(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2007 (15.11.2007)

PCT

(10) International Publication Number
WO 2007/128380 A1

(51) International Patent Classification:
H01R 4/24 (2006.01)

(21) International Application Number:
PCT/EP2007/003320

(22) International Filing Date: 16 April 2007 (16.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PV 2006902434 9 May 2006 (09.05.2006) AU

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

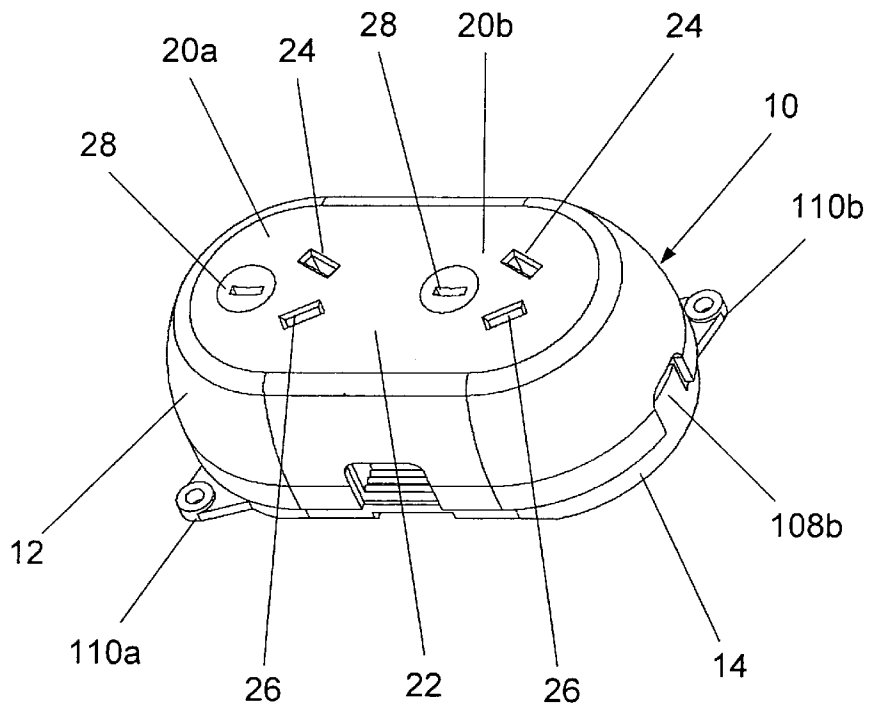
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) Title: ELECTRICAL CONNECTOR



(57) Abstract: An electrical connector for making electrical connection to insulated conductors, the connector having a first connector part which has lengthwise extending wire channels for receiving portions of the insulated conductors; insulation displacement contacts for making separate electrical connections to the conductors, when received in the lengthwise extending wire channels, under relative movement between the insulation displacement contacts and the wires, so that the insulation covering the conductors is cut and the insulation displacement contacts make electrical connections to the conductors; transverse wire channels intersecting with said lengthwise extending wire channels and being shaped to receive portions of insulated conductors of another electrical cable from which the outer covering of the cable has been removed; and a second connector part relatively moveable with respect to the first part for effecting said relative movement, wherein the insulation displacement contacts are located at intersections of the transverse wire channels and the lengthwise extending wire channels for electrically connecting conductors seated in the transverse wire channels with respective ones of the conductors seated in the lengthwise extending wire channels during said relative movement, and said insulation displacement contacts form parts of contact elements which form socket contacts of a socket formed on the first part, said socket being adapted to receive and make electrical connection to an electrical plug.

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— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ELECTRICAL CONNECTOR

Field of the Invention:

This invention relates to an electrical connector.

Background of Invention:

Electrical connectors, useful in electrical power wiring, have previously employed screw contacts for effecting electrical connections. The connectors may be somewhat inconvenient to use, requiring the following steps to be performed:

1. Stripping of insulation from end portions of wires;
2. Inserting stripped end portions of the wires into receiving openings of the connector; and
3. Screwing down of screws of the connector in order to make the connections.

Performing the above-described steps to install an electrical connector may be labour intensive, and inconvenient.

Electrical connectors may not have previously included means for controlling their operation. It may be difficult to control the operation of the individual connectors in a plurality of such connectors coupled together in series.

Insulation displacement contacts may be formed from a contact element which is bifurcated so as to define two opposed contact portions separated by a slot into which an insulated wire may be pressed so that edges of the contact portions engage and displace the insulation and such that the contact portions resiliently engage and make electrical connection with the conductor of the wire. Such a contact is described in, for example US patents 4,452,502 and 4,405,187.

While, in some cases, making electrical connection to a single wire in the above way is all that is necessary, occasions arise where it would be useful to make connection to more than one wire by inserting the wires, one after the other, into the slot. With a carefully designed contact it may be possible to make connections in this way to two wires, but it is difficult to make effective connections to several wires. This arises because, during the process of introducing a first wire into the slot, the contact portions are resiliently deformed, such that the gap between them is to some extent increased. The resultant increase in slot width may still permit an adequate connection to be made to a second wire when inserted into the slot. However, the increased slot width may even be such that the contact portions fail to properly pierce the insulation, or it may otherwise leave the second wire unreliably gripped. This problem becomes worse as more wires are inserted.

The above problem is alleviated in Krone LSA-PLUS connectors by arranging that the contact portions are torsionally twisted during insertion of the wires. That is, the wires are introduced into the slot with their directions of extent arranged at an angle of about 45 degrees to the side to side direction of the slot, so that insertion of the wires tends

to deflect contacting edges of the respective contact portions outwardly away from each other, in opposite directions relative to the general plane of the contact. In that case, it is possible to achieve good connection to two wires but even in this construction more than two wires may not be adequately accommodated.

US patent 5,492,484 also describes a particular form of contact that is indicated as being able to terminate more than a single conductor. This is however complicated in form.

It is generally desirable to overcome or ameliorate one or more of the above-described difficulties, or to at least provide a useful alternative.

Summary of Invention:

In accordance with one aspect of the present invention, there is provided 1. An electrical connector for making electrical connection to insulated conductors, the connector having:

(a) a first connector part which has lengthwise extending wire channels for receiving portions of the insulated conductors;

(b) insulation displacement contacts for making separate electrical connections to the conductors, when received in the lengthwise extending wire channels, under relative movement between the insulation displacement contacts and the wires, so that the insulation covering the conductors is cut and the insulation displacement contacts make electrical connections to the conductors;

(c) transverse wire channels intersecting with said lengthwise extending wire channels and being shaped to receive portions of insulated conductors of another electrical cable from which the outer covering of the cable has been removed; and

(d) a second connector part relatively moveable with respect to the first part for effecting said relative movement,

wherein the insulation displacement contacts are located at intersections of the transverse wire channels and the lengthwise extending wire channels for electrically connecting conductors seated in the transverse wire channels with respective ones of the conductors seated in the lengthwise extending wire channels during said relative movement, and said insulation displacement contacts form parts of contact elements which form socket contacts of a socket formed on the first part, said socket being adapted to receive and make electrical connection to an electrical plug.

Preferably, said insulation displacement contacts form parts of contact elements which form socket contacts of two sockets formed on the first part, said sockets being adapted to receive and make electrical connection to electrical plugs.

Preferably, the transverse channels intersect the lengthwise extending wire channels at an angle of substantially 90 degrees.

Preferably, the side to side direction of slots of the insulation displacement contacts is substantially 45 degrees to the direction of extent of the lengthwise extending wire channels.

In accordance with another aspect of the invention, there is provided an electrical connector, including:

(a) insulation displacement contacts for making electrical contact to conductors of electrically insulated wires by effecting relative movement between the conductors and the insulation displacement contacts;

(b) an electrical power socket including electrically conductive contact elements electrically connected to respective ones said insulation displacement contacts; and

(c) a control circuit for controlling operation of the electrical power socket.

Preferably, the control circuit is adapted to electrically isolate the socket from a power source.

Preferably, the control circuit is adapted to electrically isolate the socket from a power source without effecting the operation of electric devices also electrically connected to said conductors.

Preferably, the control circuit is adapted to electrically isolate electric devices also electrically connected to said conductors without effecting the operation of the socket.

In accordance with another aspect of the invention, there is provided an electrical connector, including:

(a) insulation displacement contacts for making electrical contact to conductors of electrically insulated wires by effecting relative movement between the conductors and the insulation displacement contacts; and

(b) a control circuit for controlling operation of one or more electric devices also electrically connected to said conductors.

Preferably, the control circuit includes a switch.

Preferably, the switch is located remotely from a main body portion of the connector.

Brief Description of the Drawings:

The invention is further described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of an electrical connector;

Figure 2 is another perspective view of the electrical connector shown in Figure 1;

Figure 3 is a perspective view of the connector of Figure 1 arranged in an open condition of use;

Figure 4 is an exploded view of the connector shown in Figure 1;

Figure 5 is a perspective view of a set of electrical contact elements of the connector shown in Figure 1;

Figure 6 is a perspective view of the electrical connector shown in Figure 3 electrically coupled to a double insulated electrical cable;

Figure 7 is a perspective view of the set of electrical contacts shown in Figure 5 electrically coupled insulated wires of the double insulated electrical cable in the manner shown in Figure 6;

Figure 8 is a perspective view of the electrical connector shown in Figure 6 electrically coupled to another double insulated electrical cable;

Figure 9 is a perspective view of the set of electrical contact elements shown in Figure 7 electrically coupled to another double insulated electrical cable in the manner shown in Figure 8;

Figure 10 is a sectioned view of part of the wire channel plate of the electrical connector shown in Figure 1;

Figure 11 is a perspective view of a part of the connector electrically connected to a power cable;

Figure 12 is a perspective view of the part shown in Figure 11 electrically connected to a power cable and to a control circuit;

Figure 13 is a perspective view of the part shown in Figure 11 electrically connected to a power cable and to another t; and

Figure 14 is a perspective view of the part shown in Figure 11 electrically connected to a power cable and to yet another control circuit.

Detailed Description of Preferred Embodiments of the Invention:

The connector 10 shown in Figures 1 and 2 includes two parts 12 and 14 which are hinged together so that they may be manipulated between the condition shown in Figures 1 and 2, at which the connector 10 is in a closed condition for use, and the condition shown in Figure 3, at which the connector 10 is in an open position, for connection to electrical conductors of an electrical cable (not shown).

The electrical connector 10 includes a wire channel plate 16 and a set of electrical contact elements 18 seated in the part 12 in the manner shown in Figure 4, where the set of contact elements 18 is interposed between the part 12 and the wire channel plate 16. The wire channel plate 16 and the set of contact elements 18 are housed within the parts

12, 14 when the parts 12, 14 are arranged in a closed condition of use, as shown in Figures 1 and 2.

Part 12 of connector 10 is formed of electrically insulate material. It has first and second electrical power sockets 20a, 20b arranged side by side on a generally planar exterior surface 22 of the part 12. Each power socket 20a, 20b includes three apertures 24, 26, 28 that are each shaped to receive conductive pins of an electric power plug (not shown). For example, the apertures 24, 26, 28 are shaped to respectively receive the active, neutral and earth pins of the electric power plug.

The set of electrical contact elements 18 includes:

1. An active contact element 30;
2. A neutral contact element 32; and
3. An earth contact element 34.

As particularly shown in Figure 5, the active contact element 30 includes two end portions 36a, 36b which are located within part 12 behind the active apertures 24 of the first and second power sockets 20a, 20b. The end portions 36a, 36b of the active contact element 30 are arranged to make electrical connection with the active pins of electrical power plugs (not shown) as they pass through the active apertures 24 of the electrical power sockets 20a, 20b. The end portions 36a, 36b are electrically connected by an elongate strip of electrically conductive material extending therebetween.

