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(71) Applicant *(for all designated States except US)*: **ADC GmbH** [DE/DE]; Beeskowdamm 3-11, 14167 Berlin (DE).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **DENNES, Wayne** [AU/AU]; 30 Malison Street, Wyoming, New South Wales 2250 (AU).

(74) Agents: **CLARK, Ross, James** et al.; Davies Collison Cave, 1 Nicholson Street, Melbourne, Victoria 3000 (AU).

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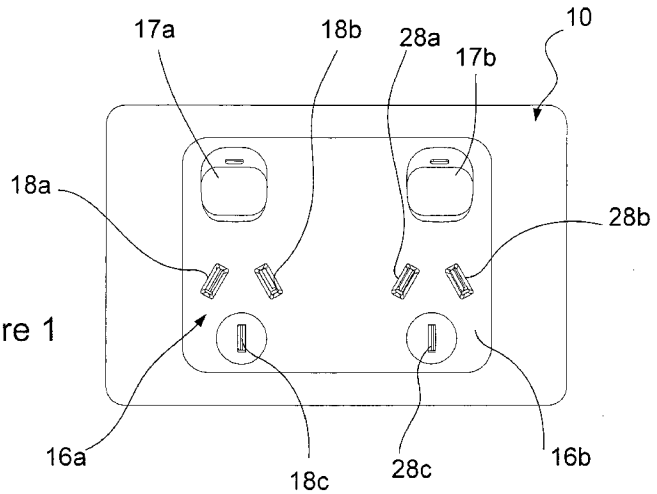

Figure 1

(57) Abstract: A power outlet for effecting an electrical connection between an electric device and insulated conductors of an electric power cable, including a socket having apertures including electrically conductive socket contacts seated therein for effecting electrical connection to corresponding electrically conductive contacts of a plug of the electric device; a plurality of primary channels shaped to at least partially receive, and seat therein, respective lengthwise sections of the insulated conductors of the power cable; a plurality of insulation displacement contacts for making separate electrical connections to said insulated conductors, when received in said primary channels, under relative movement between the insulation displacement contacts and the insulated conductors; a connector, relatively movable with respect to the primary channels, for effecting said relative movement, wherein the insulation displacement contacts are electrically coupled to respective ones of said socket contacts, and said primary channels extend transversely to a lengthwise direction of extent of the power outlet.

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POWER OUTLET

Technical Field of the Invention

The present invention relates to a power outlet.

Background of the Invention

Power outlets are typically used to electrically couple electric devices to the insulated conductors of a power cable. They have previously employed screw contacts to effect electrical connections to the insulated conductors of the power cable. The following steps may be performed to electrically connect a power outlet to the insulated conductors of a power cable:

1. Stripping of insulation from end sections of the conductors;
2. Inserting stripped end sections of the conductors into openings of respective connectors of the power outlet; and
3. Fastening the conductors to the connectors by tightening the screws.

Performing the above-described steps to install a power outlet may be labour intensive and inconvenient.

An electrical connection may otherwise be effected using an insulation displacement contact that includes a contact element which is bifurcated so as to define two opposed contact portions separated by a slot into which an insulated conductor 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 provide a power outlet that can effect quick and easy electrical connection to the insulated conductors of a power cable.

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

Summary of the Invention

In accordance with the present invention, there is provided a power outlet for effecting an electrical connection between an electric device and insulated conductors of an electric power cable including:

(a) a socket having apertures including electrically conductive socket contacts seated therein for effecting electrical connection to corresponding electrically conductive contacts of a plug of the electric device;

(b) a plurality of primary channels shaped to at least partially receive, and seat therein, respective lengthwise sections of the insulated conductors of the power cable;

(c) a plurality of insulation displacement contacts for making separate electrical connections to said insulated conductors, when received in said primary channels, under relative movement between the insulation displacement contacts and the insulated conductors;

(d) a connector, relatively movable with respect to the primary channels, for effecting said relative movement,

wherein the insulation displacement contacts are electrically coupled to respective ones of said socket contacts, and said primary channels extend transversely to a lengthwise direction of extent of the power outlet.

Advantageously, the above described power outlet can effect quick and easy electrical connection to the insulated conductors of a power cable.

Brief Description of the Drawings

Preferred embodiments of the present invention are hereafter described, by way of non-limiting example only, with reference to the accompanying drawing in which:

Figure 1 is a diagrammatic illustration of a front view of a power outlet;

Figure 2 is a diagrammatic illustration of a top view of the power outlet shown in Figure 1;

Figure 3 is a diagrammatic illustration of a bottom view of the power outlet shown in

Figure 1;

Figure 4 is a diagrammatic illustration of a side view of the power outlet shown in Figure 1;

Figure 5 is a diagrammatic illustration of a back view of the power outlet shown in Figure 1;

Figure 6 is a diagrammatic illustration of a back view of the power outlet shown in Figure 1 coupled to insulated conductors of power cables;

Figure 7 is a diagrammatic illustration of a perspective view of the power outlet shown in Figure 6;

Figure 8 is a diagrammatic illustration of a side view of the power outlet shown in Figure 6;

Figure 9 is a diagrammatic illustration of a perspective view of the power outlet shown in Figure 6 arranged in another condition of use;

Figure 10 is a diagrammatic illustration of a back view of the power outlet shown in Figure 6 arranged in yet another condition of use;

Figure 11 is a diagrammatic illustration of a side view of the power outlet shown in Figure 10;

Figure 12 is a diagrammatic illustration of a connector of the power outlet shown in Figure 1;

Figure 13 is a diagrammatic illustration of a perspective view of electrically conductive contacts of the power outlet shown in Figure 1;

Figure 14 is a diagrammatic illustration of another perspective view of the electrically conductive contacts shown in Figure 13;

Figure 15 is a diagrammatic illustration of a back view of the electrically conductive contacts shown in Figure 13;

Figure 16 is a diagrammatic illustration of an exploded view of the electrically conductive contacts shown in Figure 13; and

Figure 17 is a diagrammatic illustration of another exploded view of the electrically conductive contacts shown in Figure 13.

Detailed Description of Preferred Embodiments of the Invention

The power outlet 10 shown in Figures 1 to 5 is used to effect electrical connection between an electric device (not shown) and the insulated conductors 12 of an electric power cable 14 in the manner shown in Figures 6 to 11. The power outlet 10 can, advantageously, effect electrical connections with the insulated conductors 12 of the power cable 14 without the need for an installer to screw the conductors into position. The power outlet 10 can, advantageously, be utilised to effect connection to the insulated conductors 12 of the power cable 14 quickly and easily.

The outlet 10 includes a socket 16a having apertures 18a, 18b, 18c including electrically conductive socket contacts 20a, 20b, 20c, seated therein, arranged in the manner shown in Figures 13 to 17. The socket contacts 20a, 20b, 20c are shaped to receive, and form electrical connections with, corresponding electrically conductive contacts of the plug (not shown) of the electric device. As particularly shown in Figure 5, the outlet 10 includes primary channels 22a, 22b, 22c shaped to at least partially receive, and seat therein, respective lengthwise sections 24a, 24b, 24c of the insulated conductors 12 of the power cable 14. The outlet 10 includes a plurality of insulation displacement contacts 26a, 26b, 26c for making separate electrical connections to the insulated conductors 12, when received in the primary channels 22a, 22b, 22c, under relative movement between the insulation displacement contacts 26a, 26b, 26c and the insulated conductors 12. As particularly shown in Figure 4, the outlet 10 also includes a connector 28, relatively movable with respect to the primary channels 22a, 22b, 22c, for effecting the relative movement between the insulation displacement contacts 26a, 26b, 26c and the insulated conductors 12. The insulation displacement contacts 26a, 26b, 26c are electrically coupled to respective ones of the socket contacts 20a, 20b, 20c. The primary channels 22a, 22b, 22c extend transversely to a lengthwise direction of extent "X" of the power outlet 10.

The outlet 10 also includes another socket 16b having apertures 28a, 28b, 28c including electrically conductive socket contacts 30a, 30b, 30c, seated therein, arranged in the manner shown in Figures 13 to 17. The socket contacts 30a, 30b, 30c are shaped to

receive, and form electrical connections with, corresponding electrically conductive contacts of a plug (not shown) of another electric device connected to the socket 16b. The insulation displacement contacts 26a, 26b, 26c are electrically coupled to respective ones of the socket contacts 30a, 30b, 30c.

As particularly shown in Figures 13 to 17, the socket contacts 20a and 30a of the sockets 16a and 16b are shaped for electrical connection to corresponding active electrical contacts of a plug of an electrical device (not shown). The socket contacts 20a and 30a are electrically coupled to an electrically conductive spanning contact 32a by electrically conductive clips 34a and 34b. The insulation displacement contact 26a includes a lateral bifurcated contact 36a electrically coupled to the spanning contact 32a. The spanning contact 32a is electrically connected to the insulation displacement contact 26a when inserted between the bifurcated arms of the contact 36a. The bifurcated arms of the contact 36a resiliently bear against the spanning contact 32a and thereby secure the contacts 32a, 36a in electrical communication.

The active socket contacts 20a, 30a can be independently electrically isolated from the corresponding insulation displacement contact 26a by corresponding switches 17a, 17b. The switches operate in a conventional manner and are not described here in further detail.

The socket contacts 20b and 30b of the sockets 16a and 16b are shaped for electrical connection to corresponding neutral electrical contacts of a plug of an electrical device (not shown). The socket contacts 20b and 30b are electrically coupled to an electrically conductive spanning contact 32b. The insulation displacement contact 26b includes a longitudinal bifurcated contact 36b electrically coupled to the spanning contact 32b. The spanning contact 32b is electrically connected to the insulation displacement contact 26b when inserted between the bifurcated arms of the contact 36b. The bifurcated arms of the contact 36b resiliently bear against the spanning contact 32b and thereby secure the contacts 32b, 36b in electrical communication.

