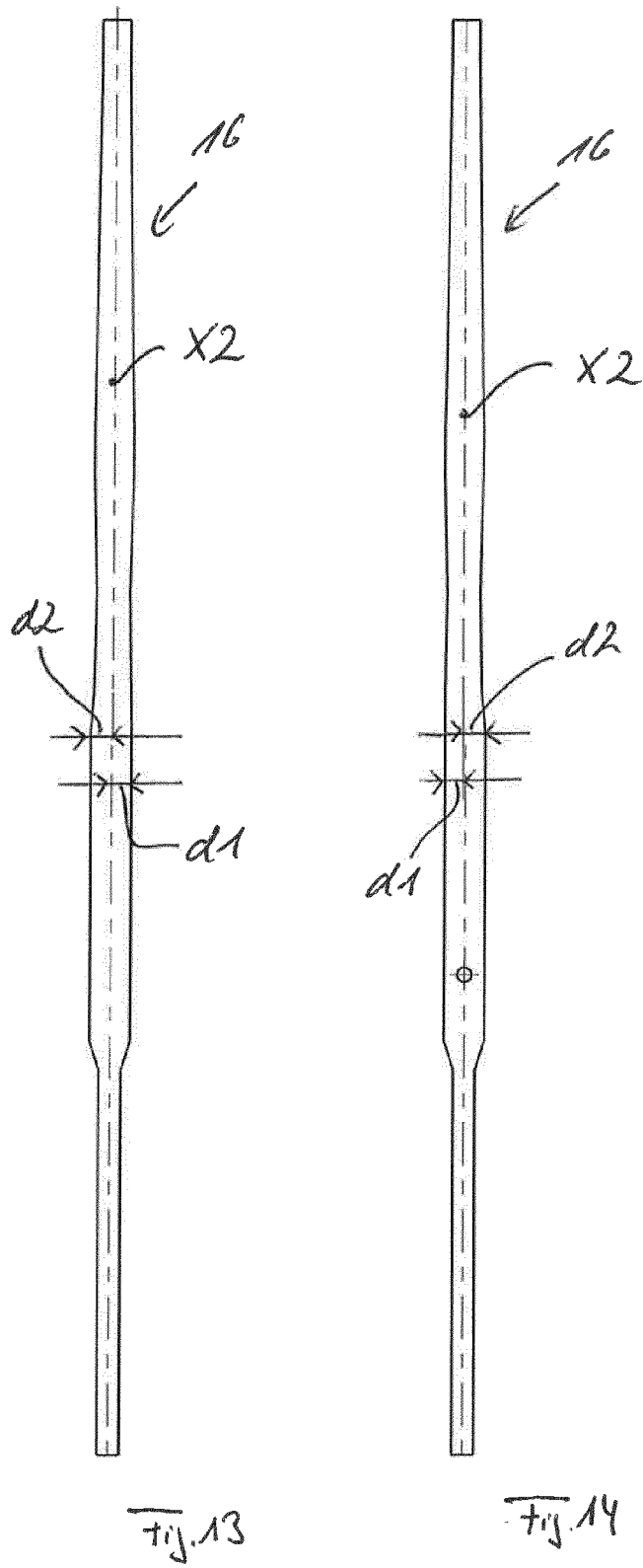
13. The adapter of claim 12, **characterized in that** each location (34) includes at least one conductive aperture (35) for receiving the fixed end (22) of the respective second contact spring (16) and at least one cut-out (36) for receiving at least one of the bends (32) of the respective second contact spring (16).
14. The adapter of claim 13, **characterized in that** the at least one cut-out (36) being at least one notch on the printed circuit board (14), the notch extending from the top surface (27) of the printed circuit board (14) to the bottom surface (33) of the printed circuit board (14), and from an edge (37) of the printed circuit board (14) between the top surface (27) of the printed circuit board (14) and bottom surface (33) of the printed circuit board (14).
15. The adapter of one of claims 12 to 14, **characterized by** features of one of claims 1 to 11.