The neutral contact element 32 includes two end portions 38a, 38b which are located within part 12 behind the neutral apertures 26 of the first and second power sockets 20a, 20b. The end portions 38a, 38b of the neutral contact element 32 are arranged to make electrical connection with the neutral pins of electrical power plugs (not shown) as they pass through the neutral apertures 26 of the sockets 20a, 20b. The end portions 38a, 38b are electrically connected by an elongate strip of electrically conductive material extending therebetween.

The earth contact element 34 includes two end portions 40a, 40b which are located within part 12 behind the earth apertures 28 of the first and second power sockets 20a, 20b. The end portions 40a, 40b of the earth contact element 34 are arranged to make electrical connection with the earth pins of electrical power plugs (not shown) as they pass through the earth apertures 28 of the sockets 20a, 20b. The end portions 40a, 40b are electrically connected by an elongate strip of electrically conductive material.

Part 12 has, at a face thereof opposite the power socket 20a, 20b, a cable channel 42 which is open to that opposite face, and which extends lengthwise from side-to-side of the part 12. Cable channel 42 has parts at the ends thereof which are sized so as to neatly accommodate spaced portions a double insulated electrical cable 44 which may be laid therein in the manner shown in Figure 6. The cable 44 has therewithin three wires 46, 48, 50 which each have inner conductors and outer surrounding insulation. These wires 46, 48, 50 are arranged side-by-side within an outer cover 52 of the cable 44. Prior to fitting the cable in the cable channel 42, part of the outer cover 52 is removed, over the length labelled "L" in Figure 6 so that, over this length "L", the three

insulated wires 46, 48, 50 have no cover 52 over them, but the inner conductors still retain their insulation.

The wire channel plate 16 includes first 54, second 56 and third 58 walls upstanding from a base section of the plate 16 that extend along the cable channel 42, in the manner shown in figure 3. The walls 54,56, 58 are generally parallel to the length of the cable channel 42, and are positioned at an intermediate part of the cable channel 42, along the length thereof. The first wall 54 is adjacent to, but spaced from, an upstanding side wall portion 60 of cable channel 42. The second wall 56 is adjacent to, but spaced inwardly from, the first wall 54. The third wall 58 is adjacent to, but spaced inwardly from, the second wall 56. Similarly, the third wall 58 is adjacent to, but spaced inwardly from, the second wall 56. The third wall is also spaced apart from an opposite sidewall portion 62 of cable channel 42. The spacing between adjacent walls 54, 56, 58, 60, 62 is generally the same, and substantially equal to the diameter of the insulated wires 46, 48, 50. The side wall portion 60 and the first wall 54 define therebetween a neutral wire channel 66; the first wall 54 and the second wall 56 define therebetween an earth wire channel 68; the second wall 56 and the third wall 58 define therebetween an active wire channel 70; and the third wall portion 58 and the opposite side wall portion define therebetween a control wire channel 72.

Disposed within the lengthwise extending wire channels 66, 68, 70, 72 are insulation displacement contacts (IDCs) 74, 76, 78, 80, 140. These IDCs form part of the set of contact elements 18. The first IDC 74 is electrically coupled to the neutral contact element 32; the second IDC 76 is electrically coupled to the earth contact element 34; and the third

and fourth IDCs 78, 80 are electrically coupled to the active contact element 30. The fifth IDC 140 is electrically electrically isolated from the other contact elements 30, 32, 34. The IDC 140 is used to couple the connector to a control circuit. The operation of the control circuit is described in detail below.

Each insulation displacement contact 74, 76, 78, 80, 140 is formed as a generally upstanding planar conductive portion of the respective contact element, being bifurcated so as to form two opposed upstanding contact portions 82a, 82b which are separated by an upwardly open space 84. The spacing between the contact portions 82a, 82b is such as to be slightly less than the diameter of the inner conductors of the wires 46, 48, 50.

Part 14 of the electrical connector 10 is formed of electrically insulative material and has an elongate somewhat planar form, shaped such that it can be positioned over the top of part 12 so as to close the cable channel 42 at the open side thereof. It thus has a generally elongate planar roof portion 86 with side rim portions 88 extending along opposed side-to-side edges thereof.

Restraining means, in the form of a hinge 90 is provided for pivotally coupling parts 12, 14 together. Thus, part 12 has two sidewardly extending lugs 92 between which extends a hinge pin 94. The axis of this hinge pin 94 is arranged to be generally parallel to, and to one side of, the cable channel 42 and lengthwise extending wire channels 66, 68 ,70. Part 14 has at one side thereof a part-tubular elongate portion 96 of length only slightly less than the length of pin 94. The part-tubular elongate portion 96 has a lengthwise extending inner part-tubular

insulated wires 46, 48, 50 have no cover 52 over them, but the inner conductors still retain their insulation.

The wire channel plate 16 includes first 54, second 56 and third 58 walls upstanding from a base section of the plate 16 that extend along the cable channel 42, in the manner shown in figure 3. The walls 54,56, 58 are generally parallel to the length of the cable channel 42, and are positioned at an intermediate part of the cable channel 42, along the length thereof. The first wall 54 is adjacent to, but spaced from, an upstanding side wall portion 60 of cable channel 42. The second wall 56 is adjacent to, but spaced inwardly from, the first wall 54. The third wall 58 is adjacent to, but spaced inwardly from, the second wall 56. Similarly, the third wall 58 is adjacent to, but spaced inwardly from, the second wall 56. The third wall is also spaced apart from an opposite sidewall portion 62 of cable channel 42. The spacing between adjacent walls 54, 56, 58, 60, 62 is generally the same, and substantially equal to the diameter of the insulated wires 46, 48, 50. The side wall portion 60 and the first wall 54 define therebetween a neutral wire channel 66; the first wall 54 and the second wall 56 define therebetween an earth wire channel 68; the second wall 56 and the third wall 58 define therebetween an active wire channel 70; and the third wall portion 58 and the opposite side wall portion define therebetween a control wire channel 72.

Disposed within the lengthwise extending wire channels 66, 68, 70, 72 are insulation displacement contacts (IDCs) 74, 76, 78, 80, 140. These IDCs form part of the set of contact elements 18. The first IDC 74 is electrically coupled to the neutral contact element 32; the second IDC 76 is electrically coupled to the earth contact element 34; and the third

covering 52 of the cable 44 are positioned within outer end portions of the cable channel 42;

3. The wires 46, 48, 50 are positioned so as to extend over respective ones of the first, second and third lengthwise extending wire channels 66, 68, 70;
4. The wires 46, 48, 50 are then lightly pressed into the first, second and third lengthwise extending wire channels 66, 68, 70;
5. The part 14 is swung about the axis of the pin 94 so that it overlies the part 12 and so that the projections 98 engage the wires 46, 48, 50 and press them into their respective channels 66, 68, 70; and
6. Part 14 is then pressed fully down so that portions of the part 14 away from the hinge axis are firmly engaged with the part 12.

During the described closing action, the projections 98 bear against portions of the wires 46, 48, 50 and force them into corresponding insulation displacement contacts 74, 76, 78, 80. In doing so, the insulation of the wires 46, 48, 50 is cut by the insulation displacement contacts 74, 76, 78, 80, and the internal conductors are forced into electrically conductive connection with the insulation displacement contact, as shown in Figure 7. That is, the wires 46, 48, 50 are pressed into the space between the upstanding contact parts 82a, 82b of the insulation displacement contacts 74, 76, 78, 80, and are firmly engaged by these. Also during the above process, the projections 98 press down upon the wires 46, 48, 50 to further assist in locating these in the channels 66, 68, 70. The electrical connector 10 need only be terminate once to provide a double socket outlet.

As will be observed particularly from Figure 6, that because a rotary action about an axis offset from, but generally parallel to, the direction of extent of the cable 44 is used to bring the projections 98 into engagement with the wires 46, 48, 50 for pressing these into the channels 66, 68, 70, at least initially, contact between the projections 98 and respective ones of the wires does not occur all at once. That is to say, at first the projection 98a is brought into contact with the wire 50 located in the third channel 70; then the projection 98b is brought in to contact with the wire 48 located in the second channel 68; and, lastly, the projection 98c is brought into contact with the wire 46 located in the first channel 66. As a result, the wires are forced into the IDCs 74, 76, 78, 80 sequentially, and the forces which need to be applied to effect the making of electrical connection to the IDCs 74, 76, 78, 80 are also sequentially applied. By this, at any one time, it is sufficient to generally apply a force which would be enough to force only one wire at a time into position.

As shown in Figures 1 and 2, the parts 12, 14 may be latched in the closed position by resilient clips 102 coupled to the part 14 which releasably grip corresponding portions of the part 12. The parts 12, 14 can otherwise be fastened together using any other suitable means.

The part 14 includes first and second cable restraining flanges 108a, 108b arranged at opposite ends of the part 14. The flanges 108a, 108b extend from the planar roof portion 86 towards the end portions 100 of the outer covering 52 of the cable 44 when the connector is arranged in the closed position shown in Figure 1. When so arranged, the flanges 108a, 108b bear against respective end portions 100 of the cable 44

and inhibit movement of the cable 44 in direction "L". The flanges thereby reduce wear and tear on the electrical connections formed by the IDCs 74, 76, 78, 80 with the wires 46, 48, 50.

The connector 10 described is useful as a general purpose outlet for supply of electricity via the set of contact elements 18 from cable 44 to electrical devices which may be plugged into the sockets 20a, 20b. However, the invention may be applied to other types of connector.

While, in the described connector 10, the parts 12, 14 are connected together for relative swinging movement by restraining means formed as a simple hinge having the hinge pin 94 and cooperating part tubular portion 96, other forms of restraining means may be employed. For example, the parts 12, 14 may be integrally moulded with a connecting flexible hinge element.

While it has been found useful to align the planes of the insulation displacement contacts 47, 76, 78, 80 angularly with respect to the directions of extent of lengthwise extending wire channels 66, 68, 70 (at 45° in the illustrated embodiment) this is not necessarily essential to the invention.

The electrical connector 10 also includes two lugs 110a, 110b coupled to and extending from opposite ends of the part 14. The lugs 110a, 110b include apertures through which screws or nails can be driven to secure the connector to a wall surface, for example. The connector 10, alternatively include three or four lugs to secure the connector to the mentioned wall surface.

The connector 10 can be used to effect a straight through connection for the electrical power sockets 20a, 20b. The connector 10 can also be used to effect a "T" connection for a second double insulated cable 120 at right angles to the first one 44, as shown in Figures 8 and 9.

As particularly shown in Figure 6, the wire channel plate 16 of the part 12 includes transverse wire channels 122, 124, 126 that intersect the lengthwise extending wire channels 66, 68, 70, 72 at an angle of 90 degrees, for example. In the illustrated example, the transverse wire channels 122, 124, 126 overlie the lengthwise extending wire channels 66, 68, 70. Alternatively, the transverse wire channels 122, 124, 126 could underlie the lengthwise extending wire channels 66, 68, 70. The transverse wire channels 122, 124, 126 are generally parallel and extend through the opposite side wall portion 62 of part 12 and terminate in the side wall portion 60 of the part 12. The width of the transverse wire channels 122, 124, 126 approximates the width of the insulated wires 128, 130, 132 of the second double insulated cable 120.

The IDCs 74, 76, 78, 80 are located at intersections of the transverse wire channels 122, 124, 126 and the lengthwise extending wire channels 66, 68, 70 for electrically connecting the conductors 128, 130, 132 seated in the transverse wire channels 122, 124, 126 with respective ones of the conductors 46, 48, 50 seated in the lengthwise extending wire channels 66, 68, 70. For example, the wire channel plate 16 has the following configuration:

1. The transverse active wire channel 122 passes through the insulation displacement contact 78 located in the active wire channel 70 of the part 12;

2. The transverse earth wire channel 124 passes through the insulation displacement contact 76 located in the earth wire channel 68 of the part 12; and
3. The transverse neutral wire channel 126 passes through the insulation displacement contact 74 located in the neutral wire channel 66 of the part 12.