The socket contacts 20c and 30c of the sockets 16a and 16b are shaped for electrical

connection to corresponding earth electrical contacts of a plug of an electrical device (not shown). The socket contacts 20c and 30c are electrically coupled to an electrically conductive spanning contact 32c. The insulation displacement contact 26c includes a lateral bifurcated contact 36c electrically coupled to the spanning contact 32c. The spanning contact 32c is electrically connected to the insulation displacement contact 26c when inserted between the bifurcated arms of the contact 36c. The bifurcated arms of the contact 36c resiliently bear against the spanning contact 32c and thereby secure the contacts 32c, 36c in electrical communication.

The insulation displacement contacts 26a, 26b, 26c are preferably electrically connected to respective spanning contacts 32a, 32b, 32c by bifurcated contacts 36a, 36b, 36. However, they could, alternatively, be electrically coupled to the spanning contacts 32a, 32b, 32c by any other suitable means.

As particularly shown in Figure 5, the insulation displacement contacts 26a, 26b, 26c are stacked vertically, in respective primary channels 22a, 22b, 22c, in a central section 38 of the back side 40 of the outlet 10. Side to side directions of the openings of the contacts 26a, 26b, 26c are generally parallel. In other words, slots defined by the bifurcated arms of the contacts 26a, 26b, 26c open in a generally common direction "X".

As particularly shown in Figure 7, the primary channels 22a, 22b, 22c are formed in a channel plate 42 coupled to the back side 40 of the power outlet 10. The channel plate 42 is centrally disposed on the back side 40 of the outlet 10. The channels 26a, 26b, 26c extend through respective insulation displacement contacts 26a, 26b, 26c and converge at a common point towards the corner 44 of the back side 40 of the connector 10. Thus, the insulated conductors 24a, 24b, 24c fan out from the cable 14 when they are seated in corresponding channels 22a, 22b, 22c. The cable 14 thereby extends past the corner 44 of the back side 40 of the outlet 10 when the insulated conductors 24a, 24b, 24c are seated in their respective channels 22a, 22b, 22c. As particularly shown in Figure 5, the channel plate 42 includes termination wells 46a, 46b, 46c located at terminal ends of the channels 24a, 24b, 24c. The termination wells 46a, 46b, 46c are shaped to receive and electrically

isolate terminal ends of the insulated conductors 24a, 24b, 24c.

The connector 28 is formed of an electrically insulative material and has an elongate and somewhat planar shape. The connector 28 is shaped to fit over the channel plate 42 so as to close the channels 22a, 22b, 22c. A restraining means, in the form of a hinge 48, is provided to for pivotally coupling the connector 28 to the channel plate 42. The hinge 48 rotates about an axis generally parallel to, and to one side of, the lengthwise direction of extent of the outlet 10. The connector is adapted to rotate about the hinge 48 between the open position shown in Figures 5 to 8 and the closed position shown in Figures 10 and 11.

As particularly shown in Figures 7 and 12, an inner side 50 of the connector 28 includes a plurality of projections 52a, 52b, 52c that extend along corresponding channels 22a, 22b, 22c of the channel plate 48 when the connector 28 is arranged in the closed position. When so arranged, the projections 52a, 52b, 52c are brought to positions where they are located over, and at least partially within, respective ones of the channels 22a, 22b, 22c. When the connector 28 is moved to the closed position shown in Figure 10, the projections 52a, 52b, 52c are likewise located in respective ones of the channels 22a, 22b, 22c.

The following steps are performed to effect electrical connection between the power outlet 10 and the insulated conductors 12 of the cable 14:

1. The outlet 10 is arranged in the open position shown in Figure 5, where the connector 28 is swung clear of the channel plate 42;
2. The cable 14, having a portion of its outer cover removed, is laid diagonally across the back side 40 of the outlet 10;
3. The insulated conductors 24a, 24b, 24c are positioned so as to extend over respective channels 22a, 22b, 22c;
4. The insulated conductors 24a, 24b, 24c are then lightly pressed into the channels 22a, 22b, 22c;
5. The connector 28 is swung about the axis of the hinge 48 so that it overlies the channel plate 48 and so that the projections 52a, 52b, 52c engage the

insulated conductors 24a, 24b, 24c and press them into their respective channels 22a, 22b, 22c; and

6. Connector 28 is then pressed fully down so that projections 52a, 52b, 52c firmly engaged the insulated conductors 24a, 24b, 24c and force them to form electrical connections with corresponding insulation displacement contacts 26a, 26b, 26c. Locking projections 54a, 54b of the connector 28 engage corresponding locking projections 56a, 56b of the back side 40 of the outlet 10. The connector 28 is thereby secured to the channel plate 42.

Following the above steps, the power outlet 10 need only be terminated once to provide a double socket 16a, 16b outlet. As will be observed particularly from Figure 9, by rotating the connector 28 about the hinge 48, the projections 52a, 52b, 52c sequentially engage respective ones of the insulated conductors 24a, 24b, 24c. That is to say, at first the projection 52c is brought into contact with the wire 24c located in the channel 22c; then the projection 52b is brought in to contact with the wire 24b located in the channel 22b; and, lastly, the projection 52a is brought into contact with the wire 24a located in the channel 22a. As a result, the wires are forced into the insulation displacement contacts 26c, 26b, 26a sequentially. The forces which need to be applied to effect the making of electrical connection to the insulation displacement contacts 26c, 26b, 26a 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 above mentioned, the insulation displacement contacts 26a, 26b, 26c are centrally disposed. As such, the force applied to close the connector 28 can be concentrated in one spot. Advantageously, the centrally disposed insulation displacement contacts reduce the force needed to close the connector 28.

As shown in Figure 9, the connector 28 and the channel plate 42 may be latched in the closed position by resilient clips 54a, 54b coupled to the connector 28 which releasably grip corresponding clips 56a, 56b of the channel plate 42. The connector 28 and the channel plate 42 can otherwise be fastened together using any other suitable means.

As particularly shown in Figures 5 and 6, the channel plate 42 includes secondary channels 58a, 58b, 58c shaped to at least partially receive, and seat therein, respective lengthwise sections 62a, 62b, 62c of the insulated conductors a second power cable 64. The channels 58a, 58b, 58c extend through respective insulation displacement contacts 26a, 26b, 26c and converge at a common point towards another corner 66 of the back side 40 of the outlet 10. Thus, the insulated conductors 62a, 62b, 62c fan out from the cable 64 when they are seated in corresponding channels 58a, 58b, 58c. The cable 64 thereby extends past the corner 66 of the back side 40 of the outlet 10 when the insulated conductors 62a, 62b, 62c are seated in their respective channels 58a, 58b, 58c. As particularly shown in Figure 5, the channel plate 42 includes termination wells 68a, 68b, 68c located at terminal ends of the channels 58a, 58b, 58c. The termination wells 68a, 68b, 68c are shaped to receive and electrically isolate terminal ends of the insulated conductors 62a. 62b, 62c.

The conductors 62a, 62b, 62c overlie the conductors 24a, 24b, 24c when arranged in the above described manner. The insulation displacement contacts 26a, 26b, 26c are located at the intersections of corresponding primary and secondary channels 22a, 22b, 22c, 58a, 58b, 58c. Thus, each insulation displacement contact 26a, 26b, 26c is adapted to receive, and form electrical connections therewith, two insulated conductors.

The primary and secondary channels 22a, 22b, 22c, 58a, 58b, 58c include restraining flanges 70 to inhibit longitudinal movement of the insulated conductors in the channels.

As particularly shown in Figures 7 and 12, an inner side 50 of the connector 28 includes a plurality of projections 72a, 72b, 72c that extend along corresponding channels 58a, 58b, 58c of the channel plate 48 when the connector 28 is arranged in the closed position. When so arranged, the projections 72a, 72b, 72c are brought to positions where they are located over, and at least partially within, respective ones of the channels 58a, 58b, 58c. When the connector 28 is moved to the closed position shown in Figure 10, the projections 72a, 72b, 72c are likewise located in respective ones of the channels 58a, 58b, 58c.

The first primary channel 22a preferably extends at an angle of substantially 145 degrees to a corresponding first secondary channel 58a. The second primary channel 22b extends at an angle of substantially 111 degrees to a corresponding second secondary channel 58b. A third primary channel 22c extends at an angle of substantially 91 degrees to a corresponding third secondary channel 58c.

The connector 28 can preferably be terminated (closed) using standard electrician's pliers. The insulated connector 28 can prevent accidental shock. The outlet preferably includes a stripping length guide. The connector 28 is adapted to over travel past the closed position to allow correct clip engagement.

While we have shown and described specific embodiments of the present invention, further modifications and improvements will occur to those skilled in the art. We desire it to be understood, therefore, that this invention is not limited to the particular forms shown and we intend in the append claims to cover all modifications that do not depart from the spirit and scope of this invention.

Claims Defining the Invention

1. A power outlet for effecting an electrical connection between an electric device and insulated conductors of an electric power cable, including:

(a) a socket having apertures including electrically conductive socket contacts seated therein for effecting electrical connection to corresponding electrically conductive contacts of a plug of the electric device;

(b) a plurality of primary channels shaped to at least partially receive, and seat therein, respective lengthwise sections of the insulated conductors of the power cable;

(c) a plurality of insulation displacement contacts for making separate electrical connections to said insulated conductors, when received in said primary channels, under relative movement between the insulation displacement contacts and the insulated conductors;

(d) a connector, relatively movable with respect to the primary channels, for effecting said relative movement,

wherein the insulation displacement contacts are electrically coupled to respective ones of said socket contacts, and said primary channels extend transversely to a lengthwise direction of extent of the power outlet.