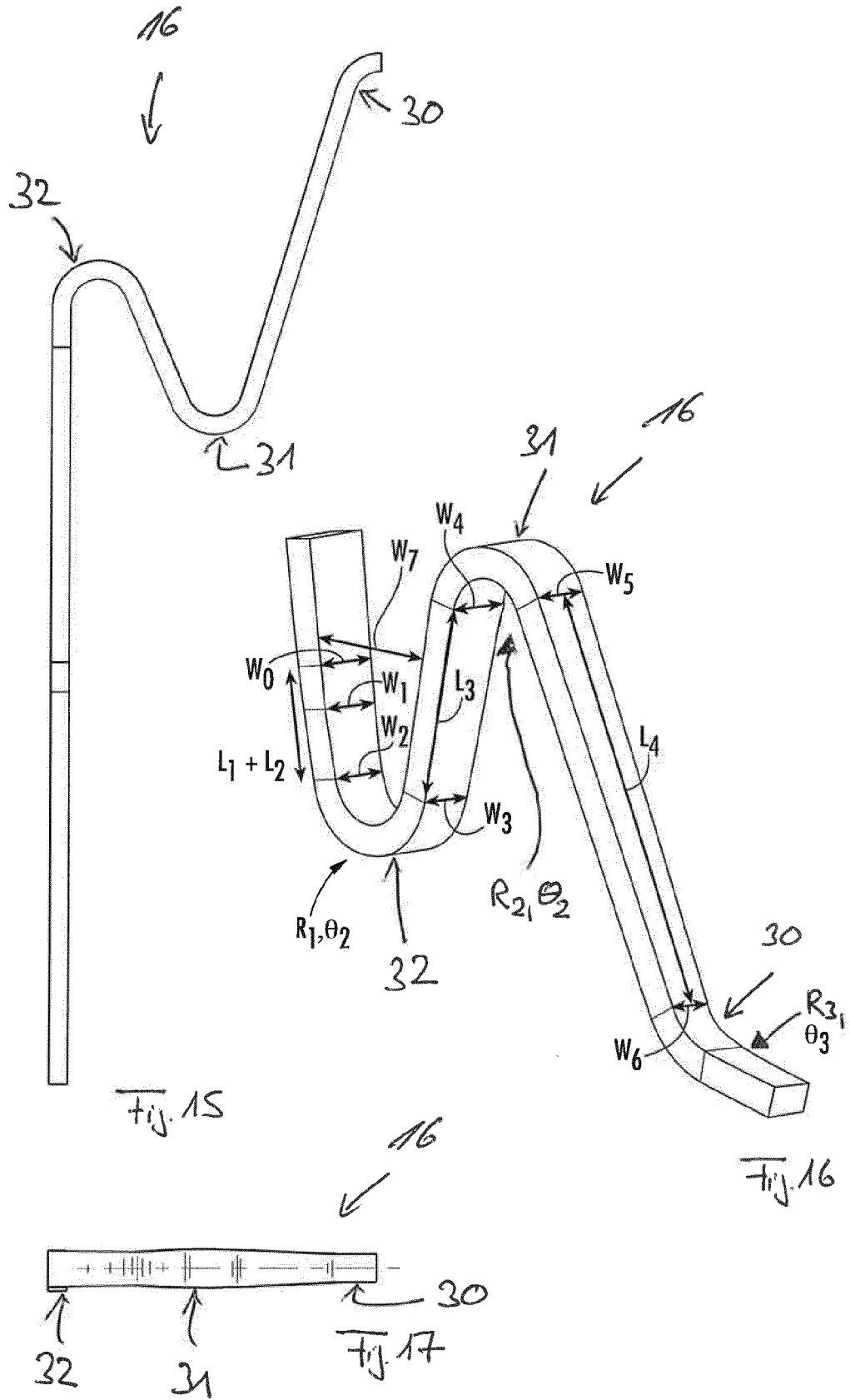












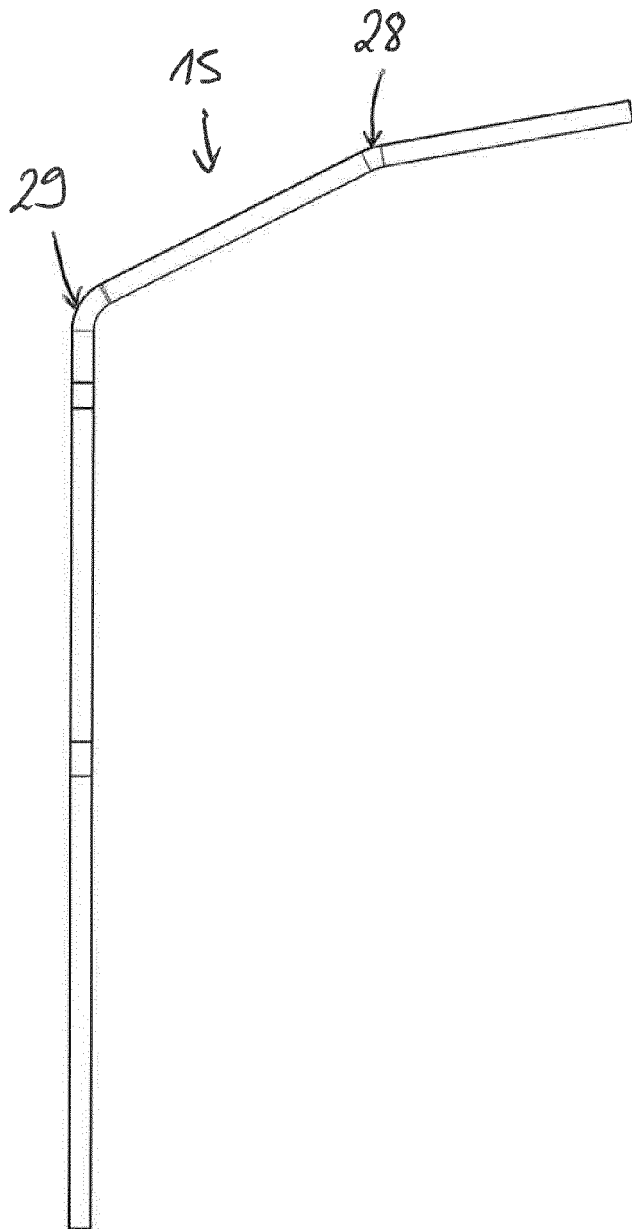


Fig. 18

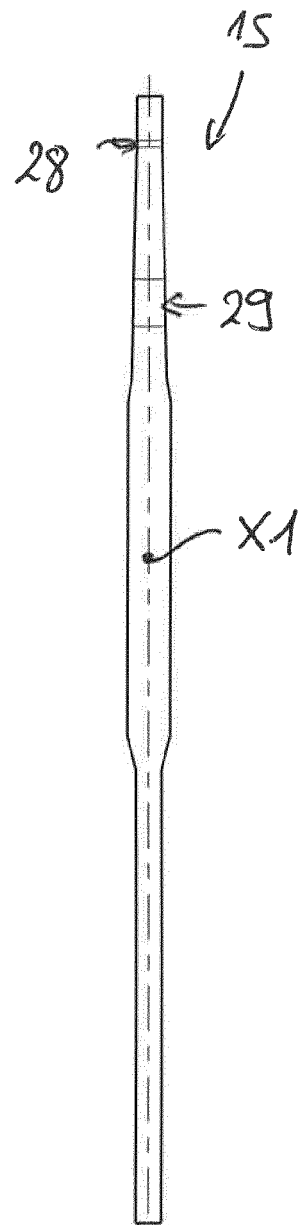


Fig. 19

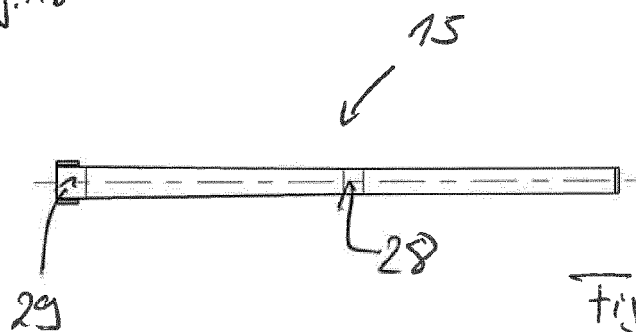
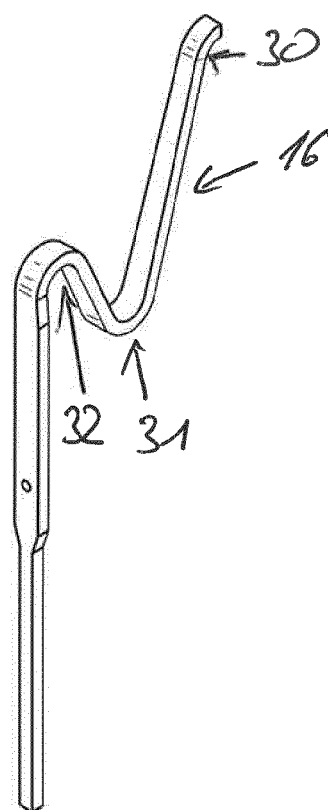