The insulation displacement contacts 74, 76, 78, 80 are held within a side-to-side elongate slots 200 formed in the wire channel plate 16 at intersections of the transverse wire channels 122, 124, 126 and the lengthwise extending wire channels 66, 68, 70, as shown in Figure 10. The slot 198 extends through the plate 16 from an upper surface to a bottom surface. Viewed from above the slot 198 extends with its longer cross-sectional dimension arranged at 45° to the directions of extent of both the transverse channel 122, 124, 126 and the lengthwise extending wire channel 46, 66, 68 and crosses and breaks into these. The insulation displacement contact 74, 76, 78, 80 is thus located within slot 198 so that the side to side direction of the slot 84 of the IDC is substantially 45 degrees to the direction of extent of the lengthwise extending wire channel 66, 68, 70 and substantially 45 degrees to the direction of extent of the transverse wire channel 122, 124, 126. The upstanding contact portions of the IDCs 74, 76, 78, 80 are disposed within channels.

The insulated wire 128, 130, 132 of the second cable 120 can be electrically coupled to corresponding insulated wire 46, 48, 50 of the first cable 44 by performing the following steps to effect the "T" connection:

1. The connector 10 is arranged in the position shown in Figures 1 and 2, that is in an open condition where the part 14 is swung clear of the cable channel 42;
2. The first cable 44, having the above-described portion of its outer cover 52 removed, is laid in the cable channel 42, as shown in Figure 6, so that end portions 100 of the outer covering 52 of the cable 44 are positioned within outer end portions of the cable channel 42;
3. The wires 46, 48, 50 are positioned so as to extend over respective ones of the first, second and third lengthwise extending wire channels 66, 68, 70;
4. The wires 46, 48, 50 are then lightly pressed into the first, second and third lengthwise extending wire channels 66, 68, 70;
5. The outer cover of a terminal end of the second cable 120 is removed exposing a length of the terminal ends of the active, neutral and earth insulated wires 128, 130, 132;
6. The wires 128, 130, 132 are inserted into their respective transverse wire channels 122, 124, 126 through the opposite side wall portion 62 of the part 12 so that they overlie and intersect the active, earth and neutral wires 46, 48, 50 of the first cable 44;
7. The wires 128, 130, 132 are then lightly pressed into the transverse wire channels 122, 124, 126;
8. The part 14 is swung about the axis of the pin 94 so that it overlies the part 12 and so that the projections 98 engage the wires 46, 48, 50 and press them into their respective channels; and

9. Part 14 is then pressed fully down so that portions of the part 14 away from the hinge axis are firmly engaged with the part 12.

During the described closing action, the projections 98 bear against portions of the wires 46, 48, 50 and force them into the insulation displacement contacts 74, 76, 78, 80. In doing so, the insulation of the wires 46, 48, 50 is cut by the insulation displacement contacts 74, 76, 78, 80, and the internal conductors are forced into electrically conductive connection with the insulation displacement contact, as shown in Figure 7. That is, the wires 46, 48, 50 are pressed into the space between the upstanding contact parts 82a, 82b of the insulation displacement contacts 74, 76, 78, 80, and are firmly engaged by these. Also during the above process, the projections 98 press down upon the wires 46, 48, 50 to further assist in locating these in the channels 66, 68, 70.

As part 14 is closed over part 12, the elongate planar roof portion 86 bears against the transverse wires 128, 130, 132 and forces them into respective ones of the insulation displacement contacts 74, 76, 78 as shown in Figure 9. Thus, the transverse wires 128, 130, 132 are electrically coupled to respective ones of the wires 46, 48, 50 of the first cable 44.

Relative movement of the upstanding contact portions 82a, 82b of the insulation displacement contacts 74, 76, 78, 80, 140 when the conductors are forced therebetween in the above described manner is limited by the shape of the slots 200 within which they are seated. The

slots 200 thereby assist the process of making good electrical connections between multiple conductors.

As above-mentioned, the parts 12, 14 may be latched in the closed position by resilient clips 102 coupled to the part 14 which releasably grip corresponding portions of the part 12. The parts 12, 14 can otherwise be fastened together using any other suitable means.

Control Circuit

As above-mentioned, the connector 10 also includes a spare insulation displacement contact 140 seated in the control wire channel 72, as shown in Figure 11. The spare IDC 140 allows the connector to interface with a control circuit 200. The control circuit 200 can be used to:

1. Control the electrical power outlets 20a, 20b of connector 10 and other electric devices also electrically connected to the power cable 44;
2. Control other electric devices also electrically connected to the power cable 44;
3. Control the electrical power sockets 20a, 20b of the connector 10 without interrupting power supply for other electric devices also electrically connected to the cable 44.

A description of the operation of the above configurations of the control circuit 200 and the connector 10 is set out below.

1. Control the electrical power outlets 20a, 20b of connector 10 and other electric devices also electrically connected to the power cable 44.

The connector 10 shown in Figures 12 is coupled to the control circuit 200. The circuit 200 is used to control the operation of the electrical power sockets 20a, 20b of the connector 10 and the operation of any other electric devices, such as additional connectors, electrically connected to the power cable 44.

In the arrangement shown, the active wire 50 of the power cable 44 has been cut. A first section 212 of the cut active wire 50 extends into, and is seated in, a left hand side of the control channel 72. An end portion of the first section 212 of the active wire 50 overlies the spare IDC 140. The first section 212 of the active wire 50 can thereby be electrically connected to the spare IDC 140. A second section 214 of the active wire 50 extends into, and is seated in, a right hand side of the active wire channel 70. An end portion of the second section 214 of the active wire 50 overlies the IDC 80. The second section 214 of the active wire 50 can thereby be electrically connected to the active IDC 80. The earth and neutral wires 48, 46 are respectively arranged in the earth and neutral wire channels 68, 66.

The control circuit 200 includes first and second insulated conductors 216, 218 electrically connected to respective sides of a switch 220. An end section of the first insulated conductor 216 extends into a spare traverse wire channel 222 through an opening in the opposite sidewall portion 62. The end section of the first insulated conductor 216 overlies

the spare IDC 140. The first insulated conductor 216 can thereby be electrically connected to the spare IDC 140. Similarly, an end section of the second insulated conductor 218 extends into another traverse wire channel 224 through an opening in the opposite sidewall portion 62. The end section of the second insulated conductor 218 overlies the active IDC 80. The second insulated conductor 218 can thereby be electrically connected to the active IDC 80.

When the part 14 is closed over the part 12 in the above-described manner, the insulated conductors 46, 48, 212, 214, 216, 218 are forced into respective ones of the IDCs 74, 78, 140, 80, 140, 80 by corresponding lengthwise extending projections 98.

The first section 212 and the second section 214 of the active wire 50 are thereby electrically connected by way of the control circuit 200. When the switch 220 is open, the active wire 50 is incomplete and the active contact element 30 of the connector 10 is electrically isolated. As such, the electrical power sockets 20a, 20b are inactive and all electric equipment connected to the power cable 44 after the connector 10 is also inactive. Alternatively, when the switch 220 is closed, the active wire 50 is complete and the active contact element 30 of the connector 10 is electrically charged. As such, the electrical power sockets 20a, 20b are active and all electric equipment connected to the power cable 44 after the connector 10 is also active.

For example, if a number of connectors 10 were fitted in series to the one length of power cable 44 to power a row of fluorescent lights, then the lights could all be turned on or off using a control circuit 200 connected to the first connector 10 in the series.

2. Control the electric devices also electrically connected to the power cable 44.

In the alternative arrangement of the above-described control circuit 200 shown in Figure 13, the electrical power sockets 20a, 20b of the connector 10 are always electrically connected to the active power supply and are always live. The control circuit 200 is used to control the operation of a series of electric devices, such as additional connectors, electrically connected to the power cable 44 after the connector 10.

In the arrangement shown, the first section 212 of the cut active wire 50 extends into, and is seated in, a left hand side of the active channel 70. An end portion of the first section 212 of the active wire 50 overlies the active IDC 76. The first section 212 of the active wire 50 can thereby be electrically connected to the active IDC 76. The second section 214 of the active wire 50 extends into, and is seated in, a right hand side of the control wire channel 72. An end portion of the second section 214 of the active wire 50 overlies the spare IDC 140. The earth and neutral wires 48, 46 are respectively arranged in the earth and neutral wire channels 68, 66.

As mentioned, the control circuit 200 includes first and second insulated conductors 216, 218 electrically connected to respective sides of a switch 220. An end section of the first insulated conductor 216 extends into a traverse wire channel 230 through an opening in the opposite side wall portion 62 and overlies the active IDC 76. The first insulated conductor 216 can thereby be electrically connected to the active IDC

76. Similarly, an end section of the second insulated conductor 218 extends into the spare wire channel 222 through an opening in the opposite side wall portion 62 and overlies the spare IDC 140. The second insulated conductor 218 can thereby be electrically connected to the spare IDC 140.

When the part 14 is closed over the part 12 in the above-described manner, the insulated conductors 46, 48, 212, 214, 216, 218 are forced into respective ones of the IDCs 74, 78, 76, 140, 76, 140 by corresponding lengthwise extending projections 98.

The first section 212 of the active wire 50 is always connected to the active IDC 76 and, as such, the active contact element 30 is always live. The electrical power sockets 20a, 20b are thereby always live.

The first section 212 and the second section 214 of the active wire 50 are electrically connected by way of the control circuit 200. The switch 220 is thereby used to open and close the active wire 50. When the switch 220 is open, there is an open circuit between the first and second sections 212, 214 of the active wire 50 and other connectors electrically connected to the power supply cable 44 after from the connector 10 will be inactive. When the switch 220 is closed, there is a closed circuit between the first and second sections 212, 214 of the active cable 50, and the additional connectors, or any other electric device, also electrically connected to the power supply cable 44 will be active.

For example, if a number of new connectors 10 were fitted in series to the one length of power cable 44 to power a row of fluorescent lights,

then the control circuit fitted to the first connector 10 in the series could be used to control the operation of the lights connected to the other connectors in the series. The lights connected to the first connector in the series would always be on.

3. Control the electrical power sockets 20a, 20b of the connector 10 without interrupting power supply for electric devices also electrically connected to the cable 44.

In the arrangement of the above-described control circuit 200 shown in Figure 14, the electrical power sockets 20a, 20b of the connector 10 are selectively electrically connected to the active power supply of the cable 44 by the switch 220. Operation of the control circuit 200 does not effect the operation of other electric devices also electrically connected to the power cable 44.

In the arrangement shown, the active wire 50 of the cable 44 extends into, and is seated in, the control channel 72 so as to overlie the spare IDC 140. The active wire can thereby be electrically connected to the spare IDC 140. The earth and neutral wires 48, 46 are respectively arranged in the earth and neutral wire channels 68, 66.

An end section of the first insulated conductor 216 of the control circuit 200 extends into the traverse wire channel 230, through an opening in the opposite side wall portion 62, and overlies the active IDC 76. The first insulated conductor 216 of the control circuit 200 can thereby be electrically connected to the active IDC 76. Similarly, an end section of the second insulated conductor 218 extends into the spare traverse wire channel 222 so as to overlie the spare IDC 140. The second insulated

conductor 218 can thereby be electrically connected to the spare IDC 140.

When the part 14 is closed over the part 12 in the above-described manner, the insulated conductors 46, 48, 50, 216, 218 are forced into respective ones of the IDCs 74, 78, 140, 76, 140 by corresponding lengthwise extending projections 98.

In this arrangement, the active wire 50 is unbroken and passes through the connector 10. The control circuit 200 is selectively used to electrically connect the active IDC 76 to the active wire 50. In doing so, the control circuit 200 is able to control the operation of the electrical power sockets 20a, 20b without cutting off electricity in the cable 44.