2. The power outlet claimed in claim 1, wherein longitudinal directions of extent of the primary channels converge at a common point.

3. The power outlet claimed in any one of claims 1 to 3, wherein the insulation displacement contacts are arranged centrally on a side of the outlet.

4. The power outlet claimed in claim 3, wherein the insulation displacement contacts are arranged side by side.

5. The power outlet claimed in claim 4, wherein side to side directions of slots of the

insulation displacement contacts are parallel.

6. The power outlet claimed in any one of claims 1 to 4, wherein each slot of the insulation displacement contacts opens in a direction substantially 45 degrees to a direction of extent of its respective channel.

7. The power outlet claimed in any one of the preceding claims, including a hinge for effecting said relative movement as the connector rotates there about towards the primary channels.

8. The power outlet claimed in claim 7, wherein the connector is adapted to rotate about the hinge between an open position and a closed position.

9. The power outlet claimed in claim 8, wherein said relative movement is effected as the connector moves towards the closed position.

10. The power outlet claimed in claim 8 or claim 9, wherein the connector overlies the primary channels when arranged in the closed position.

11. The power outlet claimed in claim 10 wherein the connector is adapted to rotate about the hinge past the closed position to force insulated conductors into the insulation displacement contacts.

12. The power outlet claimed in any one of claims 1 to 11, including a plurality of secondary channels shaped to at least partially receive, and seat therein, respective lengthwise sections of insulated conductors of another cable, wherein the insulation displacement contacts are located at intersections of the secondary channels and corresponding primary channels so as to electrically connect insulated conductors seated in the primary channel with corresponding insulated conductors seated in the secondary channels during said relative movement.

13. The power outlet claimed in claim 12, wherein the secondary channels extend transversely to a lengthwise direction of extent of the power outlet.

14. The power outlet claimed in claim 12 or claim 13, wherein longitudinal directions of extent of the secondary channels converge at another common point.

15. The power outlet claimed in any one of claims 12 to 13, wherein a first channel of the primary channels extends at an angle of substantially 145 degrees to a corresponding first channel of the secondary channels.

16. The power outlet claimed in any one of claims 12 to 15, wherein a second channel of the primary channels extends at an angle of substantially 111 degrees to a corresponding second channel of the secondary channels.

17. The power outlet claimed in any one of claims 12 to 16, wherein a third channel of the primary channels extends at an angle of substantially 91 degrees to a corresponding third channel of the secondary channels.

18. The power outlet claimed in any one of claims 1 to 17, wherein the primary channels include one or more strain relief ribs.

19. The power outlet claimed in any one of claims 1 to 18, wherein the secondary channels include one or more strain relief ribs.

20. The power outlet claimed in any one of claims 1 to 19, wherein the primary channels each include a include termination well for receiving, and electrically isolating, a terminal end of an insulated conductor.

21. The power outlet claimed in any one of claims 1 to 20, wherein the secondary channels each include a include terminal well for receiving, and electrically isolating, a terminal end of an insulated conductor.

22. The power outlet claimed in any one of claims 1 to 21, including a cable stripping length guide.

23. The power outlet claimed in any one of the preceding claims, wherein one or more of said insulation displacement contacts are electrically coupled to said corresponding socket contacts by bifurcated electrically conductive contacts.

24. The power outlet claimed in any one of the preceding claims, including another socket having apertures including electrically conductive socket contacts seated therein for effecting electrical connection to corresponding electrically conductive contacts of a plug of an electric device.

25. The power outlet claimed in claim 23, wherein the socket contacts of the socket are electrically coupled to corresponding socket contacts of said another socket so that the socket contacts of said socket and said another socket are both electrically coupled to corresponding common insulated conductors of the electric power cable as a result of said relative movement between the insulation displacement contacts and the insulated conductors.

26. A power outlet for effecting an electrical connection between an electric device and insulated conductors of an electric power cable substantially as hereinbefore described with reference to the accompanying drawings.