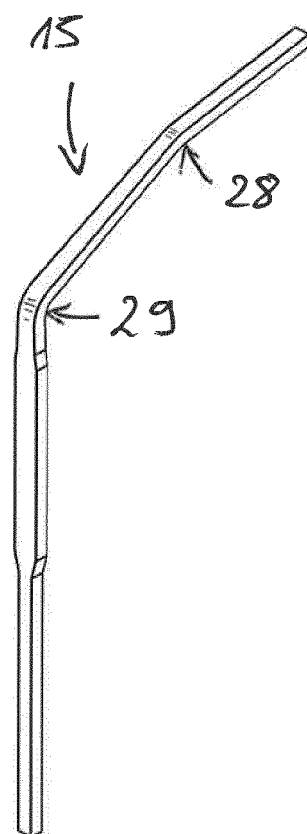
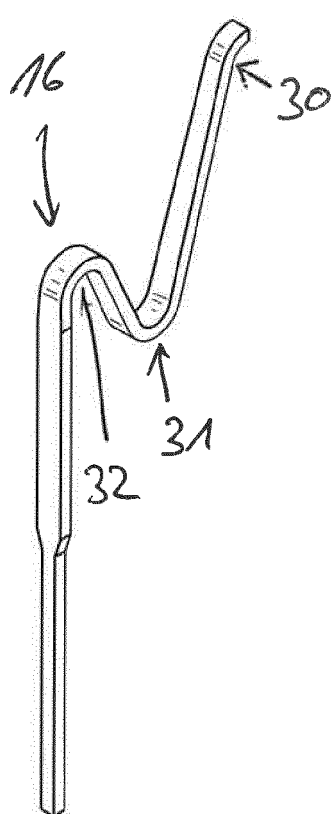
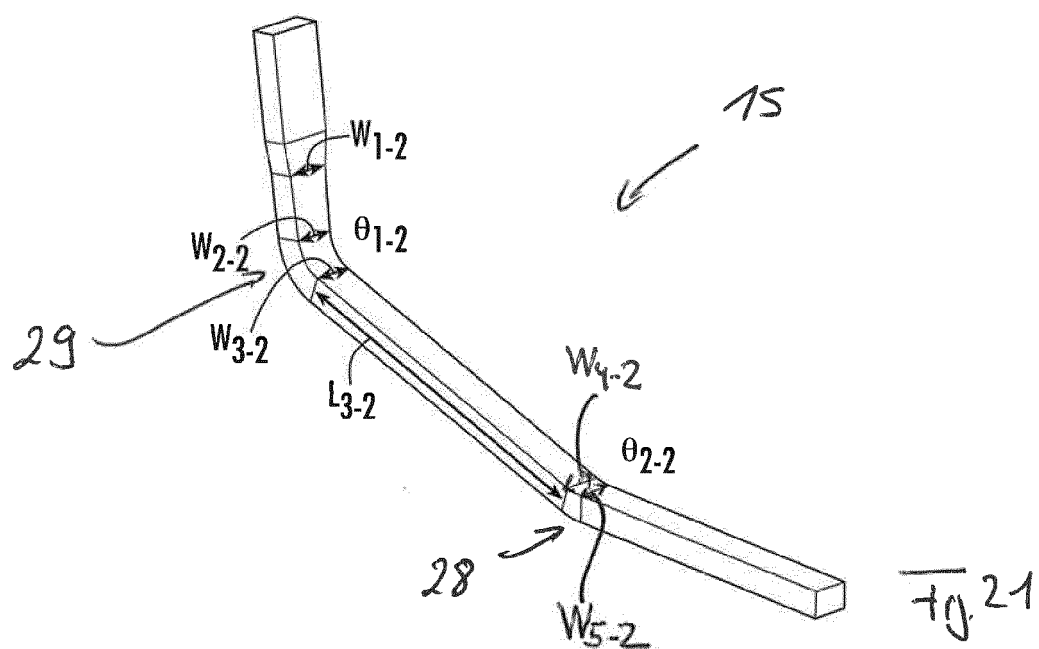


Fig. 20





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Application Number
EP 13 15 2508

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			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 23 April 2013	Examiner Esmiol, Marc-Olivier
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