For example, if a number of new connectors 10 were fitted in series to the one length of power cable 44 to power a row of fluorescent lights, then the lights could be turned on or off using individual control circuits 200, without interrupting the power on the main cable 44.

The switch 220 of the control circuit 200 is preferably located remotely from the connector 10. Alternatively, the switch 220 is located proximal to the connector 10. For example, the switch 220 is mounted on the planar surface 22 of the part 14.

The described arrangement has been advanced merely by way of explanation any many modifications may be made thereto without departing from the spirit and scope of the invention which includes every novel feature and combination of novel features herein disclosed.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that that prior art forms part of the common general knowledge in Australia.

Parts

10	Connector
12	Part
14	Part
16	Wire channel plate
20a, 20b	Electrical power socket
22	Planar surface
24, 26, 28	Apertures
30	Active contact element
32	Neutral contact element
34	Earth contact element
36a, 36b	End portions
38a, 38b	End portions
40a, 40b	End portions
42	Cable channel
44	Cable
46	Neutral wire
48	Earth wire
50	Active wire
52	Outer cover of cable
54	First wall
56	Second wall
58	Third wall
60	Side wall portion
62	Opposite side wall portion
66	Neutral wire channel
68	Earth wire channel

70 Active wire channel
72 Control wire channel
74, 76, 78, 80 Insulation displacement contacts
82a, 82b Upstanding contact portion
84 Upwardly open space
86 Elongate planar roof portion
88 Rim portion
90 Hinge 90
92 Lugs
94 Hinge pin
96 Part-tubular elongate portion
98 Lengthwise extending projections
98a, 98b, 98c Lengthwise projection
100 End portions of the outer covering of the cable
102 Resilient clips
108a, 108b Restraining flanges
110a, 110b Lugs
120 Second cable
122 Transverse active wire channel
124 Transverse earth wire channel
126 Transverse neutral wire channel
128 Transverse active insulated wire
130 Transverse earth insulated wire
132 Transverse neutral insulated wire
140 Insulation displacement contact
198 Slot
200 Control circuit
212 First section of active wire
214 Second section of active wire

216	First insulated conductor of control circuit
218	Second insulated conductor of control circuit
220	Switch
222	Spare transverse channel
224	Another transverse wire channel
230	Another transverse wire channel

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. An electrical connector for making electrical connection to insulated conductors, the connector having:

(a) a first connector part which has lengthwise extending wire channels for receiving portions of the insulated conductors;

(b) insulation displacement contacts for making separate electrical connections to the conductors, when received in the lengthwise extending wire channels, under relative movement between the insulation displacement contacts and the wires, so that the insulation covering the conductors is cut and the insulation displacement contacts make electrical connections to the conductors;

(c) transverse wire channels intersecting with said lengthwise extending wire channels and being shaped to receive portions of insulated conductors of another electrical cable from which the outer covering of the cable has been removed;

(d) a second connector part relatively moveable with respect to the first part for effecting said relative movement; and

wherein the insulation displacement contacts are located at intersections of the transverse wire channels and the lengthwise extending wire channels for electrically connecting conductors seated in the transverse wire channels with respective ones of the conductors seated in the lengthwise extending wire channels during said relative movement, and said insulation displacement contacts form parts of contact elements which form socket contacts of a socket formed on the first part, said socket being

adapted to receive and make electrical connection to an electrical plug.

2. A connector claimed in claim 1, wherein said insulation displacement contacts form parts of contact elements which form socket contacts of two sockets formed on the first part, said sockets being adapted to receive and make electrical connection to electrical plugs.

3. A connector claimed in claim 1 or claim 2, wherein the transverse channels intersect the lengthwise extending wire channels at an angle of substantially 90 degrees.

4. A connector claimed in claim 3, wherein the side to side direction of slots of the insulation displacement contacts is substantially 45 degrees to the direction of extent of the lengthwise wire channels.

5. A connector claimed in claim 3 or claim 4, wherein the side to side direction of slots of the insulation displacement contacts is substantially 45 degrees to the direction of extent of the transverse wire channels.

6. A connector claimed in any one of the preceding claims, including means for controlling the operation of the socket.

7. A connector claimed in any one of the preceding claims, including restraining means for restraining said relative movement such that said connections between the insulation displacement contacts and conductors are made substantially sequentially

8. A connector as claimed in claim 7, wherein the restraining means comprises a hinge.

9. An electrical connector as claimed in claim 8, wherein the hinge has cooperating hinge components on the first and second parts, for constraining the parts for relative swinging movement with respect to each other.

10. A connector as claimed in any preceding claim, wherein the lengthwise extending wire channels are side-by-side, and generally in a common plane, and the restraining means is arranged to, in use, restrain the parts for relative swinging movement about an axis which is displaced to one side of the wire channels.

11. A connector as claimed in any preceding claim, wherein the insulation displacement contacts are carried by said first part.

12. A connector as claimed in any one of claims 1 to 10, wherein the insulation displacement contacts are carried by said second part.

13. A connector as claimed in any preceding claim, wherein said second part has projections for sequentially engaging insulated conductors seated in the lengthwise extending wire channels during said relative movement.

14. A connector as claimed in any one of the preceding claims, wherein the connector is adapted to interface with a control circuit for controlling the operation of the socket.

15. A connector as claimed in any one of the preceding claims, wherein the connector is adapted to interface with a control circuit for controlling the operation of other electric devices also electrically connected to the insulated conductors.

16. A connector as claimed in any one of claims 1 to 13, wherein the connector is adapted to interface with a control circuit for controlling the operation of other electric devices also electrically connected to the insulated conductors.

17. A connector as claimed any one of claims 14 to 16, wherein the control circuit includes a switch located remotely to a main body portion of the connector.

18. An electrical connector, including:

(a) insulation displacement contacts for making electrical contact to conductors of electrically insulated wires by effecting relative movement between the conductors and the insulation displacement contacts;

(b) an electrical power socket including electrically conductive contact elements electrically connected to respective ones said insulation displacement contacts; and

(c) a control circuit for controlling operation of the electrical power socket.

19. A connector as claimed in claim 18, wherein the control circuit is adapted to electrically isolate the socket from a power source.

20. A connector as claimed in claim 18, wherein the control circuit is adapted to electrically isolate the socket from a power source without effecting the operation of electric devices also electrically connected to said conductors.

21. A connector as claimed in claim 18, wherein the control circuit is adapted to electrically isolate electric devices also electrically connected to said conductors without effecting the operation of the socket.

22. A connector claimed in any one of claims 18 to 21, wherein the control circuit includes a switch.

23. A connector as claimed claim 22, wherein the switch is located remotely from a main body portion of the connector.

24. An electrical connector, including:

(a) insulation displacement contacts for making electrical contact to conductors of electrically insulated wires by effecting relative movement between the conductors and the insulation displacement contacts; and

(b) a control circuit for controlling operation of one or more electric devices also electrically connected to said conductors