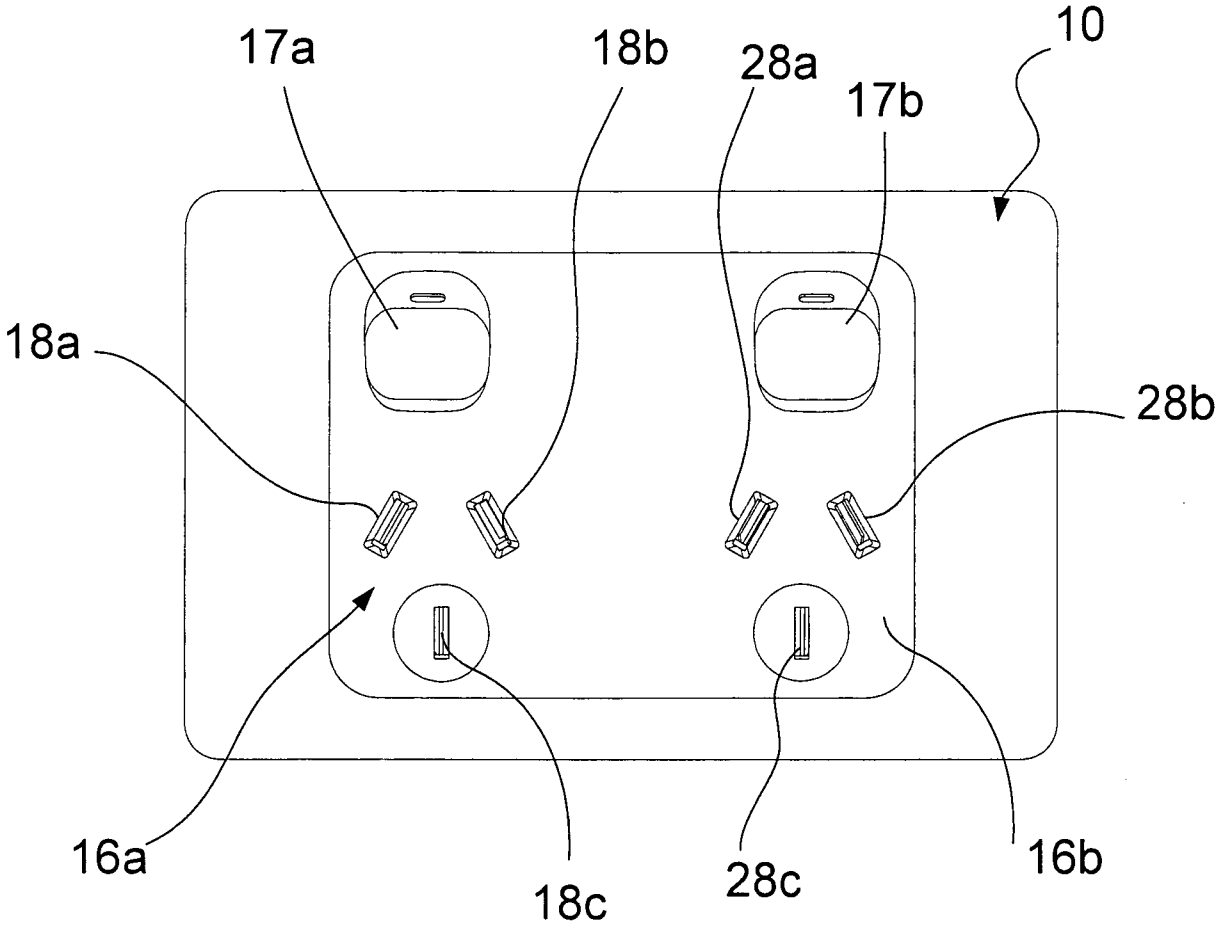


Figure 1

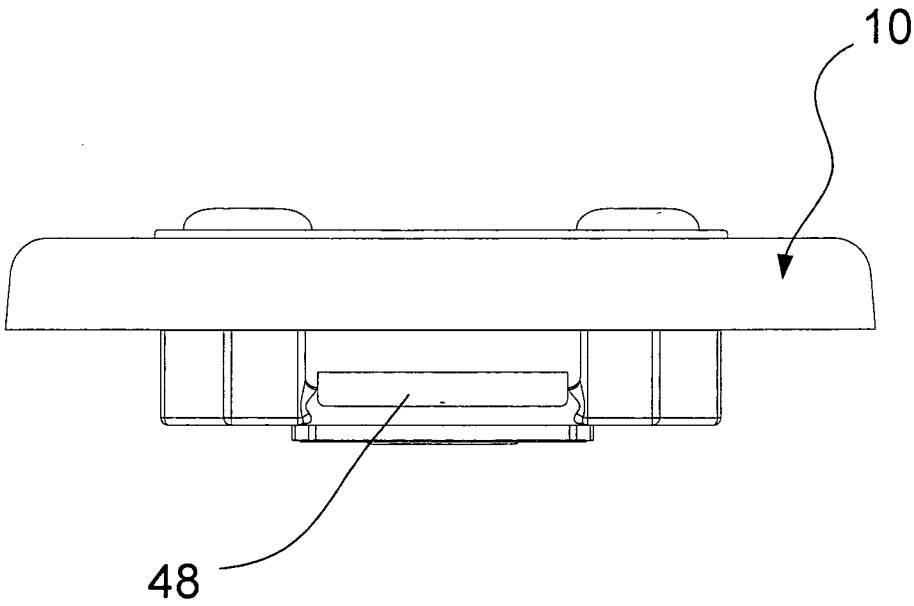


Figure 2

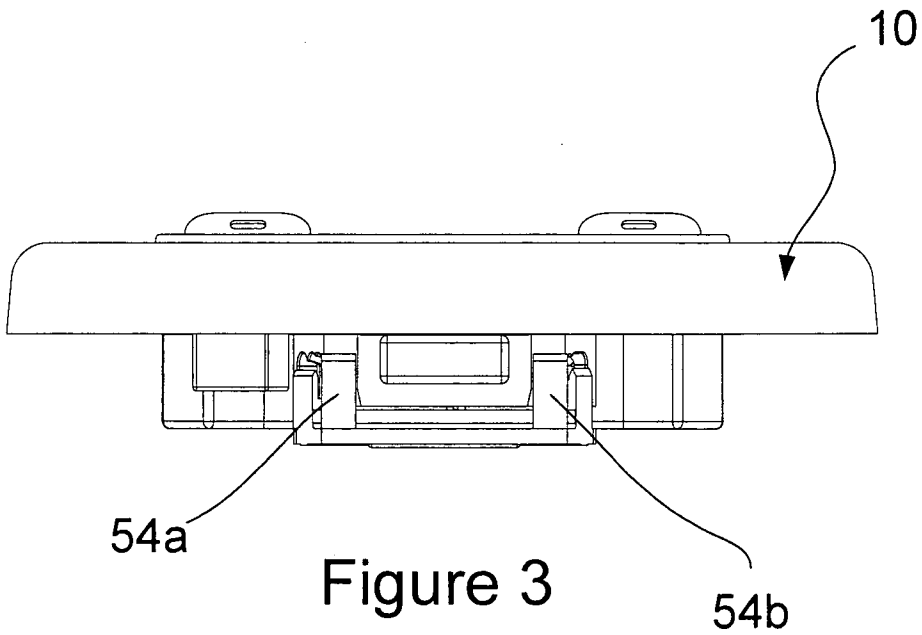


Figure 3

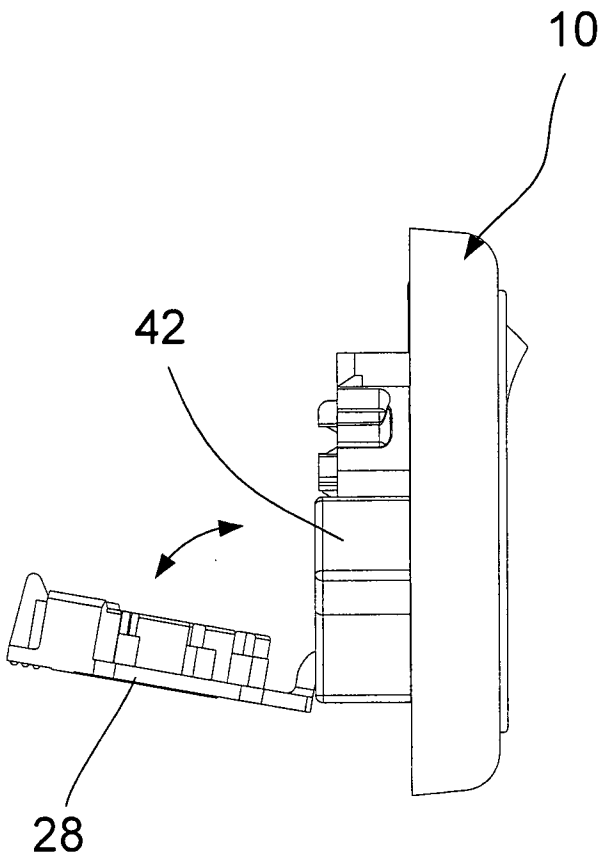
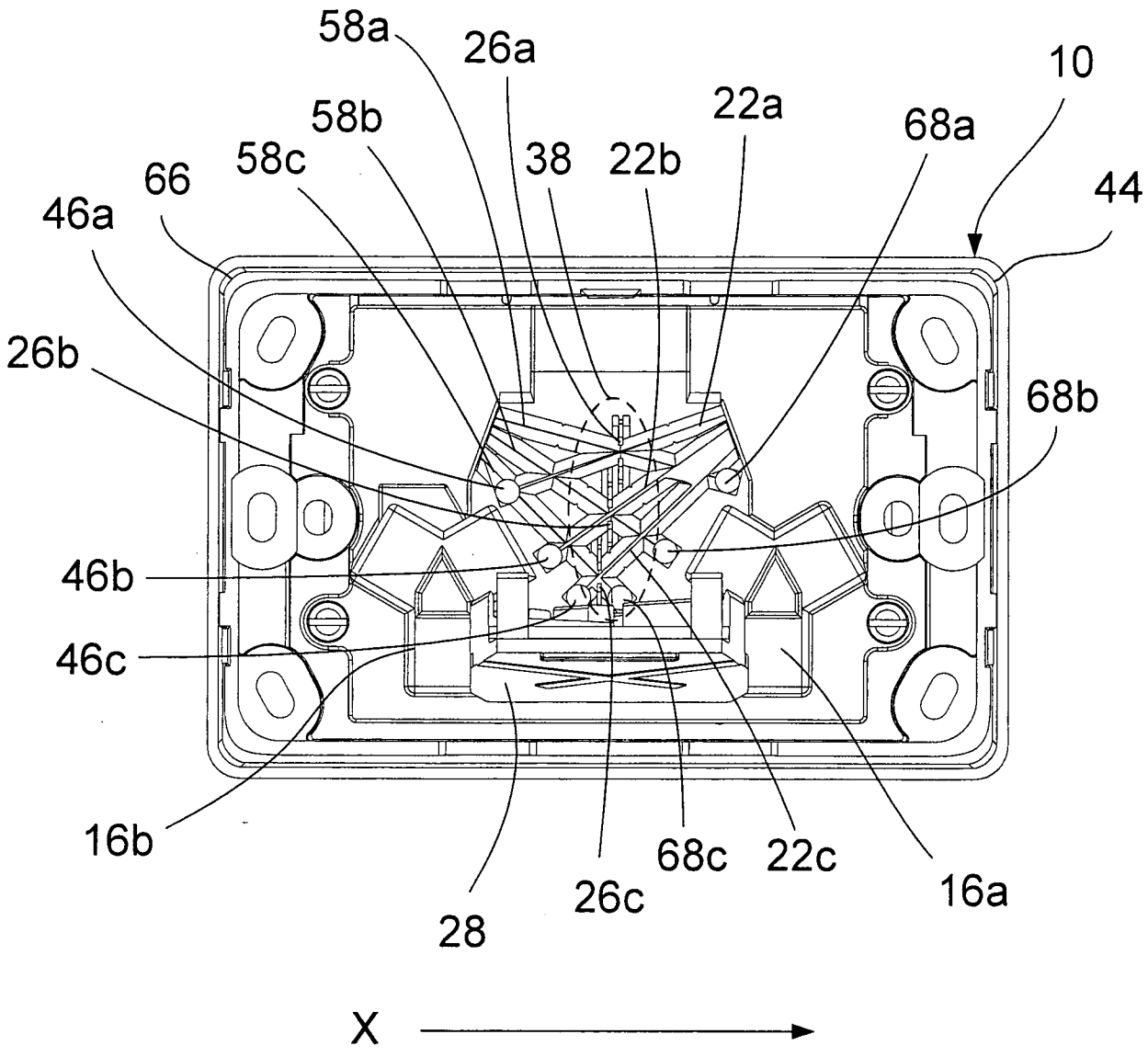


Figure 4


58a
26a
10
58b
22a
68a
66
58c
38
22b
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46a
26b
68b
46b
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16a
26c
28
X

Figure 5

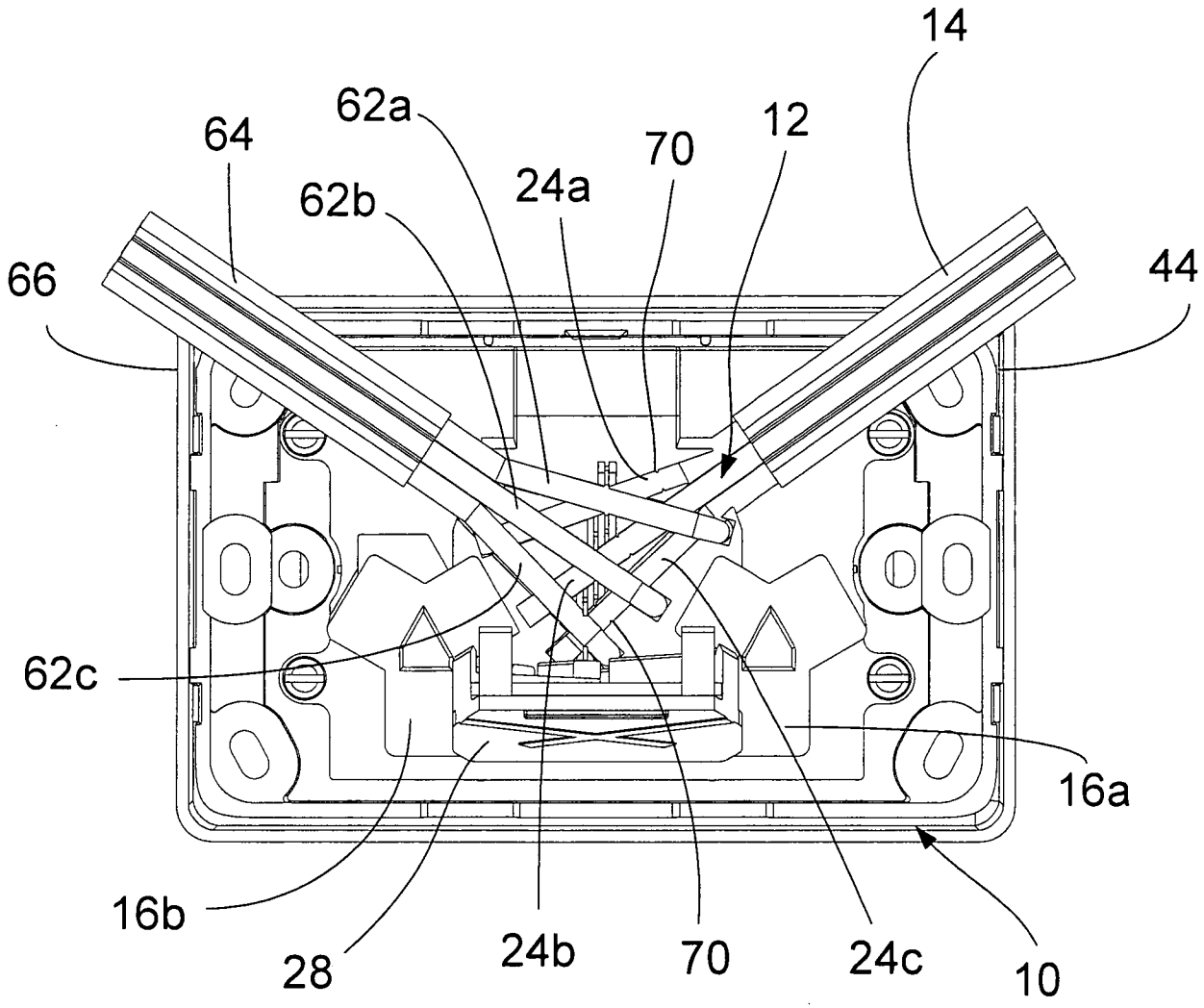


Figure 6

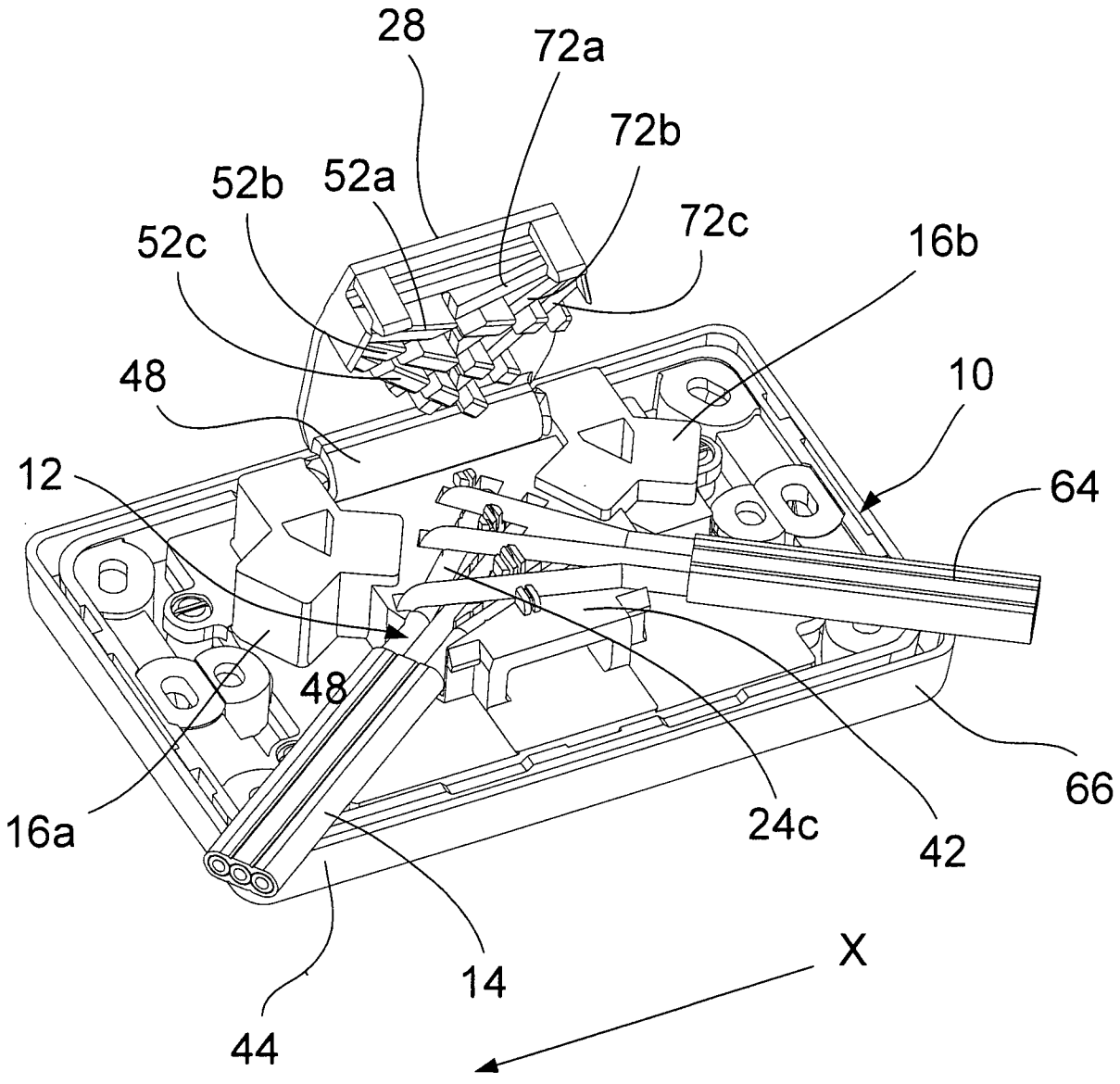


Figure 7

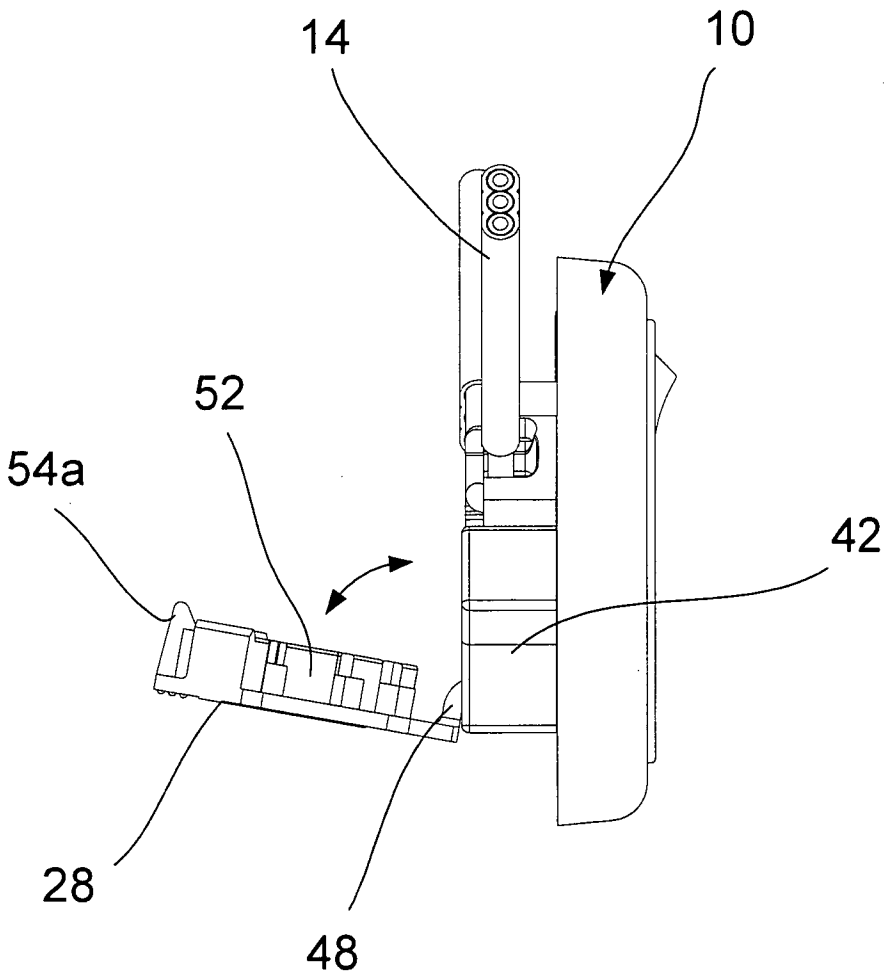


Figure 8