25. A connector claimed in claim 24, wherein the control circuit includes a switch.

26. A connector as claimed claim 25, wherein the switch is located remotely from a main body portion of the connector.

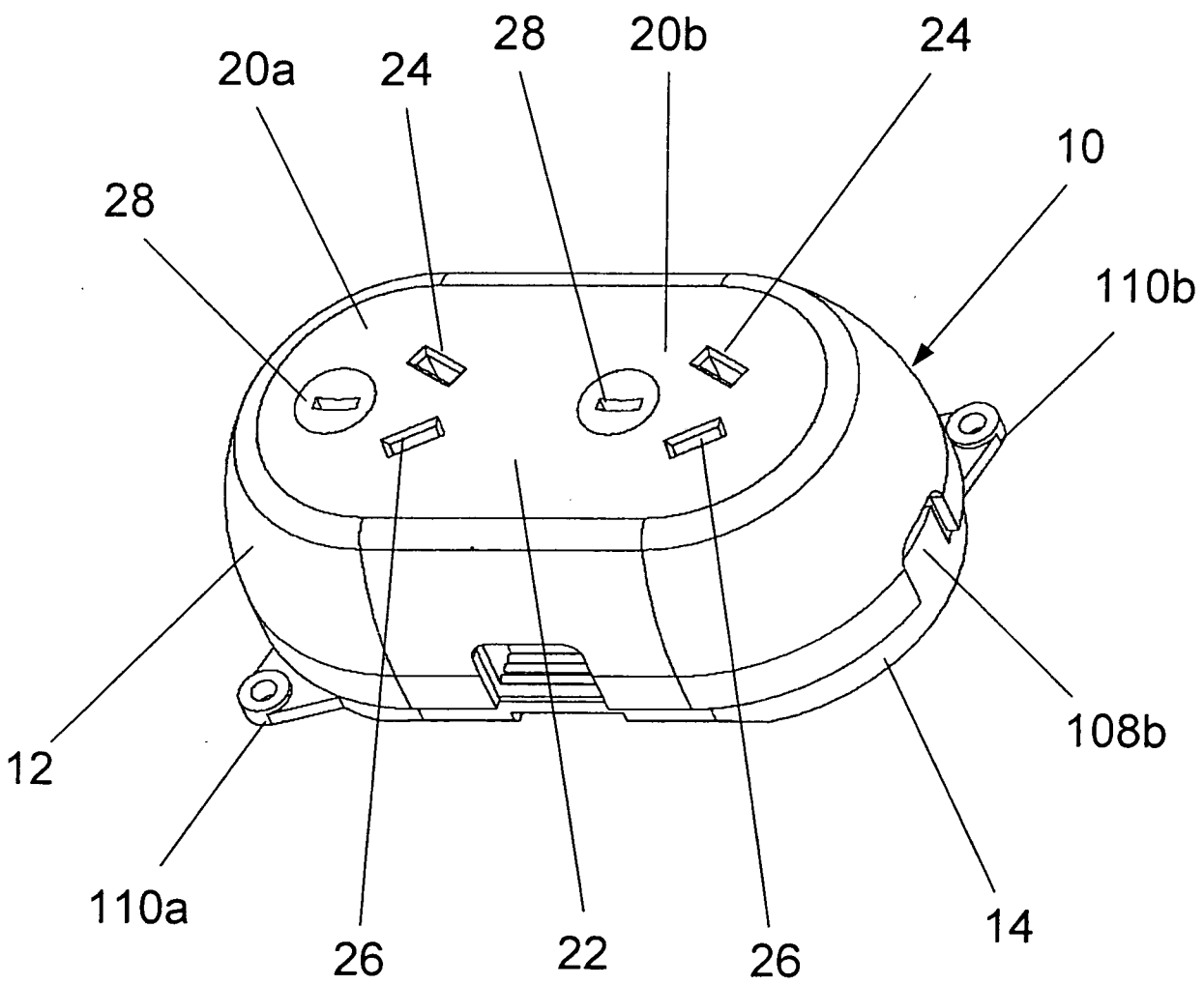


Figure 1

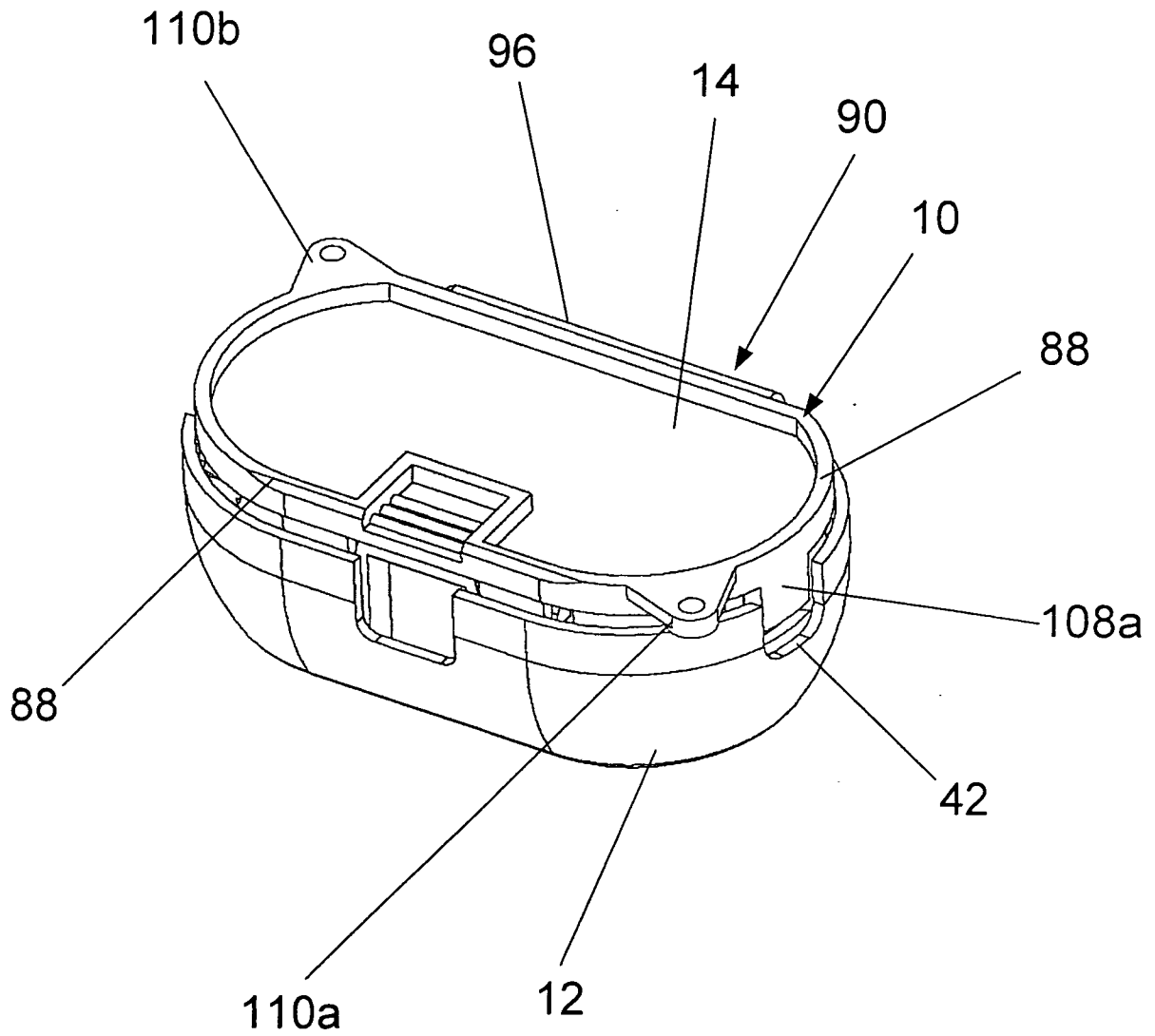


Figure 2

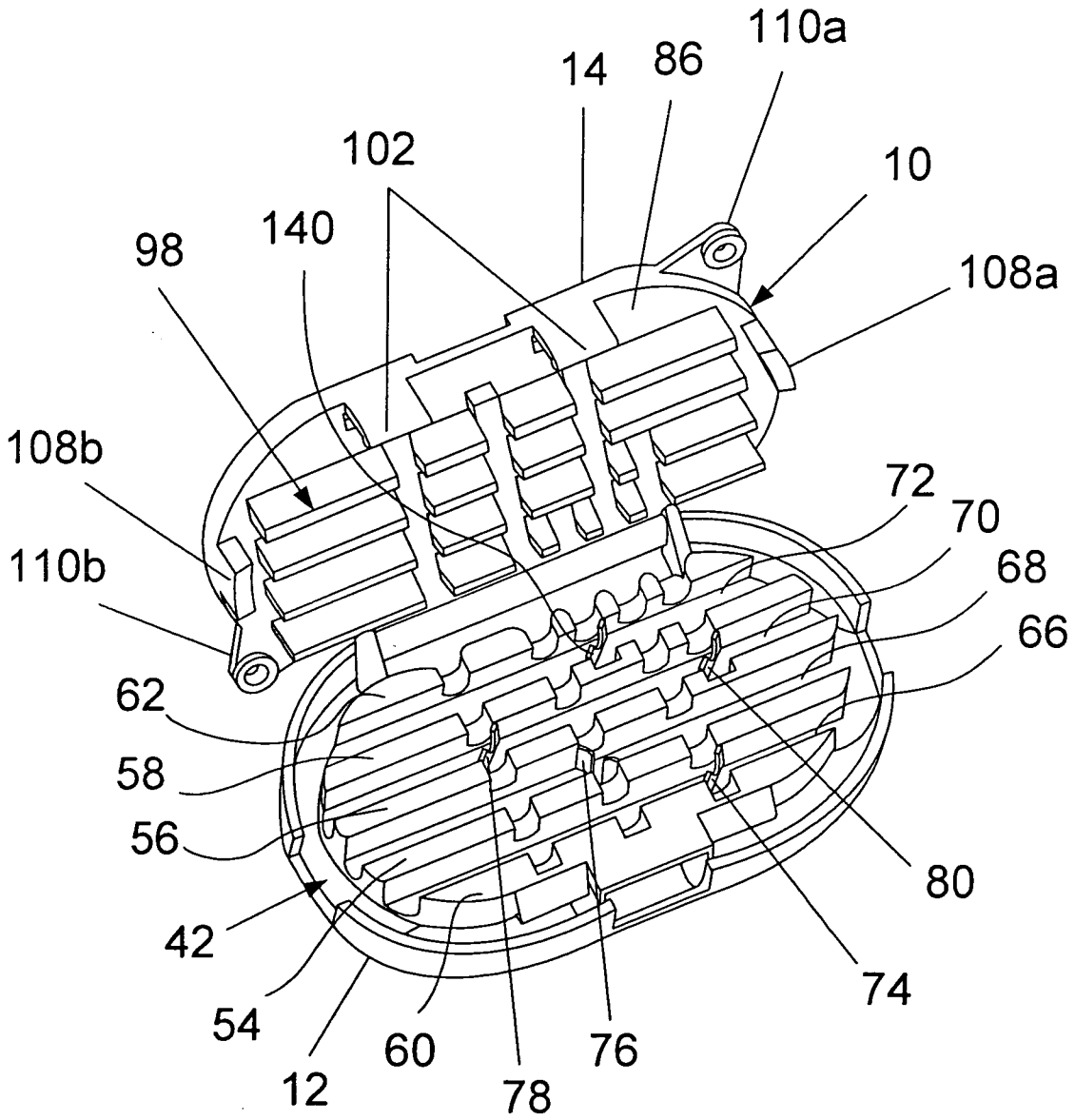

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Figure 3

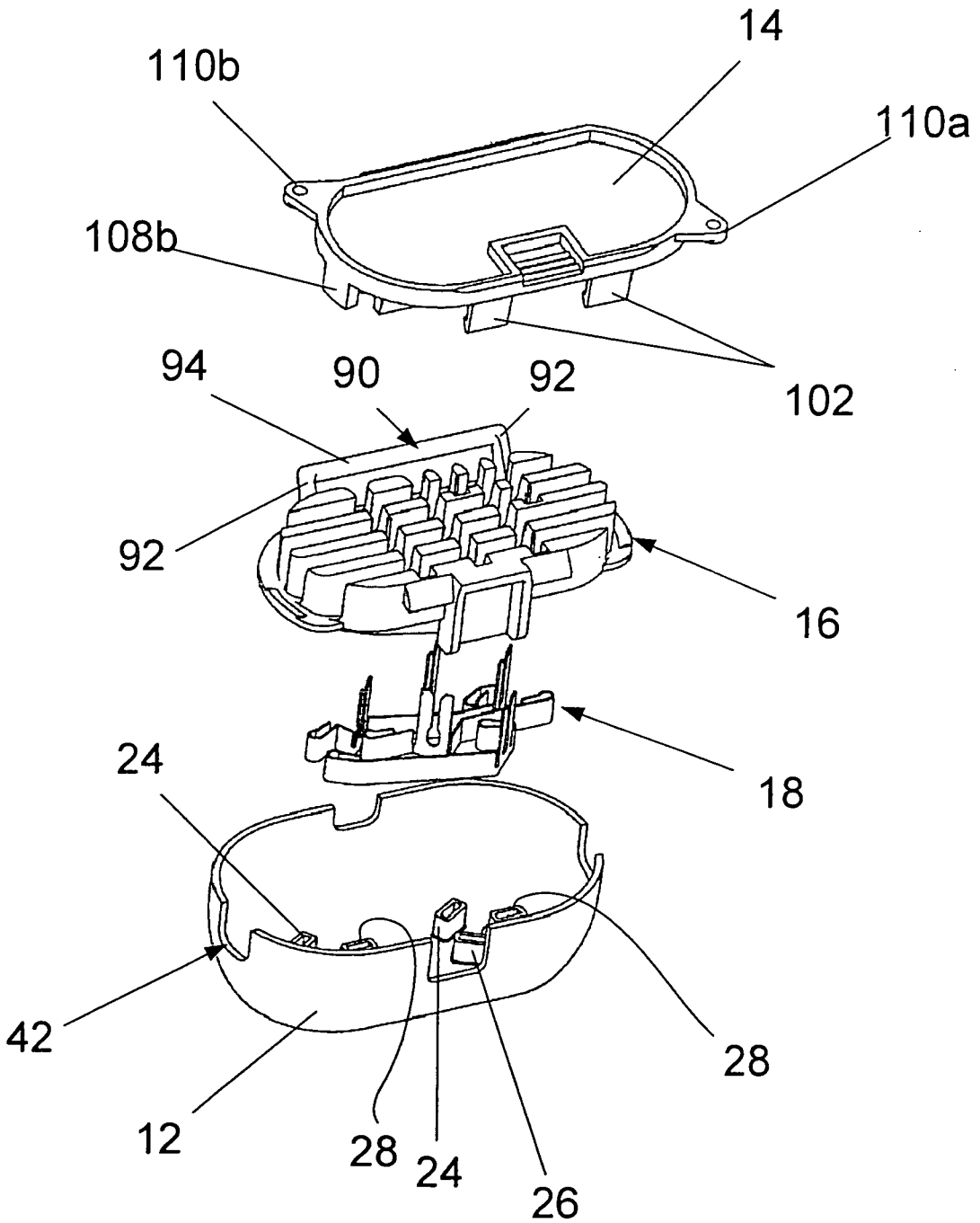


Figure 4

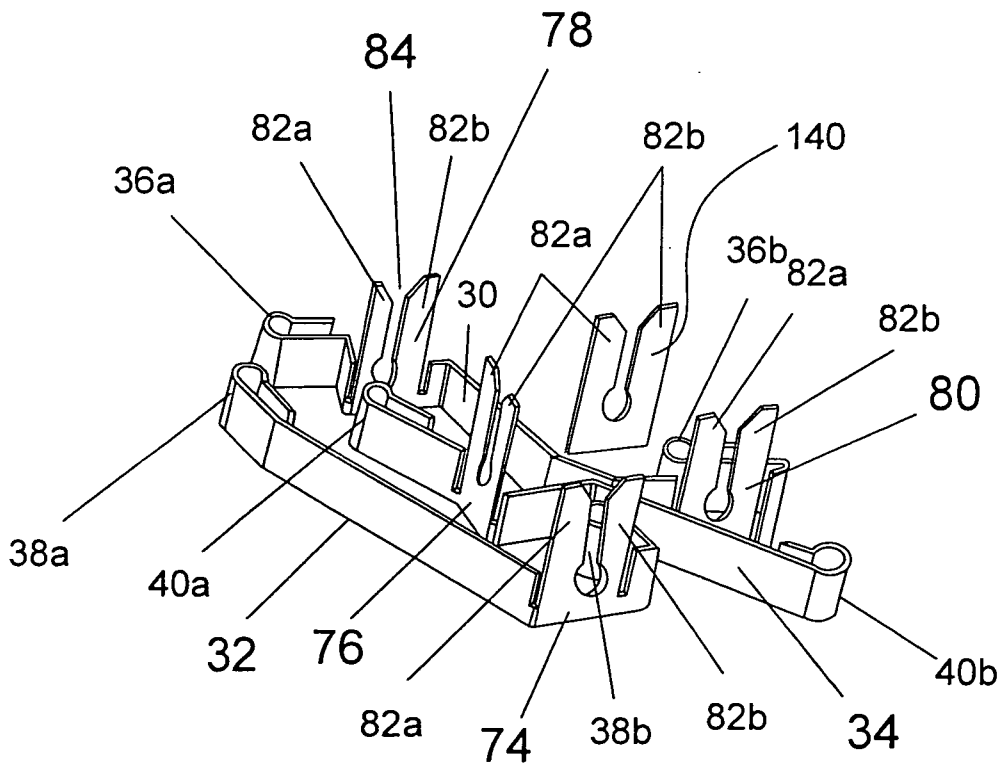

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Figure 5

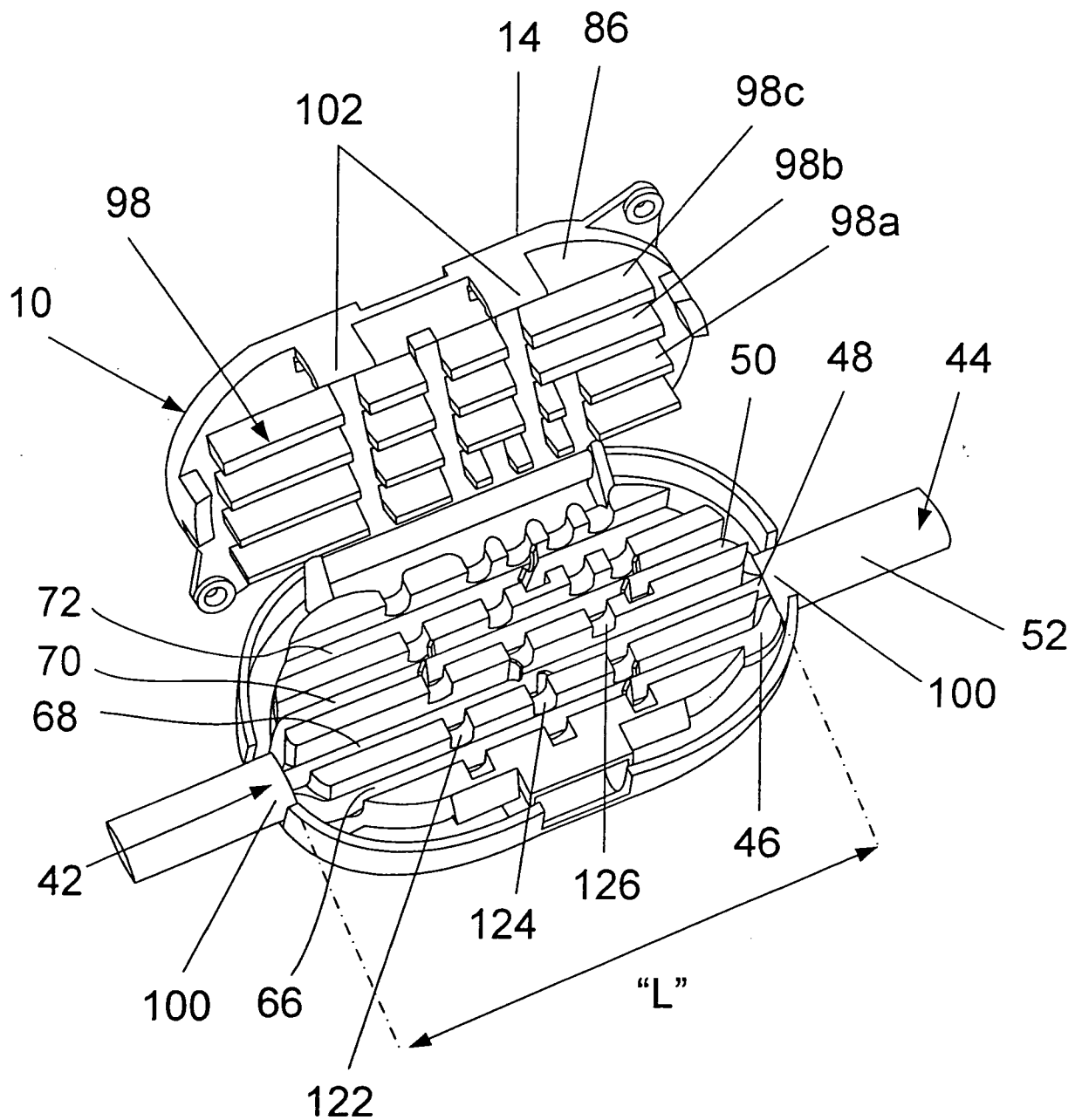

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Figure 6

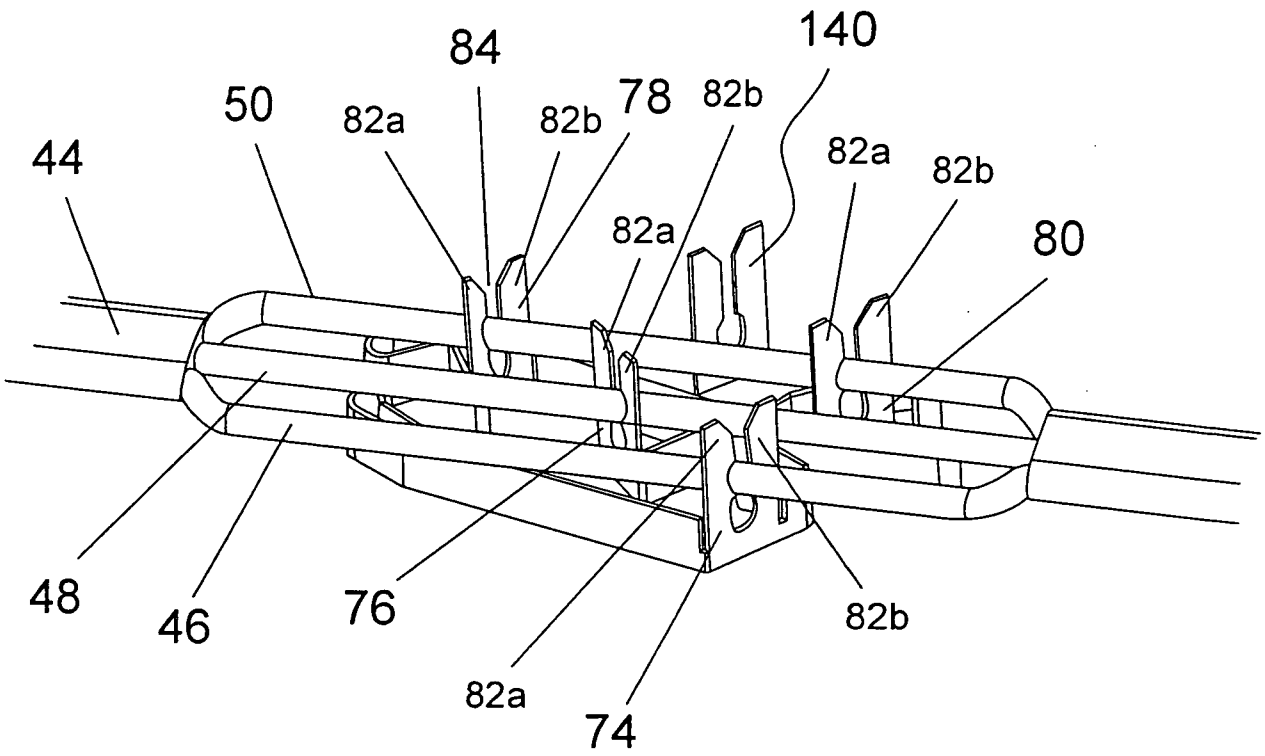


Figure 7

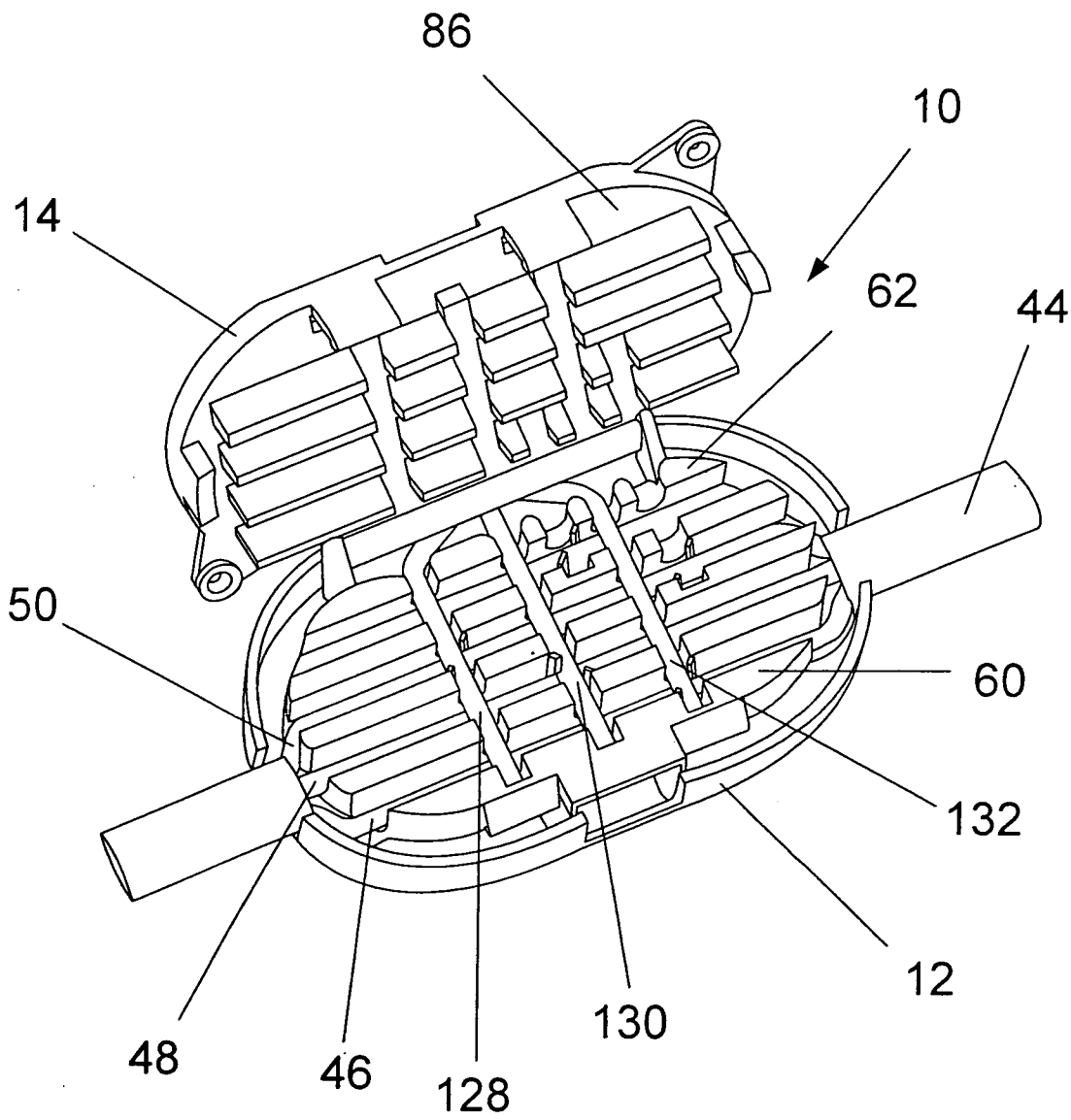


Figure 8

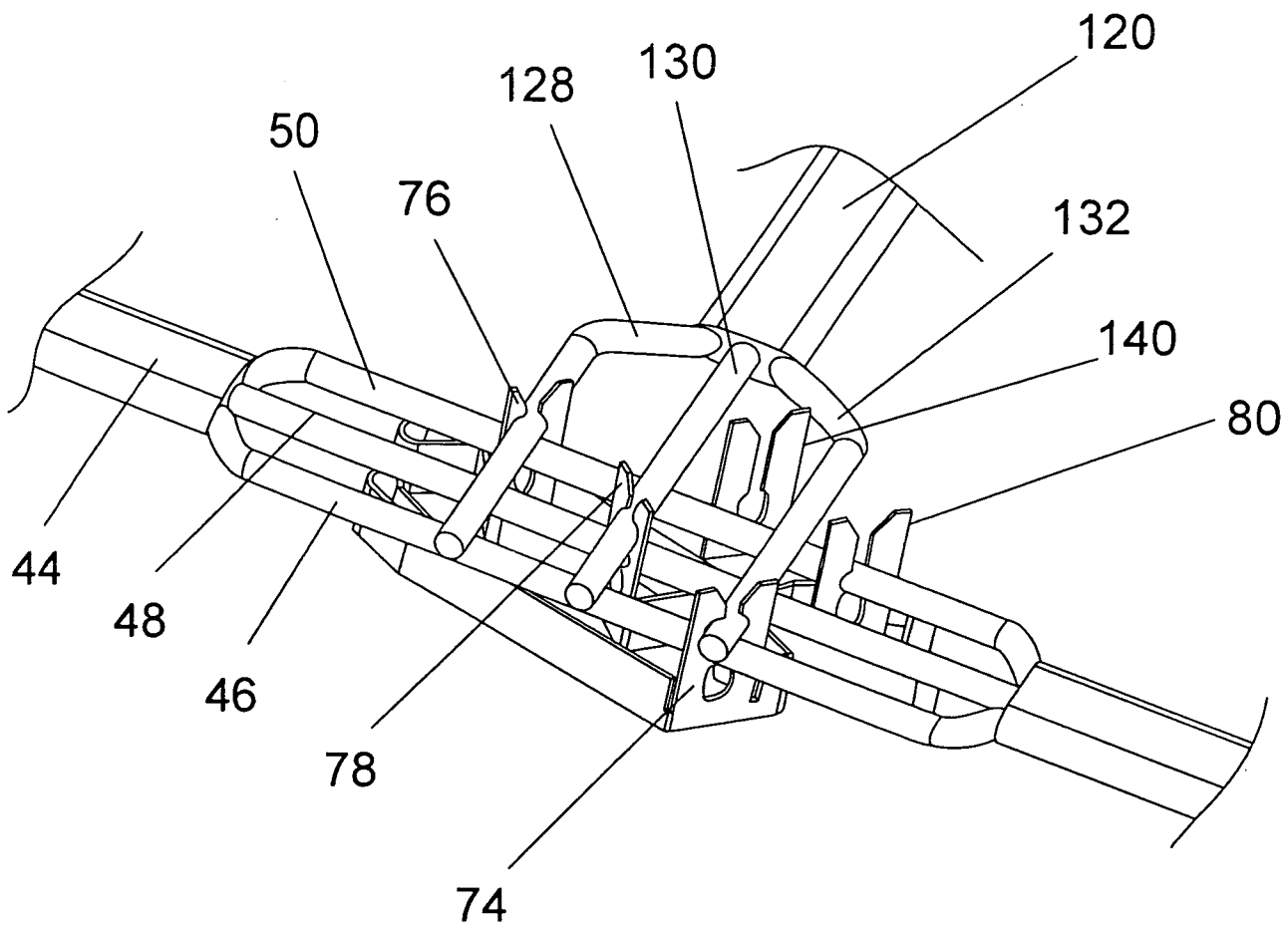