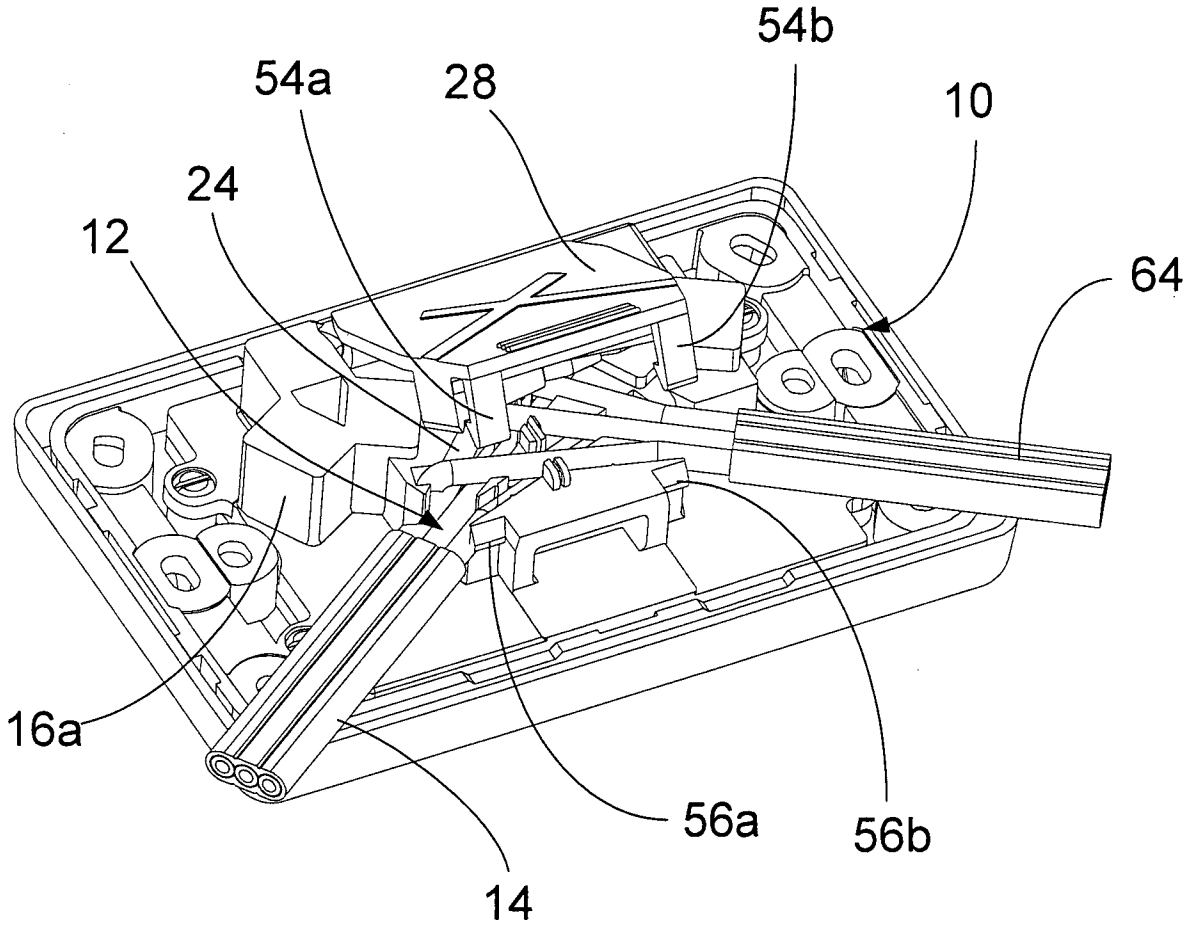


Figure 9

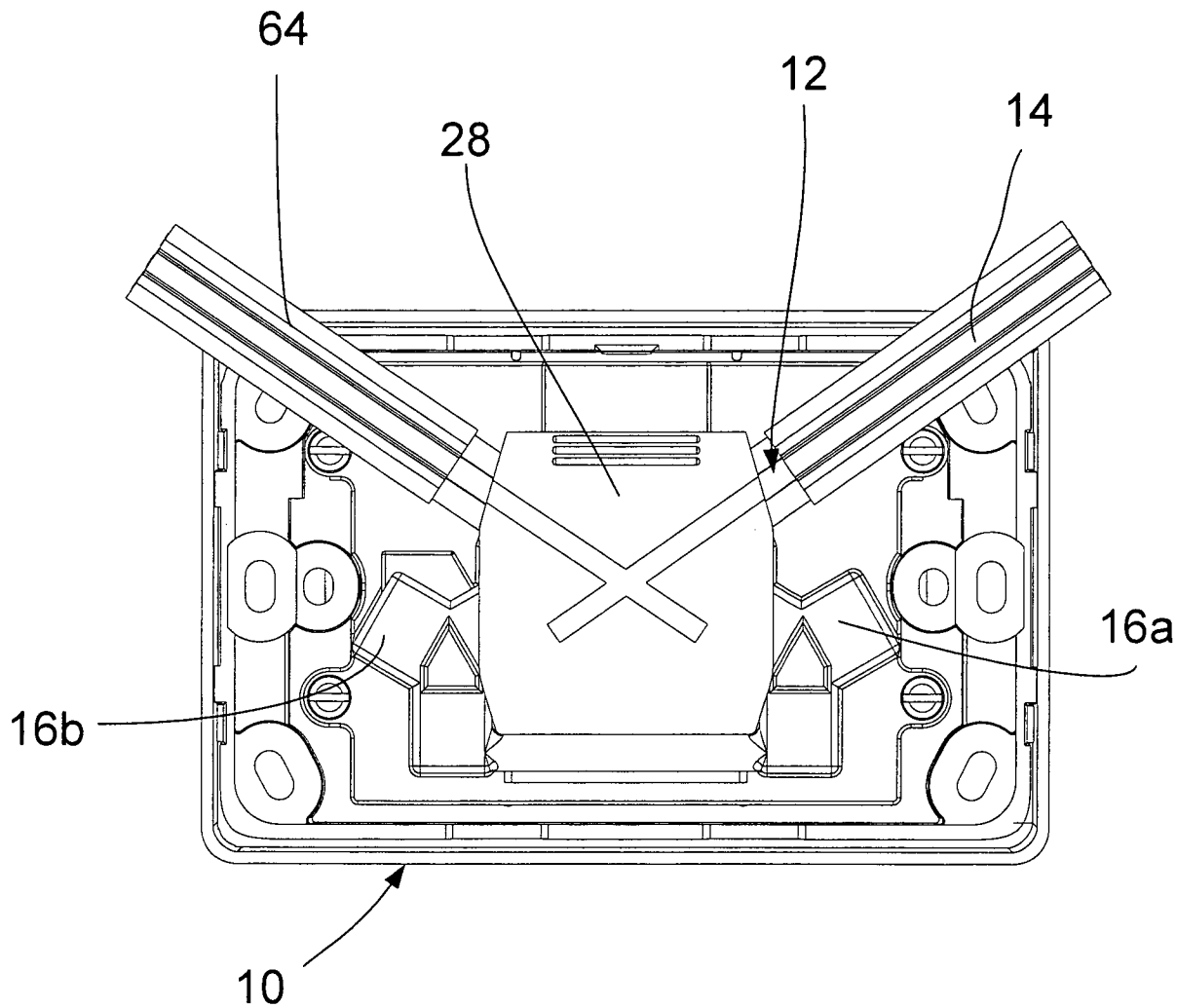


Figure 10

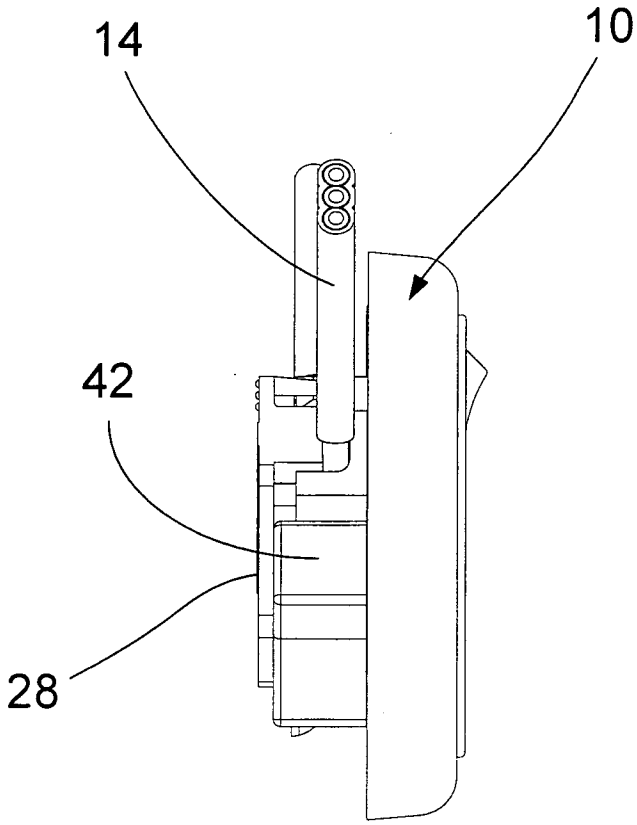
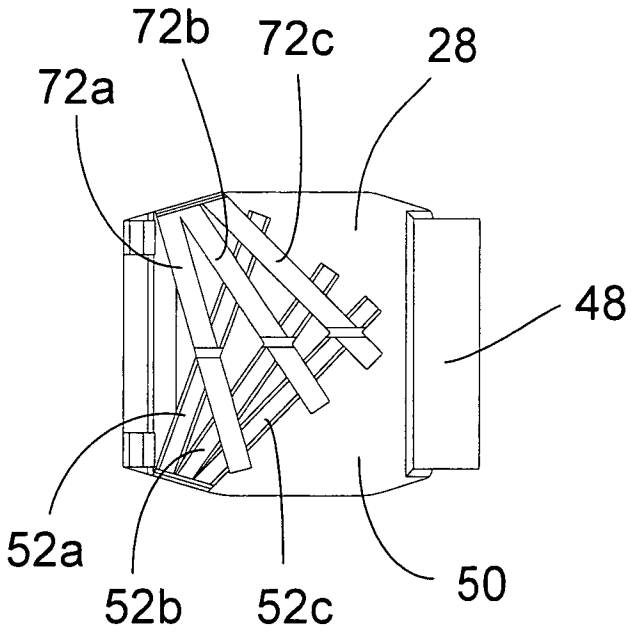


Figure 11



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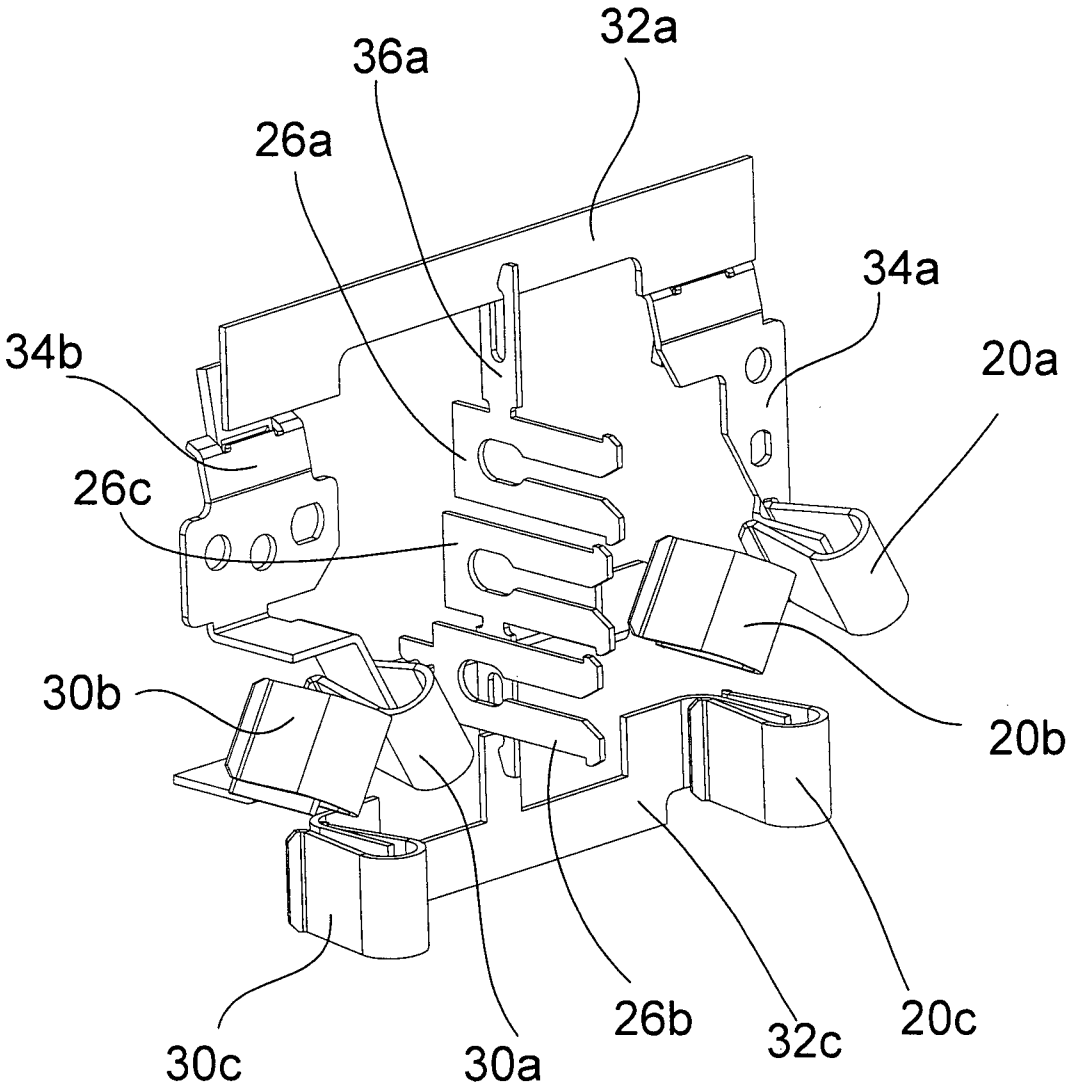
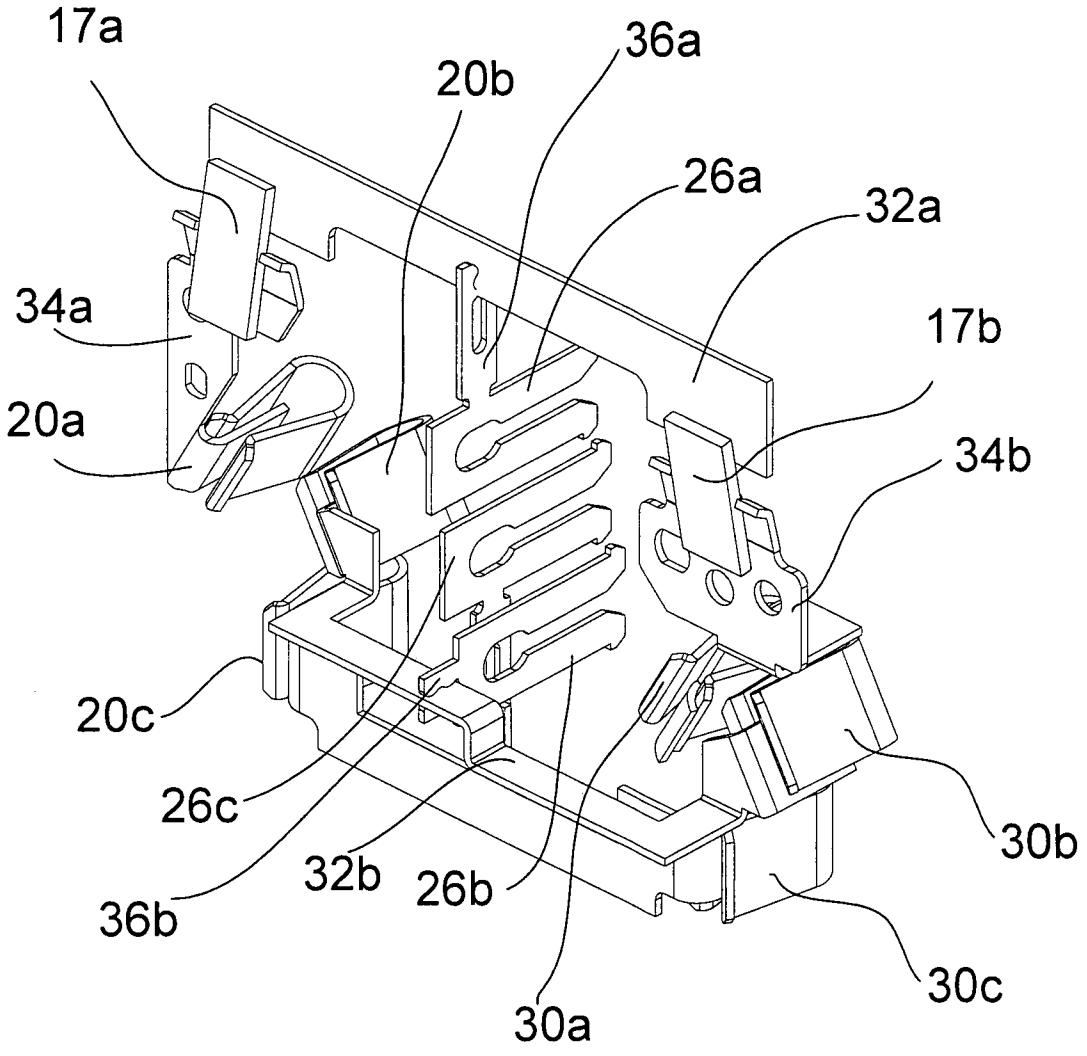


Figure 13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26b
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36b
30c
30a