Figure 9

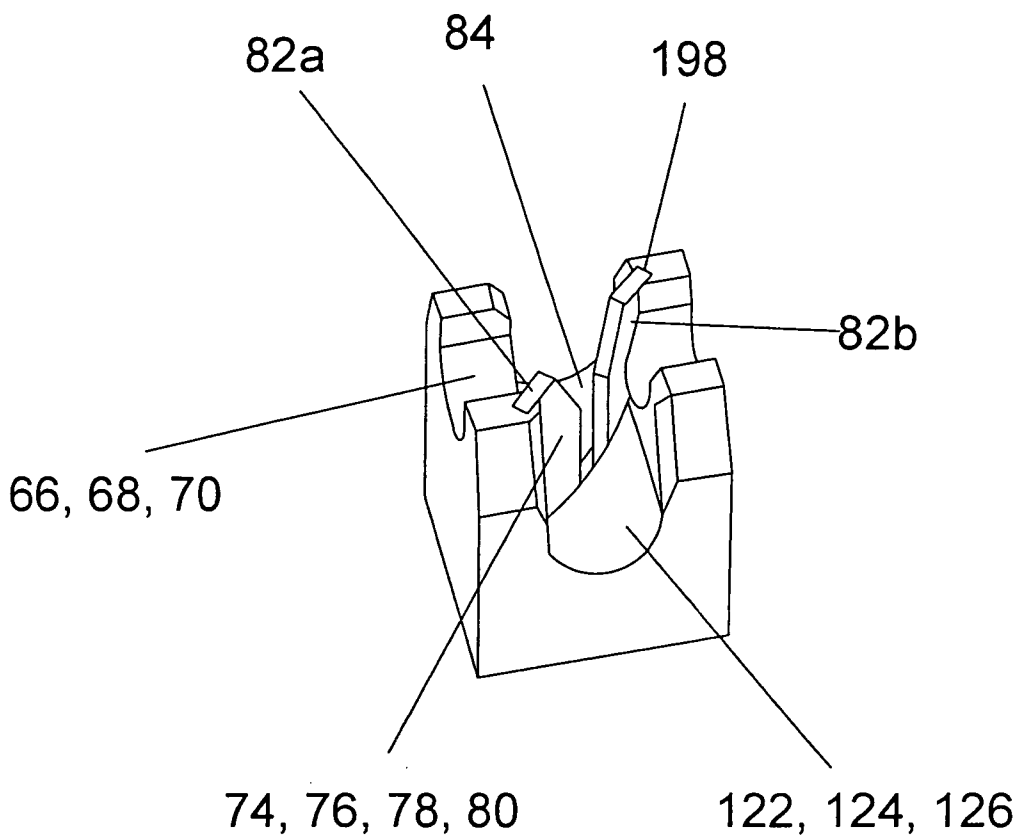


Figure 10

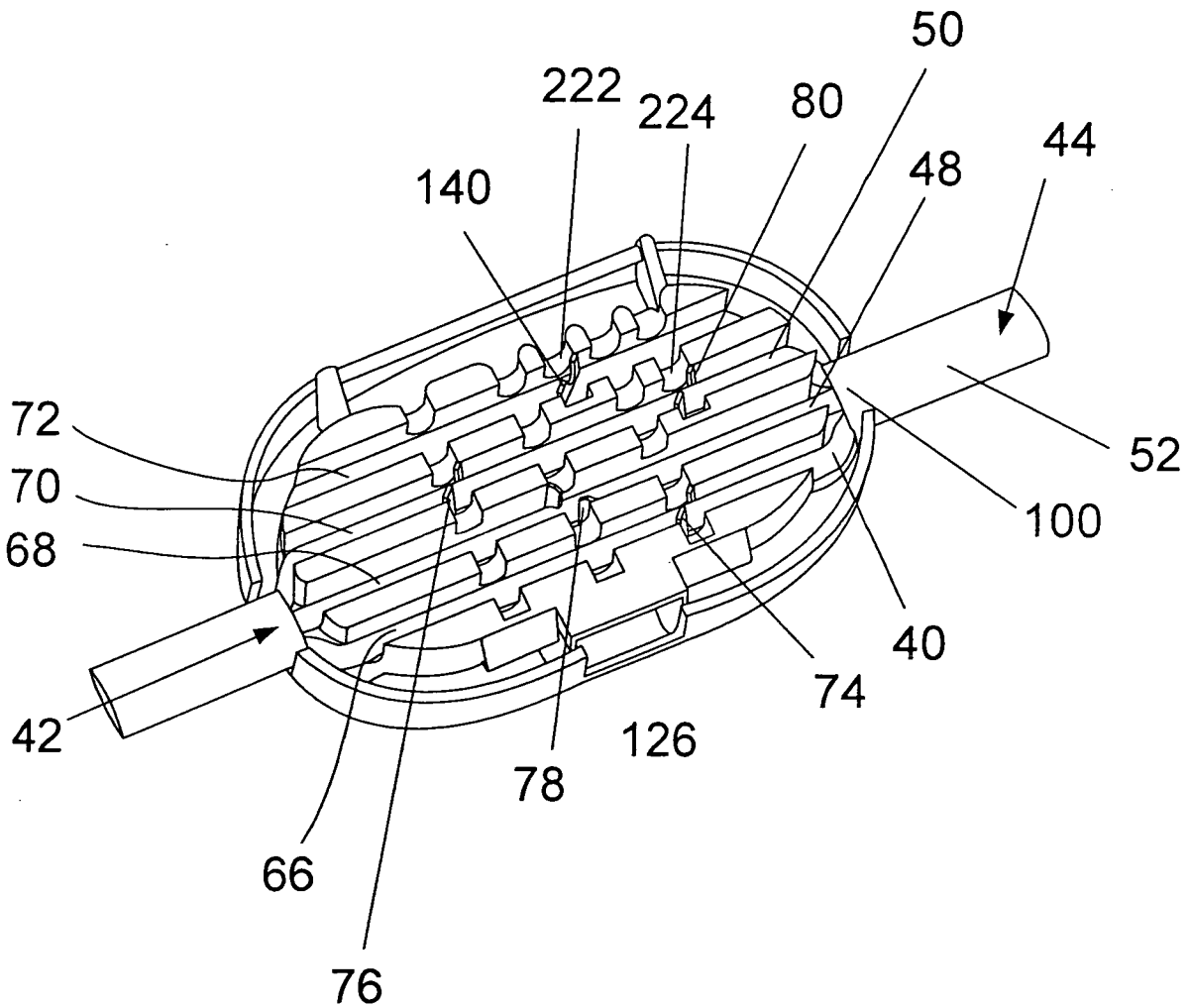


Figure 11

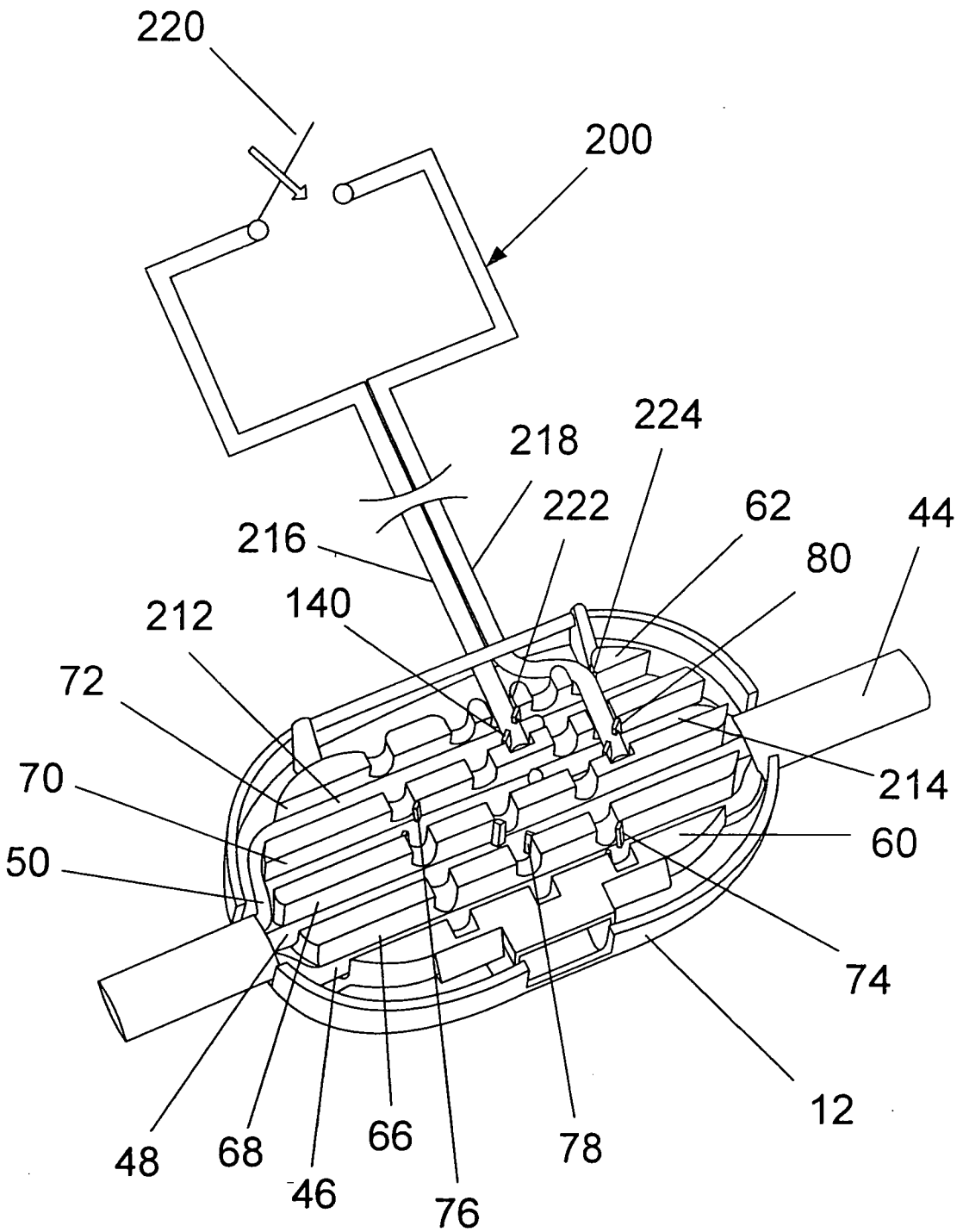

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Figure 12

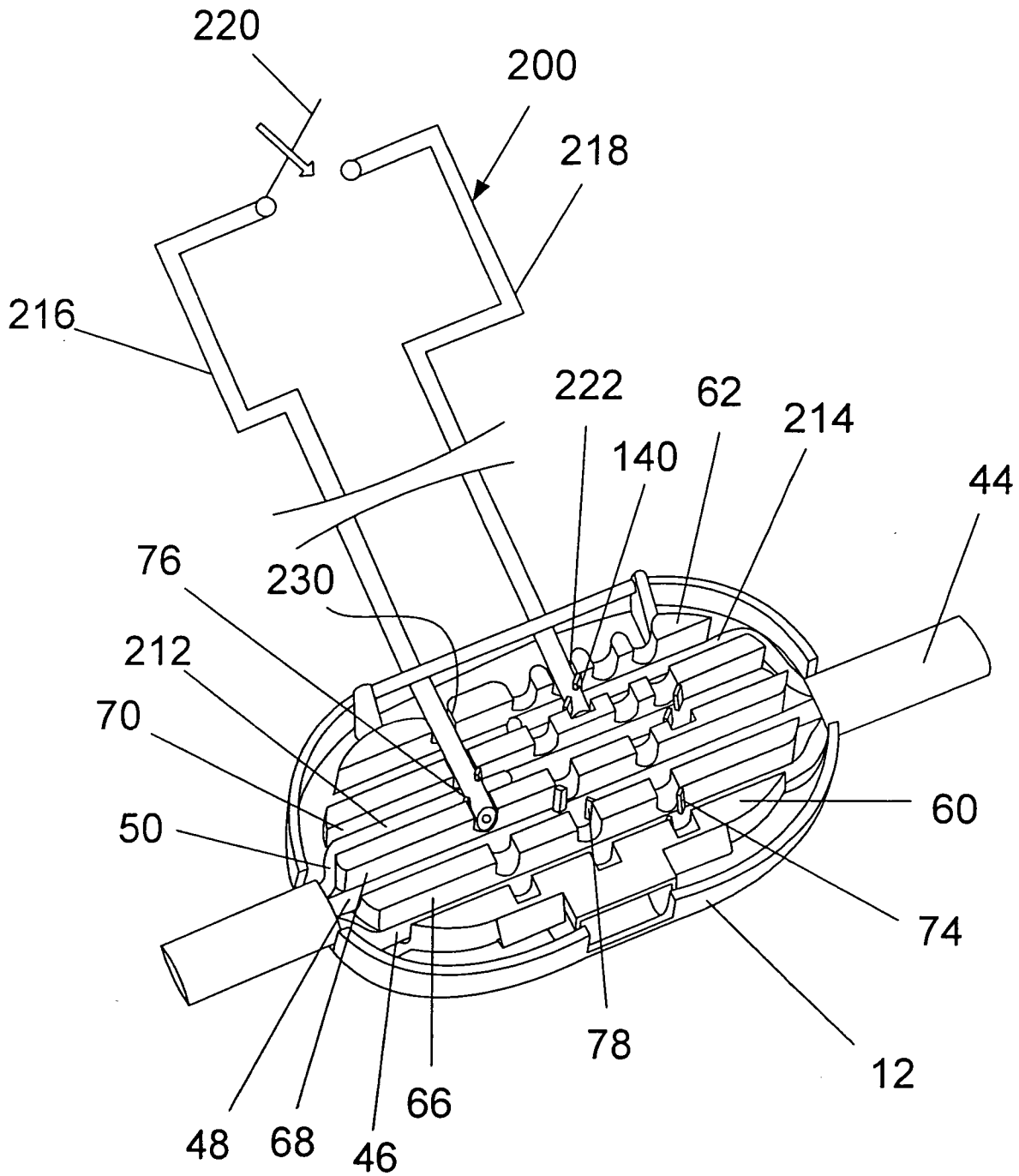

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Figure 13

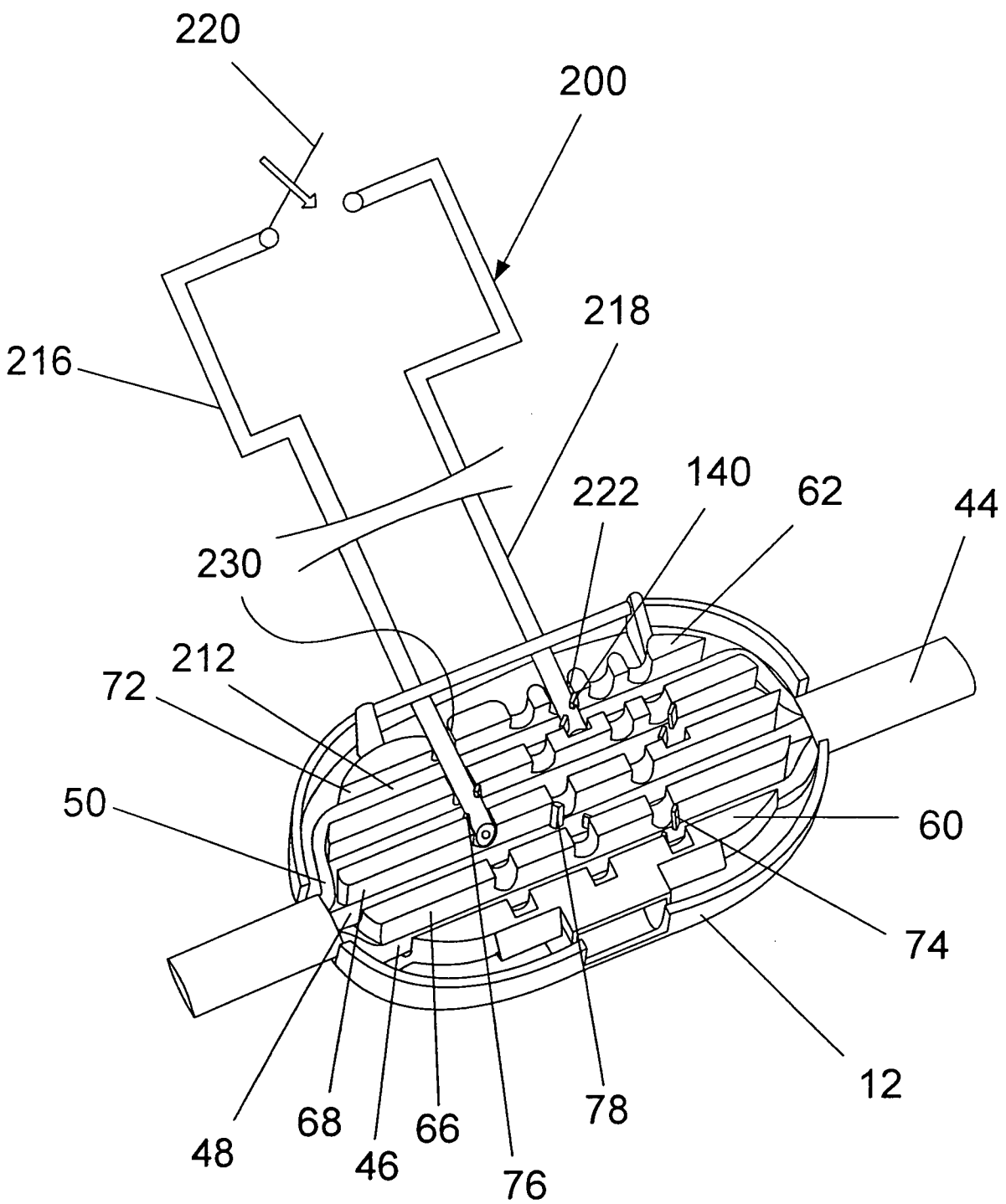

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Figure 14

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/003320

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R4/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/013081 A1 (SHAN LAVAL CHUNG LONG [AT] CHUNG LONG SHAN LAVAL [AU]) 31 January 2002 (2002-01-31) paragraph [0048] - paragraph [0053]; figures 11-14	1-17
Y	US 4 500 746 A (MEEHAN JAMES E [US]) 19 February 1985 (1985-02-19) column 10, line 3 - line 41; figure 16	1-17
X	column 11, line 40 - column 12, line 15; figures 23-25	18-26

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2007	06/08/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Criqui, Jean-Jacques

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2007/003320

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-17

An electrical connector for making electrical connection to insulated conductors having:
- a first connector part with lengthwise extending wire channels and transverse wire channels intersecting with said lengthwise extending wire channels;
- insulation displacement contacts located at intersections of the transverse wire channels and the lengthwise extending wire channels for electrically connecting conductors;
- a second connector part relatively moveable with respect to the first part; and
wherein the insulation displacement contacts form parts of contact elements which form socket contacts of a socket adapted to receive an electrical plug.

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2. claims: 18-26

An electrical connector, including:
- insulation displacement contacts for making electrical contact to conductors of electrically insulated wires; and
- a control circuit for controlling operation of one or more electric devices also electrically connected to said conductors.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2007/003320

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002013081 A1	31-01-2002	AR 030427 A1	20-08-2003
		BR 0102388 A	19-02-2002
		CA 2350716 A1	16-12-2001
		MX PA01005734 A	10-09-2002
US 4500746 A	19-02-1985	NONE	