Figure 14

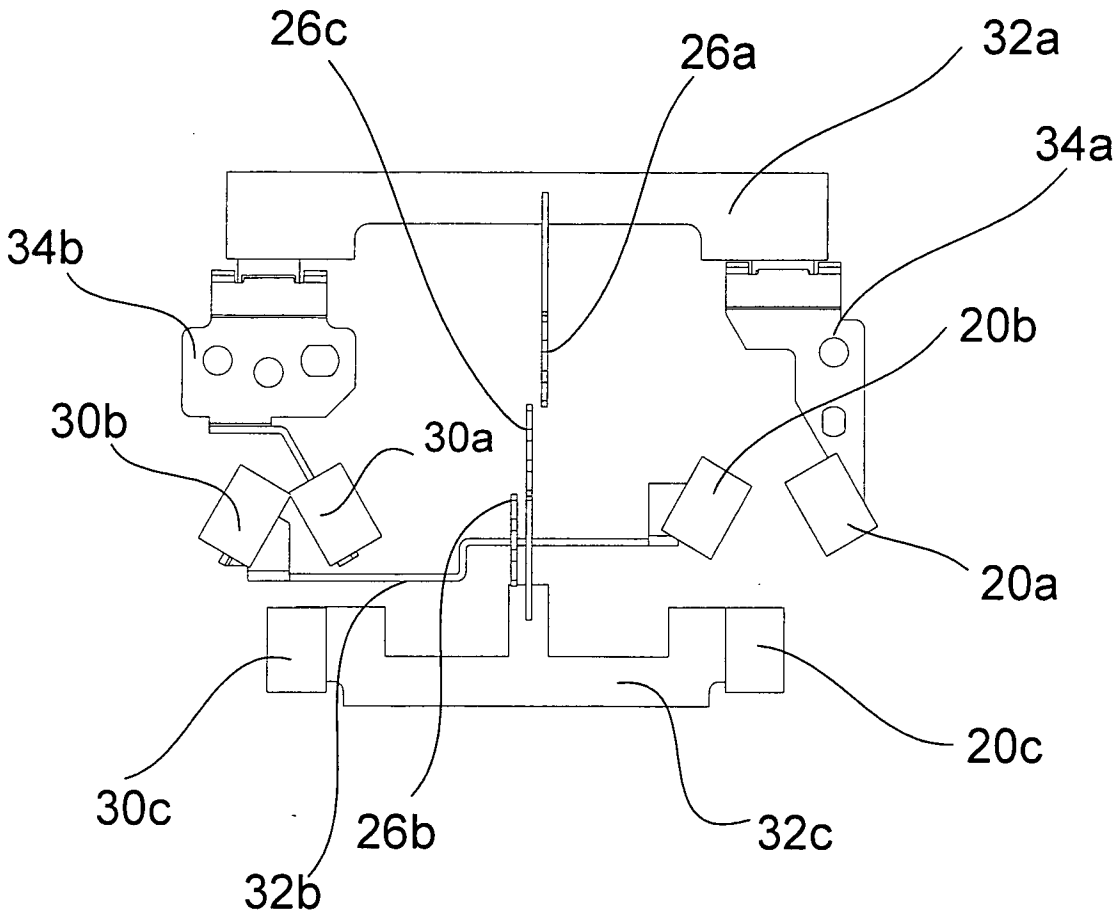
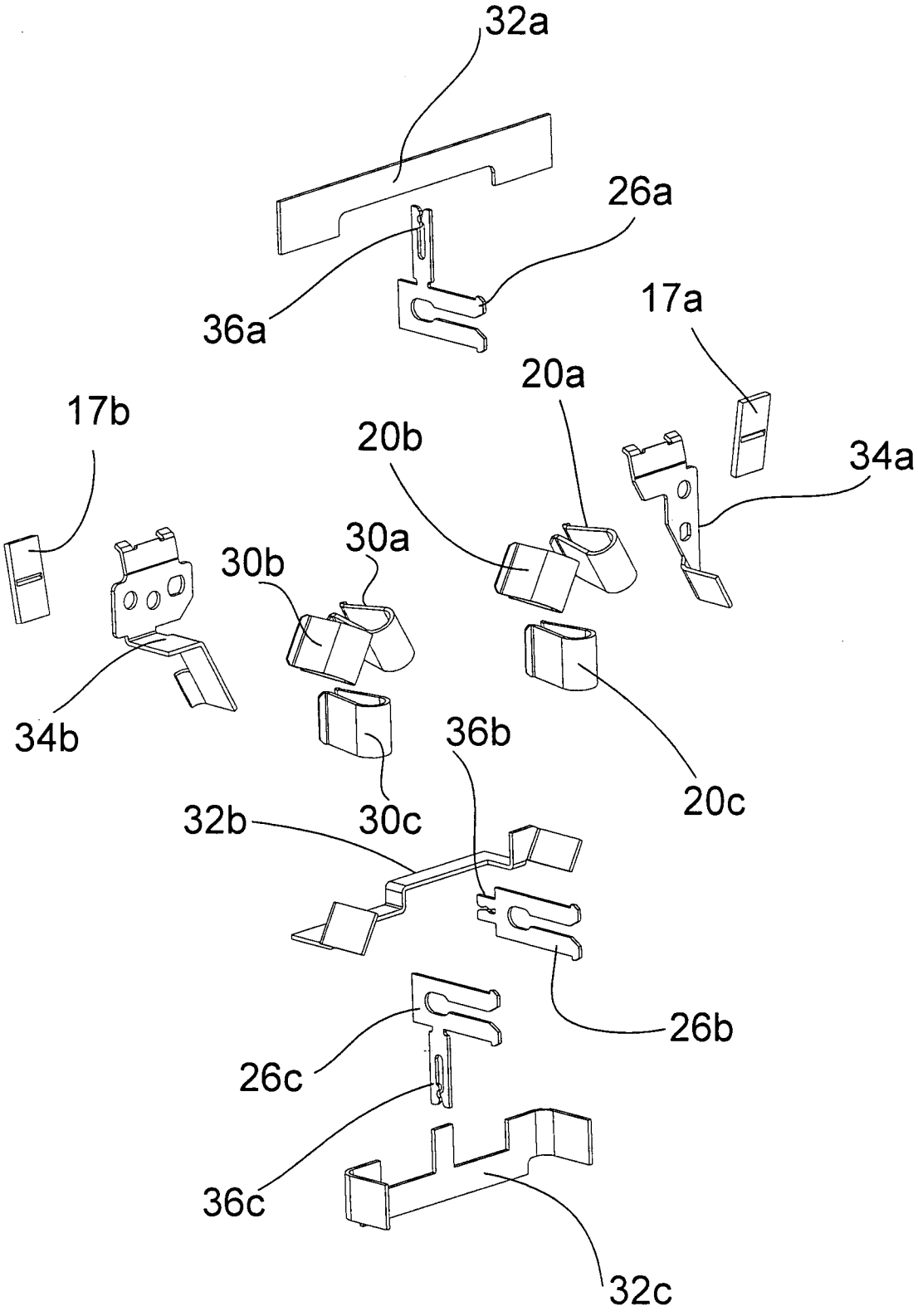


Figure 15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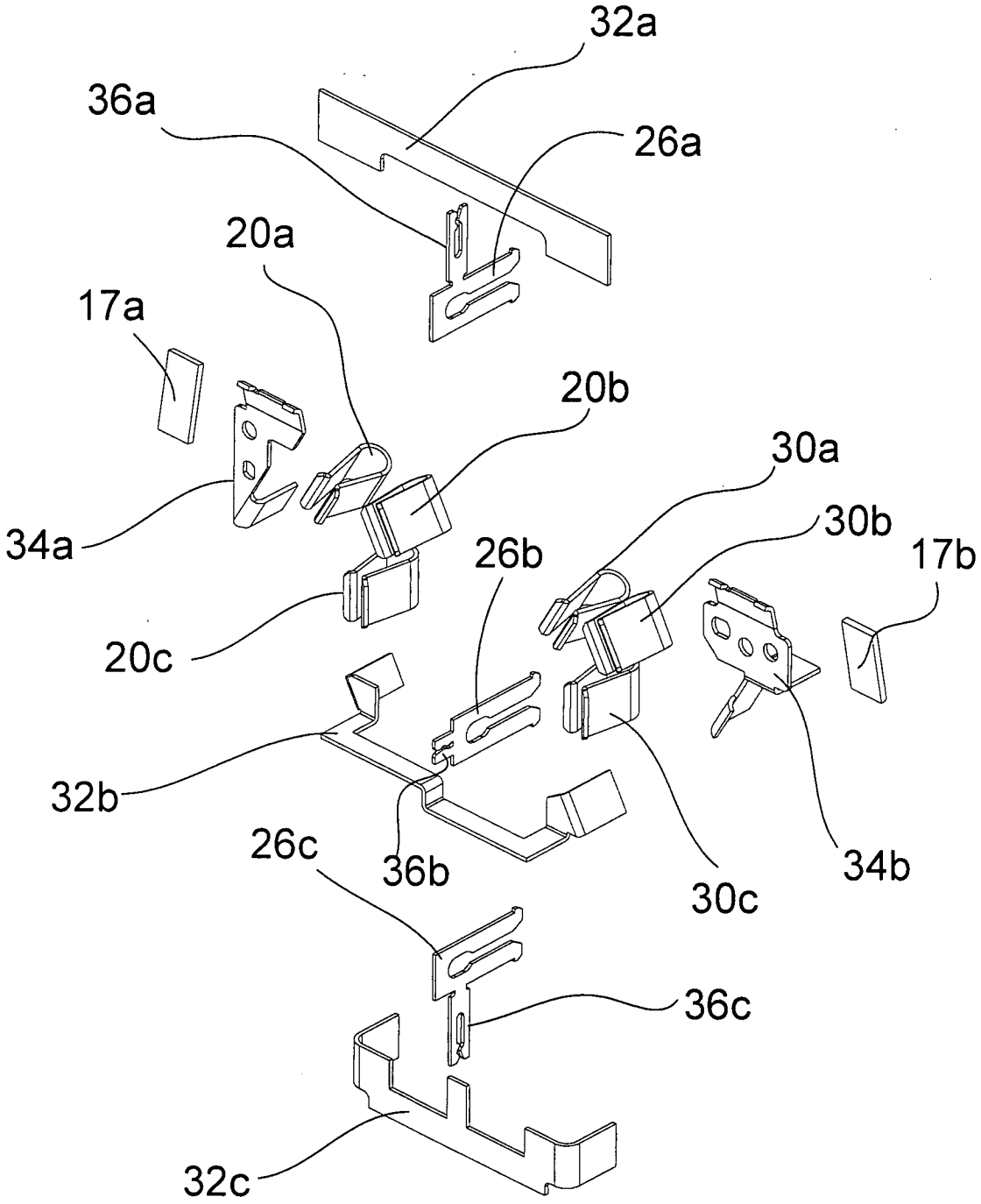
26c
36c
32c

Figure 16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26c
36b
30c
34b
36c
32c

Figure 17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/000470

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

H01R 4/24 (2006.01)

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)

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 practicable, search terms used)
DWPI, ESP@CE, and USPTO with keywords: power outlet, socket, plug, cable, transverse, IDC and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6095848 A (MUNSHI) 1 August 2000 Whole document, particularly column 4 lines 15- 19 and column 5 lines 10 – 23 and figures 1 and 5A.	1- 26
A	GB 2292269 A (MAGUIRE & 7 CO) 14 February 1996 Whole document, particularly Figures 3 and 4.	1- 26
A	US 5094630 A (JAMMET) 10 March 1992 Whole document, particularly column 1 lines 38 - 40, 44 - 53, column 3 lines 44- 47, column 4 lines 21- 36 and figures 1 and 7.	1- 26
A	GB 2165101 A ((ALLIED CORPORATION (USA-NEW YORK)) 3 April 1986 Whole document	1- 26

[X] Further documents are listed in the continuation of Box C [X] 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 application or patent 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
23 May 2008	15 JUL 2008
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **SOOSA GNANASINGHAM** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : (02) 6283 2172

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/000470

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5228872 A (LIU) 20 July 1993 Whole document	1- 26

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2008/000470

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	6095848	AU	90449/98	CN	1219005	EP	0921611
		JP	11250947	NZ	332913		
GB	2292269						
US	5094630						
GB	2165101	DE	3534200	US	4705481		
US	5228872	DE	4314908				

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX