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(54) **Electric connector with a linearly and circularly displaceable plug**

(57) An electric connector connecting one plug with several sockets in a housing, arranged to allow rotating the plug relative to the housing, as well as linearly moving the plug along the housing, while keeping the connector

functional. The plug pins are movably connected to round flat tracks, which are movably connected to linear tracks that are connected via straps to the corresponding sockets' slots.

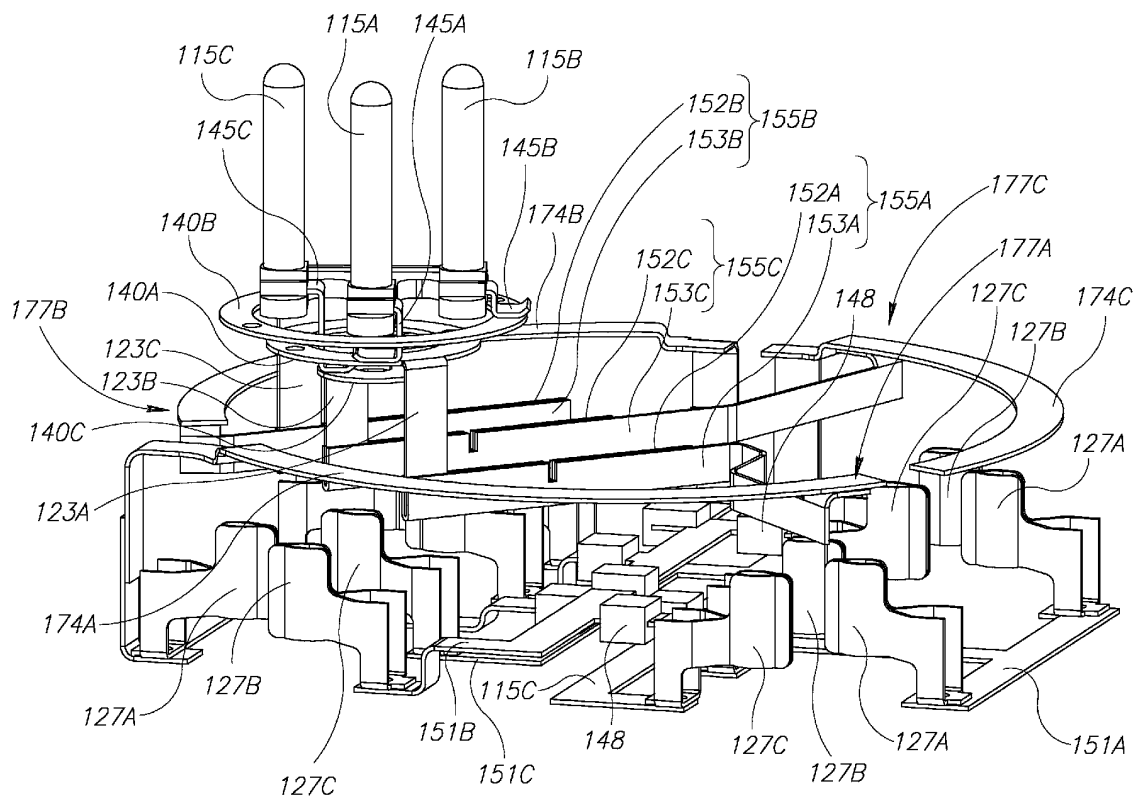


Figure 10

Description

BACKGROUND

1. TECHNICAL FIELD

[0001] The present invention relates to the field of electricity, and more particularly, to an electric connector.

2. DISCUSSION OF RELATED ART

[0002] Electric connectors are commonly used as an interface between one plug (connectable to a wall socket) and several sockets, such as to allow connecting several appliances to the electricity net through a single socket.

[0003] Common electric connectors are rigid and require certain free space around the wall socket in order to connect the electric connector properly.

BRIEF SUMMARY

[0004] One aspect of the present invention provides an electric connector comprising a plug having at least two pins; and a housing having at least one socket at a housing basis, each socket having at least two slots, each slot corresponding to one of the pins and connected to a wired contact within the housing, the electric connector is characterized in that: the plug is coaxially rotatable in respect to the housing, each pin is connected to a round flat conductive track that is parallel to the housing basis and supported within the housing by protrusions of a support, such that each track is positioned at a specified height in respect to the housing basis within the housing with their flat faces being parallel to the housing basis, the round flat tracks are concentric and have an increasing diameter from the lowest to the highest track in respect to the housing basis, each wired contact comprises a contact connection to the corresponding track that is pressed against the flat face of the corresponding track, and is moveable along the round flat track upon the rotation of the plug in respect to the housing, the contact connection is arranged to maintain electric contact during the rotation of the tracks, and wherein the electric connector allows rotating the housing in respect to the plug at any user specified angle while maintaining connector functionality.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The present invention will be more readily understood from the detailed description of embodiments thereof made in conjunction with the accompanying drawings of which:

Figures 1A to 1C are schematic perspective illustrations of an electric connector with a linearly and circularly displaceable plug, according to some embodiments of the invention,

Figures 2 and 3 are schematic upper and perspective views (respectively) of the inner structures in the electric connector, according to some embodiments of the invention,

Figures 4A to 4C are a schematic exploded view of the electric connector, according to some embodiments of the invention,

Figures 5 and 6 are schematic detailed views of the motion mechanisms of the plug, according to some embodiments of the invention,

Figure 7 is a high level schematic flowchart of a method, according to some embodiments of the invention,

Figures 8A to 8C are schematic perspective illustrations of an electric connector with a linearly and circularly displaceable plug, according to some embodiments of the invention,

Figures 9-11 are schematic upper and two perspective views (respectively) of the inner structures in the electric connector, according to some embodiments of the invention,

Figure 12 is a schematic exploded view of the electric connector, according to some embodiments of the invention,

Figures 13-15 illustrate the electric connector, according to some embodiments of the invention,

Figures 16 and 17 are schematic perspective illustrations of an electric connector, according to some embodiments of the invention,

Figure 18 is a schematic exploded view illustrating an electric connector, according to some embodiments of the invention,

Figure 19 is a schematic transparent perspective illustration of the inner workings of an electric connector, according to some embodiments of the invention,

Figure 20 is a perspective view of a part of the mechanism in an electric connector, according to some embodiments of the invention, and

Figures 21 and 22 are schematic illustrations of an electric connector, according to some embodiments of the invention.

DETAILED DESCRIPTION

[0006] Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is applicable to other embodiments or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

[0007] **Figures 1-6** are schematic illustrations of an electric connector **100** with a linearly and circularly displaceable plug **110**, according to some embodiments of

the invention.

[0008] Electric connector **100** (**Figures 1A to 1C**) comprises plug **110** having at least two pins **115A** (e.g. earth), **115B** (e.g. neutral), **115C** (e.g. live), and a housing **130** having at least one socket **120** at a housing basis **130B**. Housing **130** may comprise two or three sockets **120** or more. Each socket **120** has at least two slots **121A** (e.g. earth), **121B** (e.g. neutral), **121C** (e.g. live). Each slot per socket **120** corresponds to one of pins **115** and is connected thereto via: contacts **127** (**127A**, **127B**, **127C**) connected to contact straps **151** (**151A**, **151B**, **151C**) which are connected to linear tracks **155** (**155A**, **155B**, **155C**, **Figures 3-5**). Each linear track **155** may comprise two parallel straps **152**, **153** held together by a fastener **124** (**155A**: **152A**, **153A**, **124A**, **155B**: **152B**, **153B**, **124B**, **155C**: **152C**, **153C**, **124C**) that ensures continuous contact between corresponding wired contacts **123** and linear tracks **155**. For example, straps **153** may be connected to contact straps **151**.

[0009] Each pin **115** (**Figures 2, 3, 5**) is connected to a round flat conductive track **140** that is parallel to a housing basis **130B** and may be supported within housing **130** such that each track **140** is positioned at a specified height in respect to housing basis **130B** within housing **130**. Tracks **140** may be annular. Track **140C** having the smallest diameter may be circular. The connection of pins **115** to tracks **140** is carried out via contact connections **145** (**145A**, **145B**, **145C**, **Figure 5**), which rotate with plug **110** while continuously maintaining contact to tracks **140**. Contact connections **145** may be mounted in housing **130** such as to apply a pressure on the respective tracks **140**, to yield continuous electrical contact therewith during rotation of plug **110**. For example, the ends of contact connections **145** may be bent or preloaded to push against tracks **140**.

[0010] Tracks **140** are connected to wired contacts **123** (**123A**, **123B**, **123C**) which are held between straps **152**, **153** as explained above, and connected via straps **153** and straps **151** to contacts **127**. In the illustrated example, A denotes earth, B neutral, and C live elements.

[0011] Wired contacts **123** are movable along linear tracks **155** to allow a user determined position of the connector body in respect to plug **110**. In association with the possibility to rotate the connector body around plug **110**, the disclosed connector allows unprecedented flexibility in arranging the connector body at a required position, overcoming placing limitations inflicted by wall sockets.

[0012] Wired contacts **123** go through corresponding slits **154** (**123A** through **154A**, **123B** through **154B** and **123C** through **154C**) in a guiding plate **131** (**Figures 1C**, **4**). Plug **110** is arranged to move along guiding plate **131** with wired contacts **123** moving through slits **154** and continuously contacting tracks **152**, **153**. Guiding plate **131** may further comprise indentations **165** for controlling the horizontal linear movement of plug **110** along slits **154**, by accommodating a protrusion **164** from plug **110** (e.g. from bases **133** or **134**, **Figures 4B**, **4C**).

[0013] In addition, a plug base **133** may comprise annularly arranged indentations **161** for controlling the rotary movement of plug **110**, by accommodating a protrusion **166** from plug cap **129** (**Figure 4A**). Plug cap **129** may comprise a basis **167** affixed to plug basis **163** by screws **162**.

[0014] Conductive tracks **140** (**Figures 3, 5**) are concentric and may have an increasing diameter from the lowest (**140C**) to the highest (**140B**) track **140** in respect to housing basis **130B**. In the design illustrated in **Figure 5**, track **140B** with the largest diameter is closest to plug **110**, track **140A** has an intermediate diameter **142A**, and track **140C**, having the smallest diameter is the farthest from plug **110**.

[0015] The association between tracks **140** and the function of each track **140** and pin **115** may be selected at will. The illustrated association of A-earth, B-neutral, C-live is arbitrary and may be replaced by any configuration, with the appropriate structural changes. Advantageously, the widest track **140B** may be neutral, intermediate track **140A** may be earth, and smallest track **140C** may be live.

[0016] Conductive tracks **140**, tracks **152**, **153**, wired contacts **123** and straps **151** may be made of copper, and may be flat, or have a form or a profile that are arranged to ensure continuous contact.

[0017] Electric connector **100** allows rotating housing **130** in respect to plug **110** at any user specified angle, as well as displacing housing **130** in respect to plug **110** at any used specified distance, while maintaining the connector functionality.

[0018] Embodiments of electric connector **100** may be designed to comply with any standard, as the exact ordering of pins **115** and slots **121** does not interfere with the transmission of current between tracks **140** and connections **145**.

[0019] Electric connector **100** is designed to provide maximal usage safety. For example, tracks **140**, **152**, **153** as well as contact connections **145** and straps **151** may supported and fixated by the housing protrusions or plug support **129**, **133**, **134** and housing basis **130B**. The continuous contact between tracks **140** and contact connections **145** is ensured by stabilizing contact connections **145** within tracks **140**. The continuous contact between wired contacts **123** and linear tracks **155** is ensured by stabilizing wired contacts **123** within linear tracks **155**.

[0020] To summarize, electric connector **100** connects one plug **110** with several sockets **120** in housing **130**, and is arranged to allow rotating as well as displacing plug **110** relative to housing **130**, while keeping connector **100** functional. Plug pins **115** are connected to conducting tracks **140** by contact connections **145** that are allowed to rotate with plug **110** within housing **130**. Conducting tracks **140** are positioned within housing **130** coaxially at different heights and have different diameters. Wired contacts **123** movably contact linear tracks **155** which are connected to contact connections **127** behind

slots of sockets **120** via straps **151**. Wired contacts **123** are held tightly within linear tracks **155** to maintain electric contact, yet enable movement of wired tracks **123** within linear tracks **155**.

[0021] Figure 7 is a high level schematic flowchart of a method **200**, according to some embodiments of the invention. Method **200** enables to both rotate and displace plug **110** in respect to a connector body, thus allowing unprecedented flexibility in arranging the connector body at a required position, overcoming placing limitations inflicted by wall sockets.

[0022] Method **200** comprises the following stages: movably connecting pins of a plug of an electric connector to corresponding concentric conductive tracks within a housing of the connector (stage **210**), to enable rotating the plug within the housing while maintaining electric contact of the pins with the tracks (stage **215**), possibly controlling the rotational movement of the plug by protrusion (s) fitting into circular housing indentations (stage **217**).

[0023] Method **200** further comprises the following stages: movably connecting the concentric conductive tracks to corresponding linear tracks within the housing (stage **220**), e.g. by tightly enclosing corresponding wired contacts connected to the concentric conductive tracks within the corresponding linear tracks (stage **222**), to enable displacing the plug within the housing along the linear tracks while maintaining electric contact of the concentric conductive tracks with the linear tracks (stage **225**), possibly controlling the displacement of the plug by protrusion(s) fitting into linear housing indentations (stage **227**).

[0024] Method **200** further comprises statically connecting the linear tracks to corresponding socket slot contact connections (stage **230**), e.g. by connecting the linear tracks to corresponding straps that are attached to the socket slot contact connections (stage **232**). Method **200** may further comprise connecting the tracks to the straps via horizontal flat arcs that allow rotation of the tracks in respect to the sockets (stage **234**, see below).

[0025] Figures 8-12 are schematic illustrations of an electric connector **100** with a linearly and circularly displaceable plug **110**, according to some embodiments of the invention.

[0026] Electric connector **100** (Figures 8A to 8C) comprises plug **110** having at least two pins **115A** (e.g. earth), **115B** (e.g. neutral), **115C** (e.g. live), and a housing **130** having at least one socket **120** at a housing basis **130B** and plug **110** at housing cover **130B**. Housing **130** may comprise four **120** or more, arranged in a two dimensional array. Each socket **120** has at least two slots **121A** (e.g. earth), **121B** (e.g. neutral), **121C** (e.g. live). Each slot per socket **120** corresponds to one of pins **115** and is connected thereto via: contacts **127** (**127A**, **127B**, **127C**) connected to contact straps **151** (**151A**, **151B**, **151C**) which are connected to linear tracks **155** (**155A**, **155B**, **155C**) via a horizontal flat arc **174** (**174A**, **174B**, **174C**) that is parallel to corresponding strap **151** (Figures 9-11).

[0027] Flat arcs **174** may be arranged peripherally

within housing **130** to optimize access to linear tracks **155** and straps **151**. Straps **151** may have distinct two dimensional shapes arranged to reach each of corresponding slots **121** (Figures 9 and 11). Straps **151** may be separated by spacers **148** arranged to support, separate and isolate straps **151** from each other.

[0028] Each linear track **155** may comprise two parallel straps **152**, **153** held together by a fastener **124** (**155A**: **152A**, **153A**, **124A**, **155B**: **152B**, **153B**, **124B**, **155C**: **152C**, **153C**, **124C**) that ensures continuous contact between corresponding wired contacts **123** and linear tracks **155**. For example, straps **153** may be connected to contact straps **151**.

[0029] Each pin **115** (Figure 10) is connected to a round flat conductive track **140** that is parallel to a housing basis **130B** and may be supported within housing **130** such that each track **140** is positioned at a specified height in respect to housing basis **130B** within housing **130**. Tracks **140** may be annular. Track **140C** having the smallest diameter may be circular. The connection of pins **115** to tracks **140** is carried out via contact connections **145** (**145A**, **145B**, **145C**), which rotate with plug **110** while continuously maintaining contact to tracks **140**. Contact connections **145** may be mounted in housing **130** such as to apply a pressure on the respective tracks **140**, to yield continuous electrical contact therewith during rotation of plug **110**. For example, the ends of contact connections **145** may be bent or preloaded to push against tracks **140**.

[0030] Tracks **140** are connected to wired contacts **123** (**123A**, **123B**, **123C**) which are held between straps **152**, **153** as explained above, and connected via straps **153** and straps **151** to contacts **127**. In the illustrated example, A denotes earth, B neutral and C live elements.

[0031] Wired contacts **123** are movable along linear tracks **155** to allow a user determined position of the connector body in respect to plug **110**. Furthermore, contacts **177** of tracks **155** to horizontal flat arcs **174** are movable along arcs **174** upon rotation of round guiding plate **131** (Figure 8B, **177A** connecting track **155A** to flat arc **174A**, **177B** connecting track **155B** to flat arc **174B**, **177C** connecting track **155C** to flat arc **174C**) with which tracks **155** are associated. Rotating guiding plate **131** is possibly in almost 120° in the illustrated embodiment of three arcs **174**. Overall, connector **100** exhibits three motion lines - 360° of plug **110** by the movable contacts **123** in respect to tracks **140**, linear motion of contacts **123** in respect to tracks **155** and 120° of guiding plate **131** by the circular motion of contacts **177** along flat arcs **174**. The disclosed connector allows unprecedented flexibility in arranging the connector body at a required position, overcoming placing limitations inflicted by wall sockets.

[0032] Wired contacts **123** go through corresponding slits **154** (**123A** through **154A**, **123B** through **154B** and **123C** through **154C**) in guiding plate **131** (Figure 8B). Plug **110** is arranged to move along guiding plate **131** with wired contacts **123** moving through slits **154** and continuously contacting tracks **152**, **153**. Guiding plate

131 may further comprise indentations **165** for controlling the horizontal linear movement of plug **110** along slits **154**, by accommodating a protrusion **164** from plug **110** (e.g. from bases **133** or **134**, **Figure 12**).

[0033] In addition, plug base **133** may comprise annularly arranged indentations **161** for controlling the rotary movement of plug **110**, by accommodating a protrusion **166** from plug cap **129** (**Figure 12**). Plug cap **129** may comprise guiding rail **176** that support the linear motion of plug **110** and may be mounted on guiding plate **131** to rotate therewith.

[0034] Conductive tracks **140** (**Figures 9-11**) are concentric and may have an increasing diameter from the lowest (**140C**) to the highest (**140B**) track **140** in respect to housing basis **130B**. In the design illustrated in **Figure 10**, track **140B** with the largest diameter is closest to plug **110**, track **140A** has an intermediate diameter **142A**, and track **140C**, having the smallest diameter is the farthest from plug **110**.

[0035] The association between tracks **140** and the function of each track **140** and pin **115** may be selected at will. The illustrated association of A-earth, B-neutral, C-live is arbitrary and may be replaced by any configuration, with the appropriate structural changes. Advantageously, the widest track **140B** may be neutral, intermediate track **140A** may be earth, and smallest track **140C** may be live.

[0036] Conductive tracks **140**, tracks **152**, **153**, wired contacts **123**, horizontal flat arcs **174** and straps **151** may be made of copper, and may be flat, or have a form or a profile that are arranged to ensure continuous contact.

[0037] Electric connector **100** allows rotating housing **130** in respect to plug **110** at any user specified angle, as well as displacing housing **130** in respect to plug **110** at any used specified distance, while maintaining the connector functionality.

[0038] Embodiments of electric connector **100** may be designed to comply with any standard, as the exact ordering of pins **115** and slots **121** does not interfere with the transmission of current between tracks **140** and connections **145**.

[0039] Electric connector **100** is designed to provide maximal usage safety. For example, tracks **140**, **152**, **153** as well as contact connections **145**, horizontal flat arcs **174** and straps **151** may supported and fixated by the housing protrusions or plug support **129**, **133**, **134**, **148** and housing basis **130B**. The continuous contact between tracks **140** and contact connections **145** is ensured by stabilizing contact connections **145** within tracks **140**. The continuous contact between wired contacts **123** and linear tracks **155** is ensured by stabilizing wired contacts **123** within linear tracks **155**. The continuous contact between linear tracks **155** and horizontal flat arcs **174** is ensured by stabilizing wired contacts **177**, and the continuous contact between horizontal flat arcs **174** and straps **151** is ensured by stabilizing straps **151** by e.g. spacers **148**.

[0040] To summarize, electric connector **100** connects

one plug **110** with several sockets **120** in housing **130**, and is arranged to allow rotating as well as displacing plug **110** relative to housing **130**, while keeping connector **100** functional. Plug pins **115** are connected to conducting tracks **140** by contact connections **145** that are allowed to rotate with plug **110** within housing **130**. Conducting tracks **140** are positioned within housing **130** coaxially at different heights and have different diameters. Wired contacts **123** movably contact linear tracks **155** which are connected to contact connections **127** behind slots of sockets **120**. Linear tracks **155** are movably connected via horizontal flat arcs **174** to straps **151** to allow rotation of plug **110** together with linear tracks **155**. Wired contacts **123** are held tightly within linear tracks **155** to maintain electric contact, yet enable movement of wired tracks **123** within linear tracks **155**, as well as are linear tracks **155** in their contact with horizontal flat arcs **174** (at connections **177**).

[0041] **Figures 13-15** illustrate electric connector **100**, according to some embodiments of the invention. In these illustrations, linear tracks **155** are connected via contacts **178** to corresponding straps **151** (**178A**, **178B** and **178C** connecting track **155A** with strap **151A**, track **155B** with strap **151B** and track **155C** with strap **151C**, respectively). Plug **110** is movable along guiding plate **131** with wired contacts **123** moving through slits **154** and continuously contacting the linear tracks **155**. In these embodiments, guiding plate **131** is not allowed to rotate within housing **130**, and only two movements of plug **110** are allowed - rotation of plug **110** (with contact connections **145** moving along round flat track **140**) and a linear movement of plug **110** (with wired contacts **123** contacting tracks **155**).

[0042] These movements are supported by two pairs of protrusions that are engaged in indentations - protrusions **164** in plug basis **134** that engage in indentations **165** and protrusions **166** in plug cap **129** that engage in indentation **161**. **Figure 15** with cap **129** removed and transparent plug basis **134** illustrate an embodiment of these coupling mechanisms.

[0043] **Figures 16-20** are schematic illustrations of electric connector **100**, according to some embodiments of the invention.

[0044] Electric connector **100** (**Figures 16, 17**) comprises a plug **110** having at least two pins **115A** (e.g. earth), **115C** (e.g. live), **115B** (e.g. neutral), and a housing **130** having at least one socket **120** at a housing basis **130B**. Housing **130** may comprise one socket **120**, two or three sockets **120** or more. Each socket **120** has at least two slots **121A** (e.g. earth), **121C** (e.g. live), **121B** (e.g. neutral). Each slot **121** (**121A**, **121B**, **121C**) corresponds to one of pins **115** (**121A** to **115A**, **121B** to **115B** and **115C** to **121C**) and connected to a wired contact **123** within housing **130**.

[0045] Each pin **115** (**Figures 18-20**) is connected to a round flat conductive track **140** that is parallel to a housing basis **130B** and supported within housing **130** by protrusions in a support **112** such that each track **140** (**140A**,

140B, 140C) is positioned at a specified height **141** (**141A, 141B, 141C**) in respect to housing basis **130B** within housing **130**. Support **112** may be integrated into a plug support, into housing **130**, or in an independent part as illustrated in **Figure 18**) such as to support tracks **140** during their rotation. Tracks **140** may be annular. Track **140C** having the smallest diameter may be circular.

[0046] Connection to slots **121** (**121A, 121B, 121C, Figure 18**) is achieved via contacts **127** (**127A, 127B, 127C** respectively), connected to wired contacts **123** (**123A, 123B, 123C** respectively), which are in turn connected via contact connections **145** (**145A, 145B, 145C** respectively, **Figures 18** and **20**) to conductive tracks **140**. The protrusions in support **112** are arranged to stabilize plug **110** and conductive tracks **140** within housing **130** and during their rotation. Pins **115** may be accommodated in openings between the protrusions in support **112**, when designed as a plug support.

[0047] Conductive tracks **140** (**Figures 19, 20**) are concentric and have an increasing diameter **142** (**142A, 142B, 142C**) from the lowest (**140A**) to the highest (**140C**) track **140** in respect to housing basis **130B**. In the design illustrated in **Figure 16**, track **140A** with the largest diameter **142A** is closest to plug **110**, track **140B** has an intermediate diameter **142B**, and track **140C**, having the smallest diameter **142C** is the farthest from plug **110**.

[0048] The association between tracks **140** and the function of each track **140** and pin **115** may be selected at will. The illustrated association of A-earth, C-live, B-neutral is arbitrary and may be replaced by any configuration, with the appropriate structural changes. Advantageously, the widest track **140A** may be ground, intermediate track **140B** may be neutral, and smallest upper track **140C** may be live, thereby having the ground and neutral adjacent, and the live with the smallest movements.

[0049] Plug **110** with pins **115** and conductive tracks **140** is coaxially rotatable in respect to housing **130**. Support **112** (e.g. as a plug support **129** of plug **110**) is arranged to support conductive tracks **140** while they rotate within a mechanical socket **128** of housing **130**. Mechanical socket **128** may comprise an indentation in plug support **129** that is supported against housing **130**.

[0050] Each wired contact **123** comprises contact connection **145** (**145A, 145B, 145C**) to corresponding track **140** that maintain electric contact during the rotation of tracks **140** (**Figure 20**). Contact connections **145** may be mounted in housing **130** such as to apply a pressure on the respective tracks **140**, to yield continuous electrical contact therewith. For example, the ends of contact connections **145** may be bent or preloaded to push against tracks **140**.

[0051] Conductive tracks **140** may be made of copper, and may be flat, or have a convex profile towards the respective contact connection **145** and arranged to ensure continuous contact.

[0052] Conductive tracks **140** may be connected to pins **115** by contacts **137** (**137A, 137B, 137C, Figure**

20) extending from each track **140** to corresponding pin **115** (e.g. inwards when track **140** encircle pins **115**).

[0053] Method **200** enables a rotation of a plug within a housing of an electric connector. Method **200** may comprise the following stages: connecting each pin of the plug with a conductive track positioned within the housing and concentric with the plug, connecting the plug with the conductive tracks to the housing such as to allow their rotation within the housing, connecting each socket slot of the electric connector to a contact connection, and movably connecting each contact connection to the corresponding conductive track such as to maintain electric contact during the rotation of the tracks.

[0054] Electric connector **100** allows rotating housing **130** in respect to plug **110** at any user specified angle while maintaining the connector functionality.

[0055] Embodiments of electric connector **100** may be designed to comply with any standard, as the exact ordering of pins **115** and slots **121** does not interfere with the transmission of current between tracks **140** and connections **145**.

[0056] Electric connector **100** is designed to provide maximal usage safety. For example, tracks **140** as well as contact connections **145** are supported and fixated by the housing protrusions or plug support **112**, and the continuous contact between tracks **140** and contact connections **145** is ensured by stabilizing contact connections **145** within tracks **140**.

[0057] To summarize, electric connector **100** connects one plug **110** with several sockets **120** in housing **130**, arrange to allow rotating plug **110** relative to housing **130**, while keeping connector **100** functional. Plug pins **115** are connected to conducting tracks **140** that are allowed to rotate with plug **110** within housing **130**. Conducting tracks **140** are positioned within housing **130** coaxially at different heights **141** and have different diameters **142**, such that lowest track **140B** (most remote from plug **110**) has the smallest diameter **142B**, and diameter **142** decreases monotonously towards plug **110**. Contacts **123** behind slots **121** of sockets **120** contact tracks **140** via contact connections **145** that are positioned such as to maintain continuous contact with the corresponding tracks **140**.

[0058] Tracks **140** and contact connections **145** are supported and secured by protrusions within housing **130**, e.g. as support **112**. Association of tracks **140** with pins **115** and the association of contact connections **145** with wired contacts **123** may be selected and appropriately constructed within housing **130** at will.

[0059] Tracks **140** may be flat, and contact connections **145** contact tracks **140** on their flat sides. Furthermore, the contact is not necessarily facilitated by support **112**. Finally, tracks **140** may have a decreasing diameter from the plug inwards.

[0060] **Figures 21** and **22** are schematic illustrations of an electric connector **100**, according to some embodiments of the invention. **Figure 21** is a perspective view with a transparent housing, **Figure 22** presents a detailed

view 102.

[0061] Electric connector 100 comprises a plug 110 having at least two pins 115C (e.g. live), 115B (e.g. neutral), 115A (e.g. earth), and a housing 130 having at least one socket 120 at a housing basis 130B. Housing 130 may comprise one socket 120, two or three sockets 120 or more. Each socket 120 has at least two slots 121C (e.g. live), 121B (e.g. neutral), 121A (e.g. earth). Each slot 121 (121A, 121B, 121C) corresponds to one of pins 115 (121A to 115A, 121B to 115B and 115C to 121C) and connected to a wired contact 123 within housing 130.

[0062] Each pin 115 is connected to an annular conductive track 140 that is parallel to a housing basis 130B and supported within housing 130 by housing protrusions (not shown), such that each track 140 (140A, 140B, 140C) is positioned at a specified height 141 (141A, 141B, 141C) in respect to housing basis 130B within housing 130. The housing protrusions may be integrated into a plug support 112 (as illustrated in Figures 18 and 19) such as to support tracks 140 during their rotation.

[0063] Connection to slots 121 (121A, 121B, 121C) is achieved via contacts 127 (127A, 127B, 127C respectively), connected to wired contacts 123 (123A, 123B, 123C respectively), which are in turn connected via contact connections 145 (123A, 123B, 123C respectively) to conductive tracks 140. Contact connections 145 may be inserted through plug support 112 to contact the corresponding annular conductive tracks 140 at their outer edges. Plug support 112 may be arranged to stabilize plug 110 and annular conductive tracks 140 within housing 130 and during their rotation.

[0064] Annular tracks 140 are concentric and have a decreasing diameter 142 (142A, 142B, 142C) from the lowest (140C) to the highest (140A) track 140 in respect to housing basis 130B.

[0065] The association between tracks 140 and the function of each track 140 and pin 115 may be selected at will. The illustrated association of C-live, B-neutral, A-earth is arbitrary and may be replaced by any configuration, with the appropriate structural changes.

[0066] Plug 110 with pins 115 and annular conductive tracks 140 is coaxially rotatable in respect to housing 130. Plug support 112 of plug 110 is arranged to support annular conductive tracks 140 while they rotate within a mechanical socket 129 of housing 130. An edge 128 of plug support 112 may engage into a channel within mechanical socket 129 (Figure 22, view 102).

[0067] Each wired contact 123 comprises contact connection 145 (145A, 145B, 145C) to corresponding track 140 that maintain electric contact during the rotation of tracks 140. Contact connections 145 may be mounted in housing 130 such as to apply a pressure on the respective tracks 140, to yield continuous electrical contact therewith. For example, the ends of contact connections 145 may be bent or preloaded to push against tracks 140.

[0068] Contact connections 145 may be inserted through plug support 112 to contact the corresponding annular conductive tracks 140 at their outer edges. The

ends of contact connections 145 may be bent and pressed between tracks 140 and plug support 112.

[0069] Annular conductive tracks 140 may be made of copper, and may have a concave profile towards the respective contact connection 145 and arranged to partially enclose the respective contact connection 145.

[0070] Annular conductive tracks 140 may be connected to pins 115 by contacts 137 (137A, 137B, 137C) extending from each track 140 to corresponding pin 115 (e.g. inwards when track 140 encircle pins 115). The actual connection of contacts 137 to pins 115 may be accomplished by a ring end of contact 137 surrounding pin 115 and supported by a support 138 (138A, 138B, 138C).

[0071] Method 200 of enabling a rotation of a plug within a housing of an electric connector may comprise the following stages: connecting each pin of the plug with an annular conductive track positioned within the housing and concentric with the plug, connecting the plug with the annular conductive tracks to the housing such as to allow their rotation within the housing, connecting each socket slot of the electric connector to a contact connection, and movable connecting each contact connection to the corresponding annular conductive track such as to maintain electric contact during the rotation of the tracks.

[0072] Electric connector 100 allows rotating housing 130 in respect to plug 110 at any user specified angle while maintaining the connector functionality.

[0073] Embodiments of electric connector 100 may be designed to comply with any standard, as the exact ordering of pins 115 and slots 121 does not interfere with the transmission of current between tracks 140 and connections 145.

[0074] Electric connector 100 is designed to provide maximal usage safety. For example, tracks 140 as well as contact connections 145 are supported and fixated by the housing protrusions or plug support 112, and the continuous contact between tracks 140 and contact connections 145 is ensured by stabilizing contact connections 145 within tracks 140.

[0075] To summarize, electric connector 100 connects one plug 110 with several sockets 120 in housing 130, arrange to allow rotating plug 110 relative to housing 130, while keeping connector 100 functional. Plug pins 115 are connected to annular tracks 140 that are allowed to rotate with plug 110 within housing 130. Annular tracks 140 are positioned within housing 130 coaxially at different heights 141 and have different diameters 142, such that lowest track 140A (most remote from plug 110) has the largest diameter 142A, and diameter 142 decreases monotonously towards plug 110. Contacts 123 behind slots 121 of sockets 120 contact tracks 140 via contact connections 145 that are positioned such as to maintain continuous contact with the corresponding tracks 140, e.g. by pressing them against track 140 and curving the track's profile to hold the ends of contact connections 145. Tracks 140 and contact connections 145 are supported and secured by protrusions within housing 130.

Association of tracks **140** with pins **115** and the association of contact connections **145** with wired contacts **123** may be selected and appropriately constructed within housing **130** at will. Track **140** and plug **110** may be supported by plug support **112**, and contact connections **145** may pass through plug support **112** and be pressed against tracks **140**.

[0076] In the above description, an embodiment is an example or implementation of the invention. The various appearances of "one embodiment", "an embodiment" or "some embodiments" do not necessarily all refer to the same embodiments.

[0077] Although various features of the invention may be described in the context of a single embodiment, the features may also be provided separately or in any suitable combination. Conversely, although the invention may be described herein in the context of separate embodiments for clarity, the invention may also be implemented in a single embodiment.

[0078] Furthermore, it is to be understood that the invention can be carried out or practiced in various ways and that the invention can be implemented in embodiments other than the ones outlined in the description above.

[0079] The invention is not limited to those diagrams or to the corresponding descriptions. For example, flow need not move through each illustrated box or state, or in exactly the same order as illustrated and described.

[0080] Meanings of technical and scientific terms used herein are to be commonly understood as by one of ordinary skill in the art to which the invention belongs, unless otherwise defined.

[0081] While the invention has been described with respect to a limited number of embodiments, these should not be construed as limitations on the scope of the invention, but rather as exemplifications of some of the preferred embodiments. Other possible variations, modifications, and applications are also within the scope of the invention.

Claims

1. An electric connector (100) comprising a plug (110) having at least two pins (115) and a housing (130) having at least two sockets (120) at a housing basis (130B), each socket (120) having at least two slots (121), each slot (121) corresponding to one of the pins (115), the electric connector (100) is **characterized in that:**

the plug (110) is coaxially rotatable in respect to the housing (130), each pin (115) is connected via a contact connection (145) to a round flat track (140), wherein the contact connections (145) are circularly movable along the corresponding tracks (140) upon rotation of the plug (110) within the housing (130), the electric con-

necter (100) is **characterized in that:**

each round flat track (140) is connected to a corresponding wired contact (123),
each wired contact (123) is movable enclosed within a corresponding linear track (155),
each linear track (155) is connected via a corresponding strap (151) to the corresponding slots (121), and
the housing (130) further comprises a guiding plate (131) positioned between the round flat tracks (140) and the linear tracks (155) and comprising a corresponding slit (154) for each wired contact (123) to go through,
wherein the plug (110) is movable along the guiding plate (131) with the wired contacts (123) moving through the slits (154) and continuously contacting the linear tracks (155).

2. The electric connector according to claim 1, wherein:

the housing (130) has at least four sockets (120) arranged in a two dimensional array,
each linear track (155) is connected to the corresponding strap (151) via a horizontal flat arc (174) that is parallel to the corresponding strap (151),
each strap (151) has a two dimensional shape arranged to reach each of the corresponding slots (121).

3. The electric connector according to claim 2, wherein the flat arcs (174) movably connected to track (155) by contacts (177) enabling a rotation of the plug (110) with the linear tracks (155) in respect to the flat arcs (174).

4. The electric connector according to claim 2, wherein the flat arcs (174) are arranged peripherally within housing (130).

5. The electric connector according to claim 2, further comprising a plurality of spacers (148) arranged to support, separate and isolate the straps (151) from each other.

6. The electric connector according to claims 1 or 2, wherein each linear track (155) comprises two tracks (152, 153) joined by a fastener (124) and enclosing the corresponding wired contact (123).

7. The electric connector according to claims 1 or 2, wherein one (153) of the two tracks (152, 153) is connected to the strap (151).

8. The electric connector according to claims 1 or 2, wherein the guiding plate (131) further comprises indentations (165) arranged to releasably engage protrusions (164) in a plug basis (134) to control the

linear movement of the plug (110).

9. The electric connector according to claims 1 or 2, wherein a plug basis (133) further comprises annularly arranged indentations (161) arranged to releasably engage protrusions (166) in a plug cap (129) to control the circular movement of the plug (110). 5
10. The electric connector according to claim 1, wherein an earth strap (151A) is opposite to the neutral and live straps (151B, 151C respectively). 10
11. The electric connector according to claim 2, wherein an earth strap (151A) is positioned above the neutral and live straps (151B, 151C respectively). 15
12. The electric connector according to claims 1 or 2, wherein a smallest round track (140) is circular.
13. The electric connector according to claims 1 or 2, wherein the round flat tracks (140), the linear tracks (155), and the contacts (145, 123, 151) are made of copper. 20
14. A method comprising: 25

movably connecting pins of a plug of an electric connector to corresponding concentric conductive tracks within a housing of the connector, to enable rotating the plug within the housing while maintaining electric contact of the pins with the tracks, and 30

movably connecting the concentric conductive tracks to corresponding linear tracks within the housing, to enable displacing the plug within the housing along the linear tracks while maintaining electric contact of the concentric conductive tracks with the linear tracks, 35

wherein the linear tracks are connected to corresponding socket slot contact connections. 40
15. The method according to claim 14, wherein the linear tracks are rotationally movably connected to corresponding socket slot contact connections. 45

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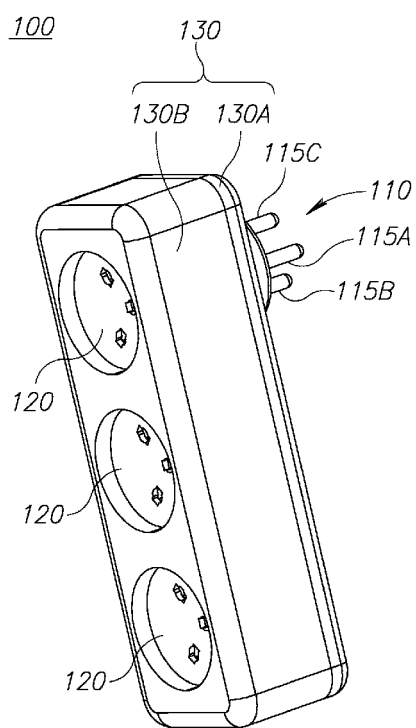


Figure 1A

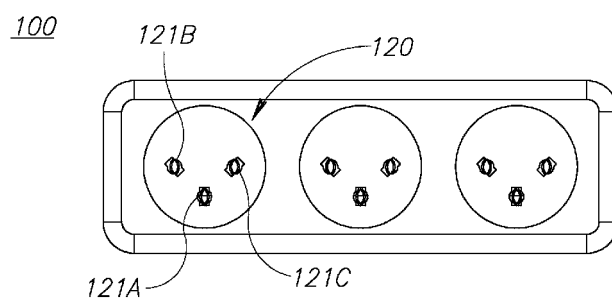


Figure 1B

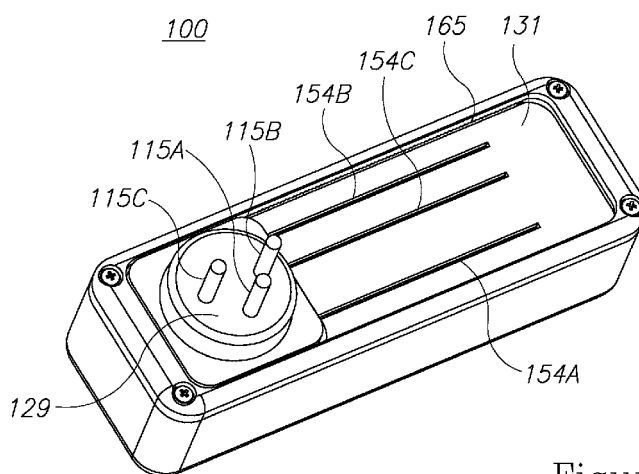


Figure 1C

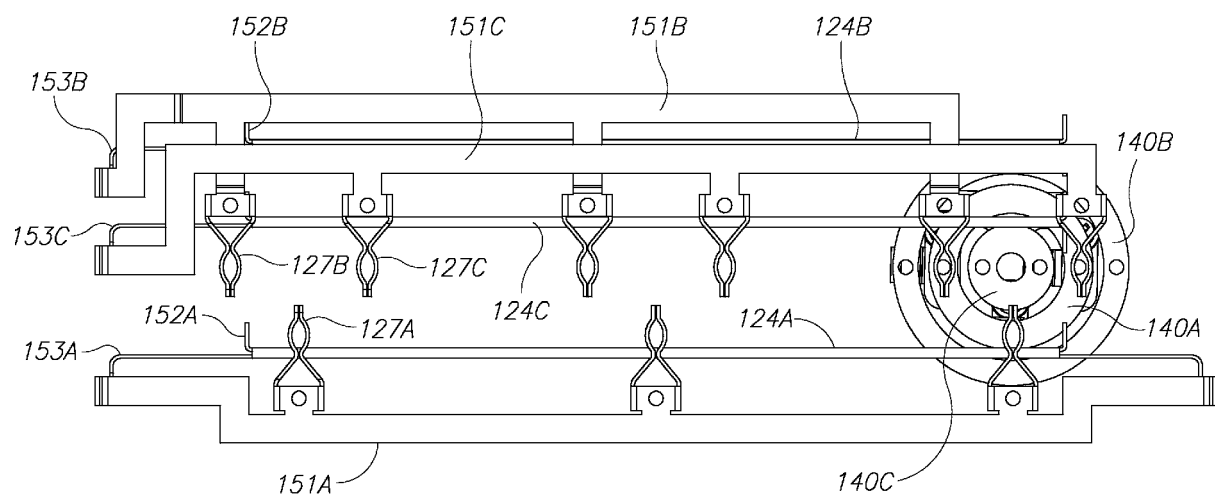


Figure 2

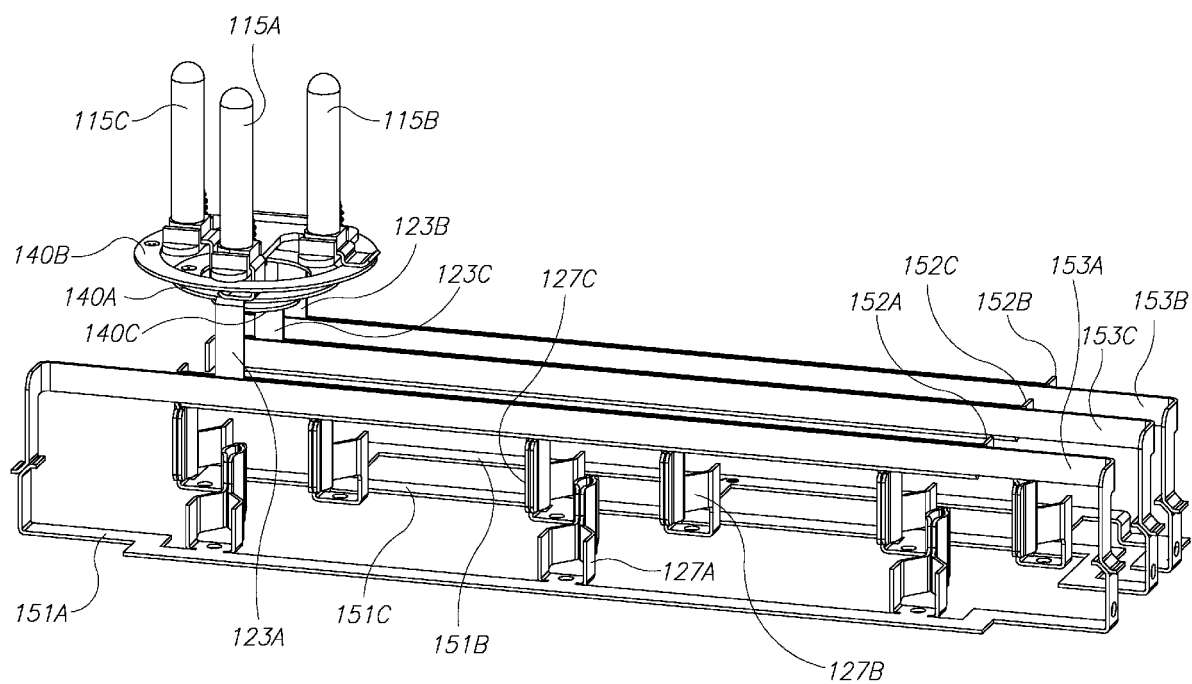


Figure 3

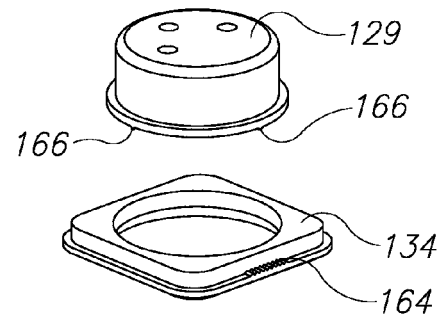
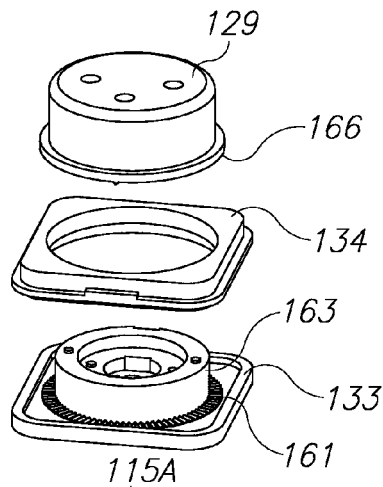


Figure 4B

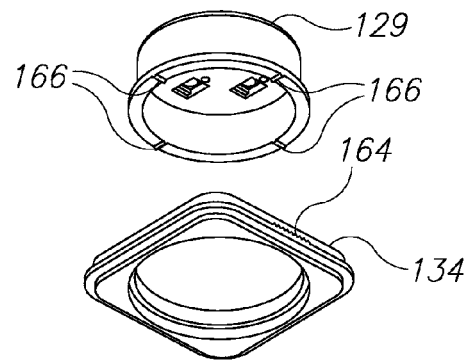
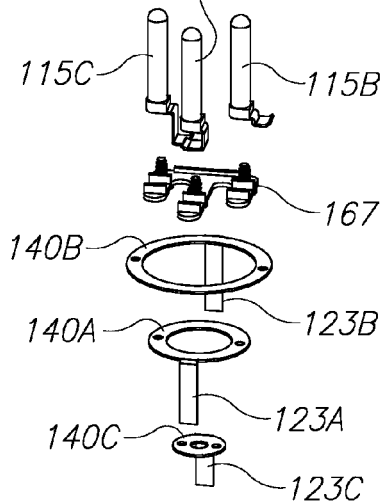


Figure 4C

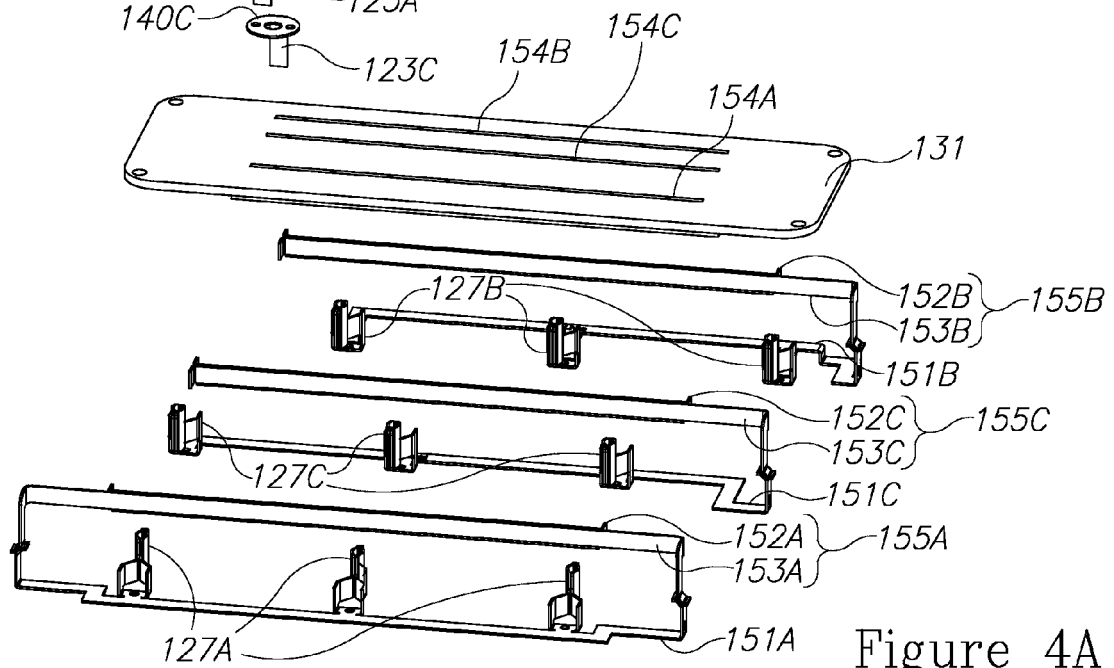


Figure 4A

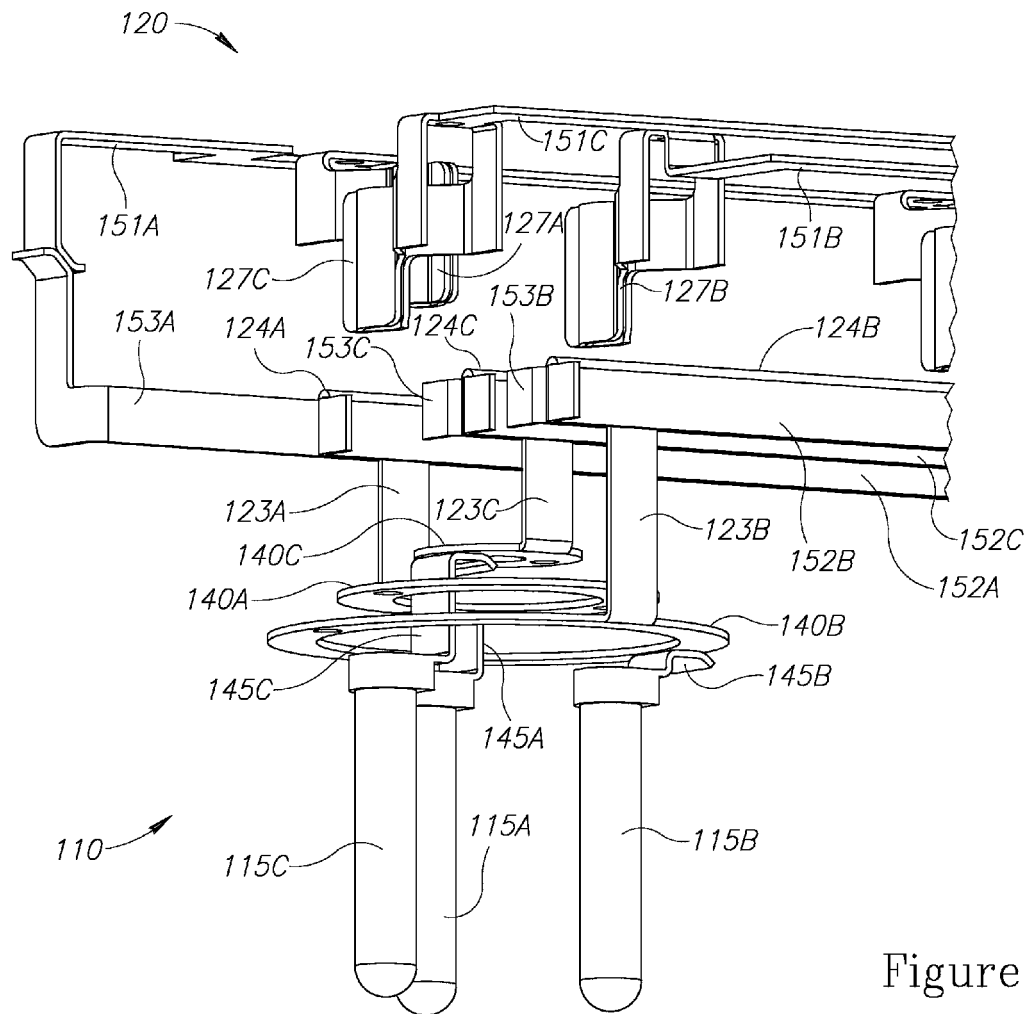


Figure 5

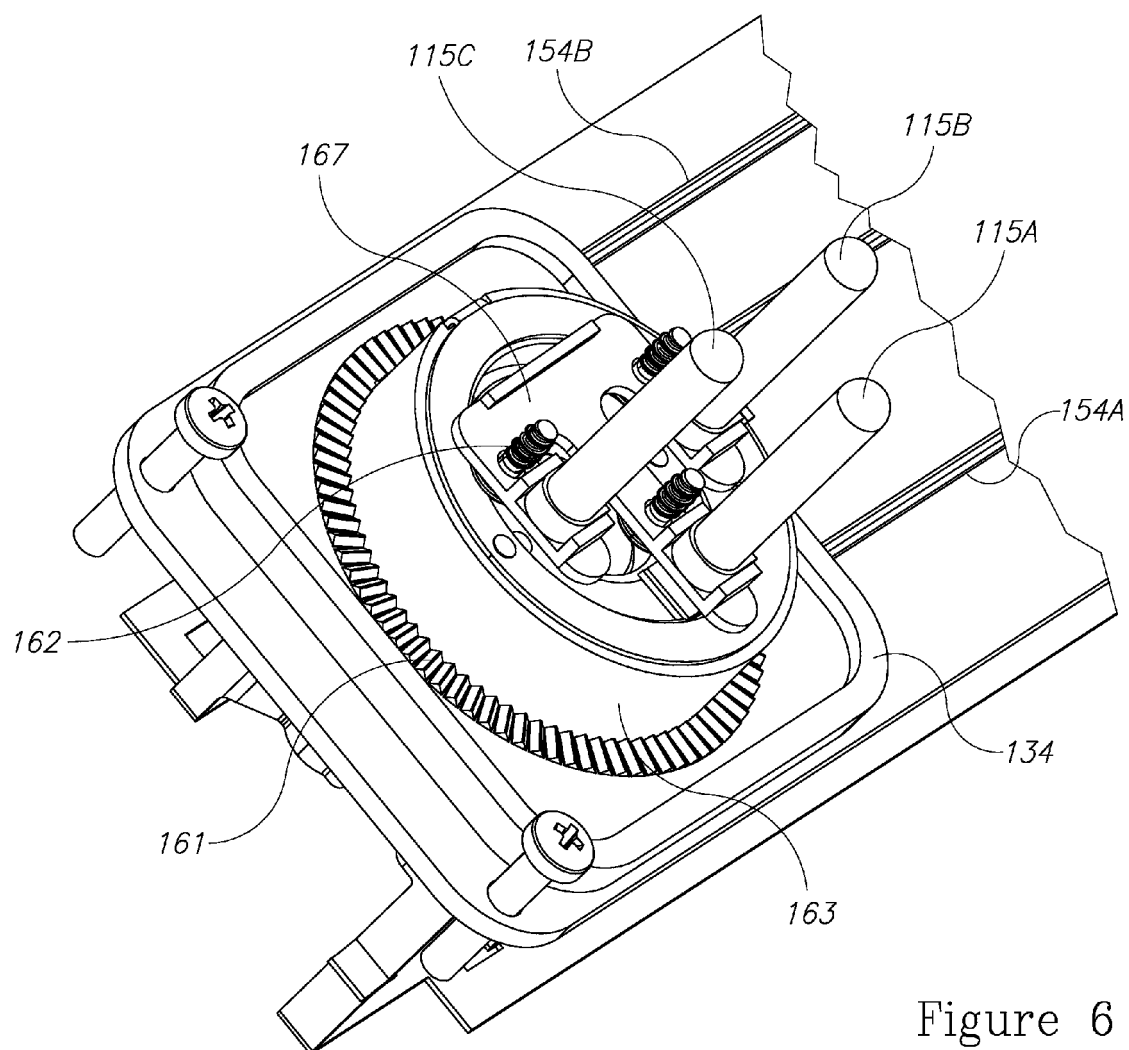


Figure 6

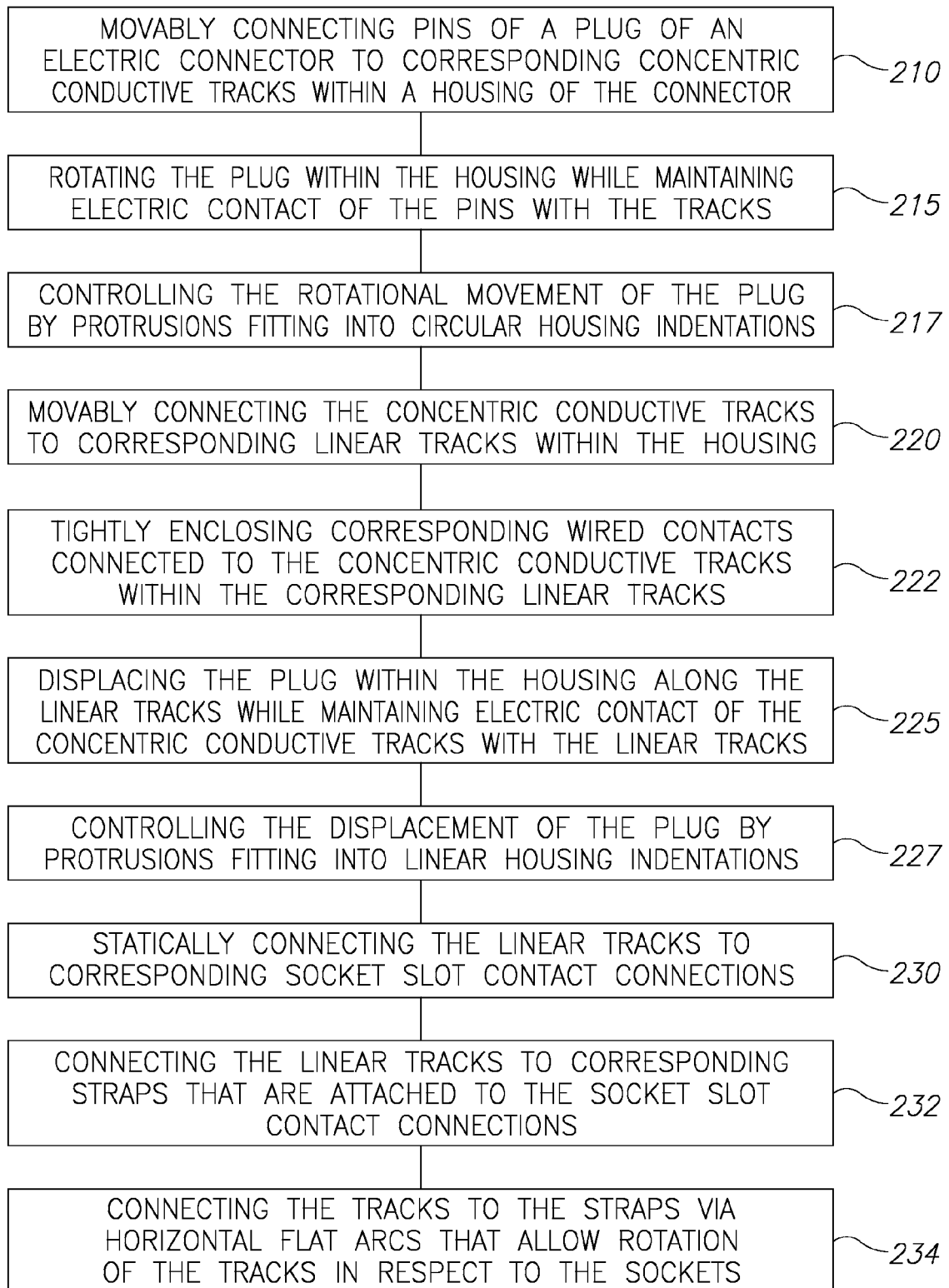
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Figure 7

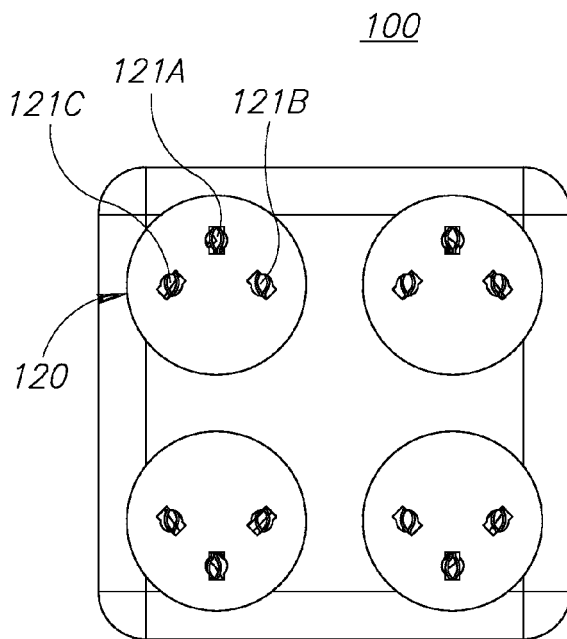


Figure 8A

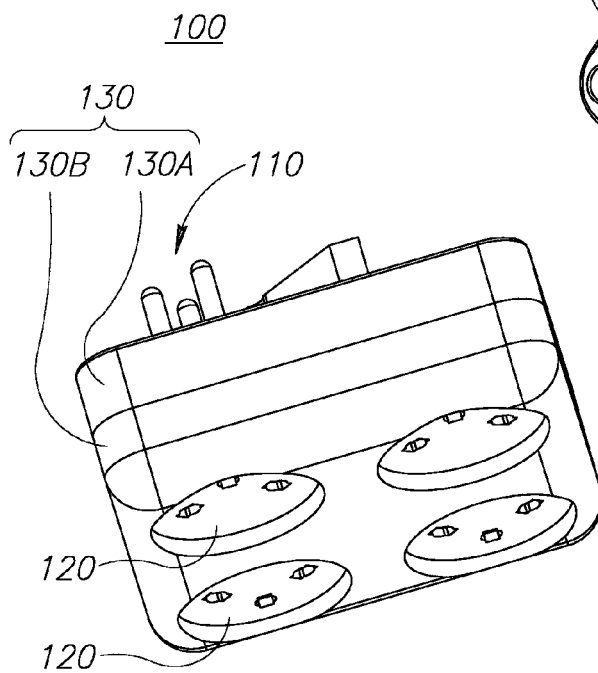


Figure 8C

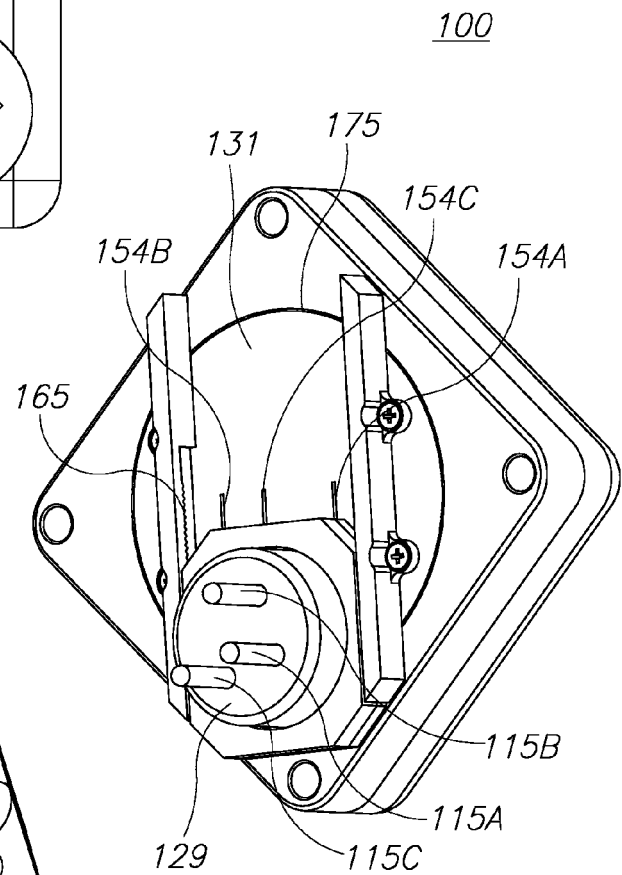


Figure 8B

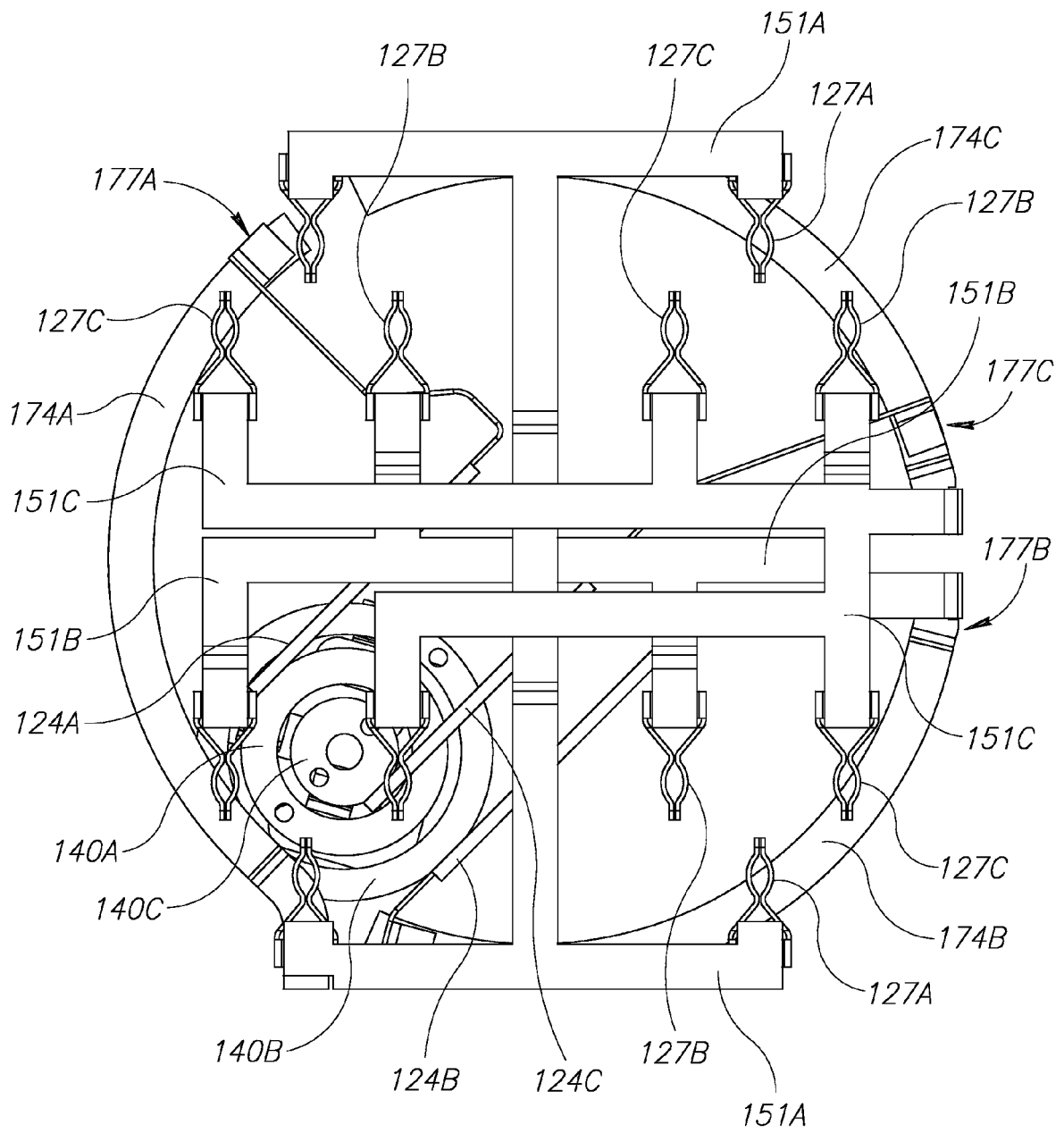


Figure 9

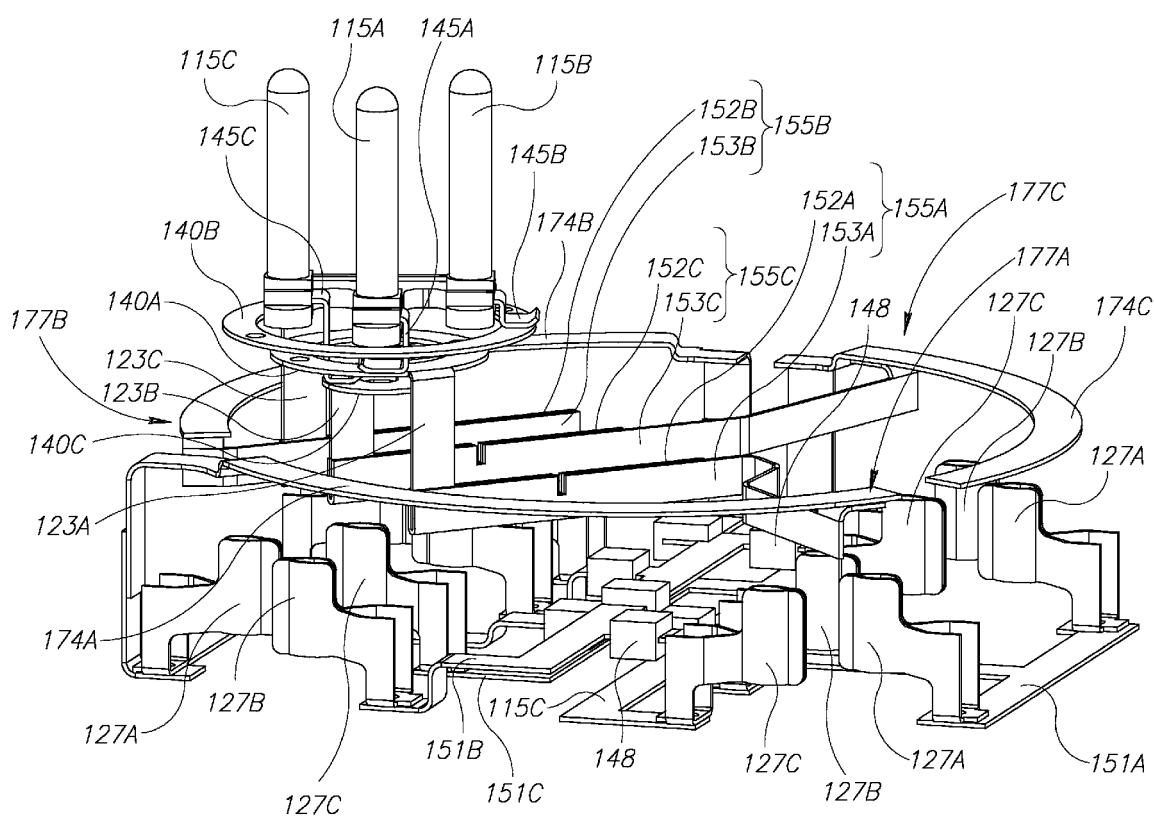


Figure 10

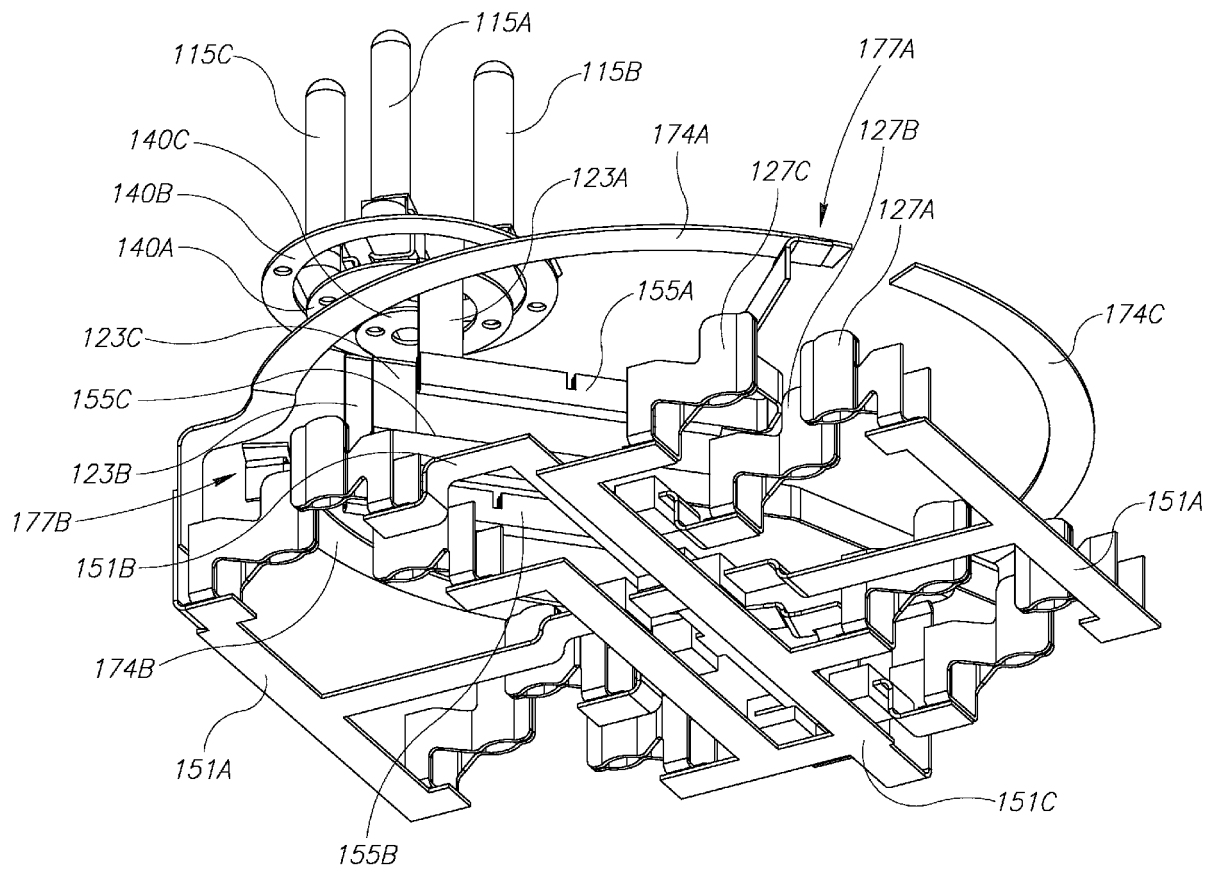


Figure 11

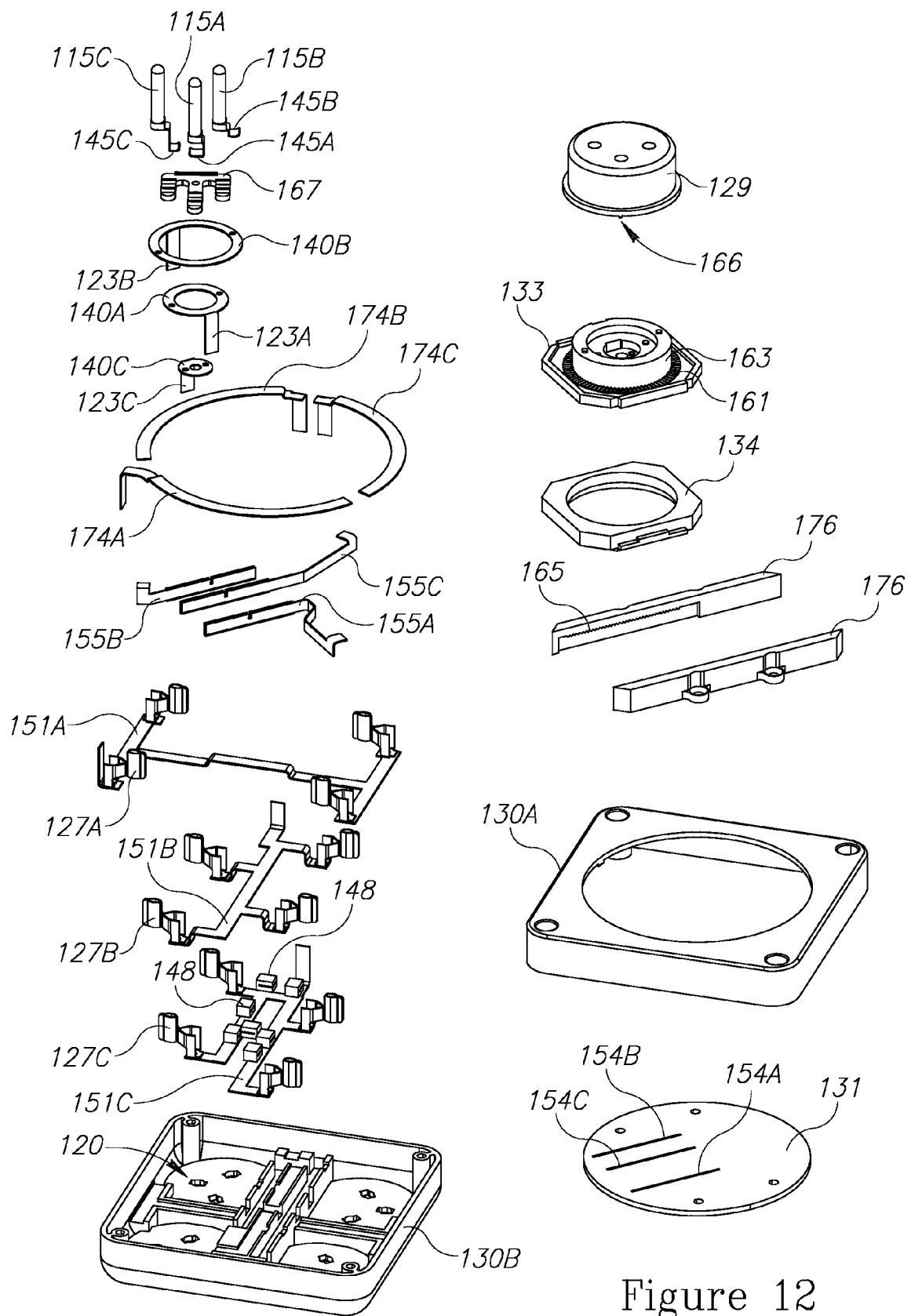


Figure 12

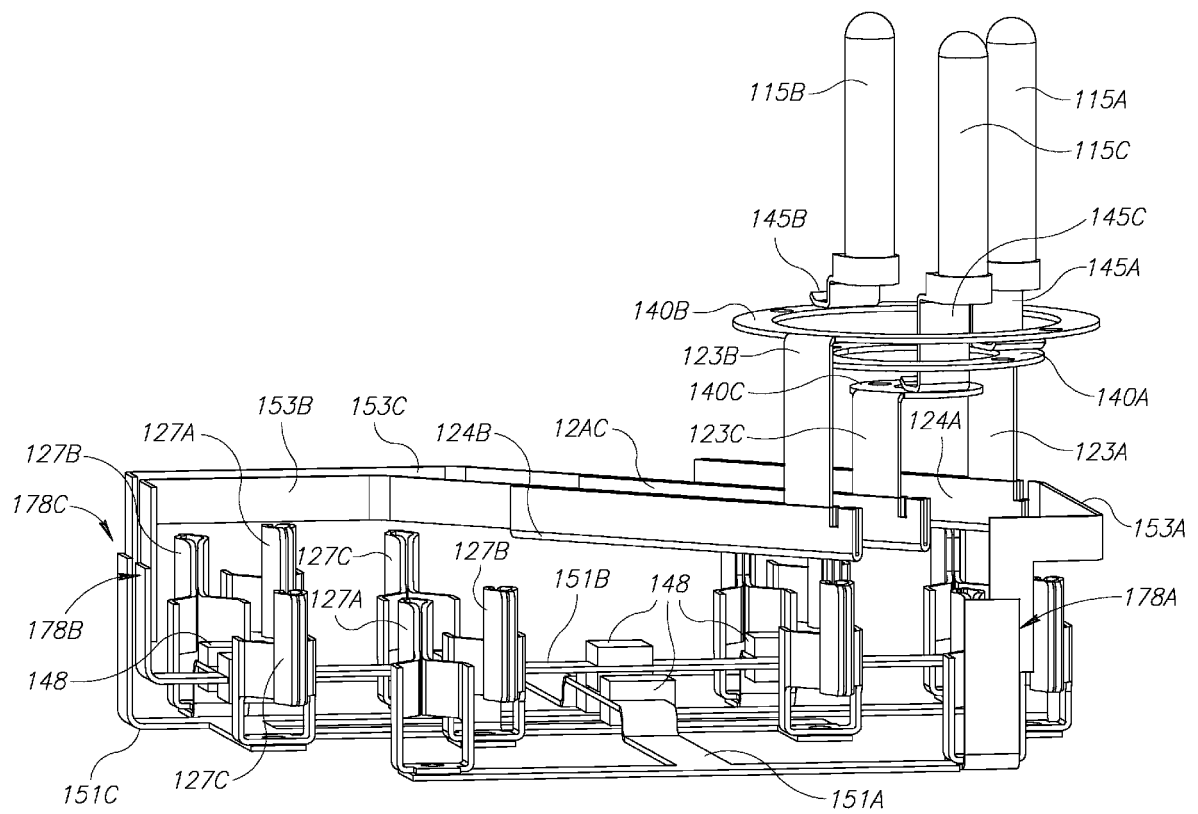


Figure 13

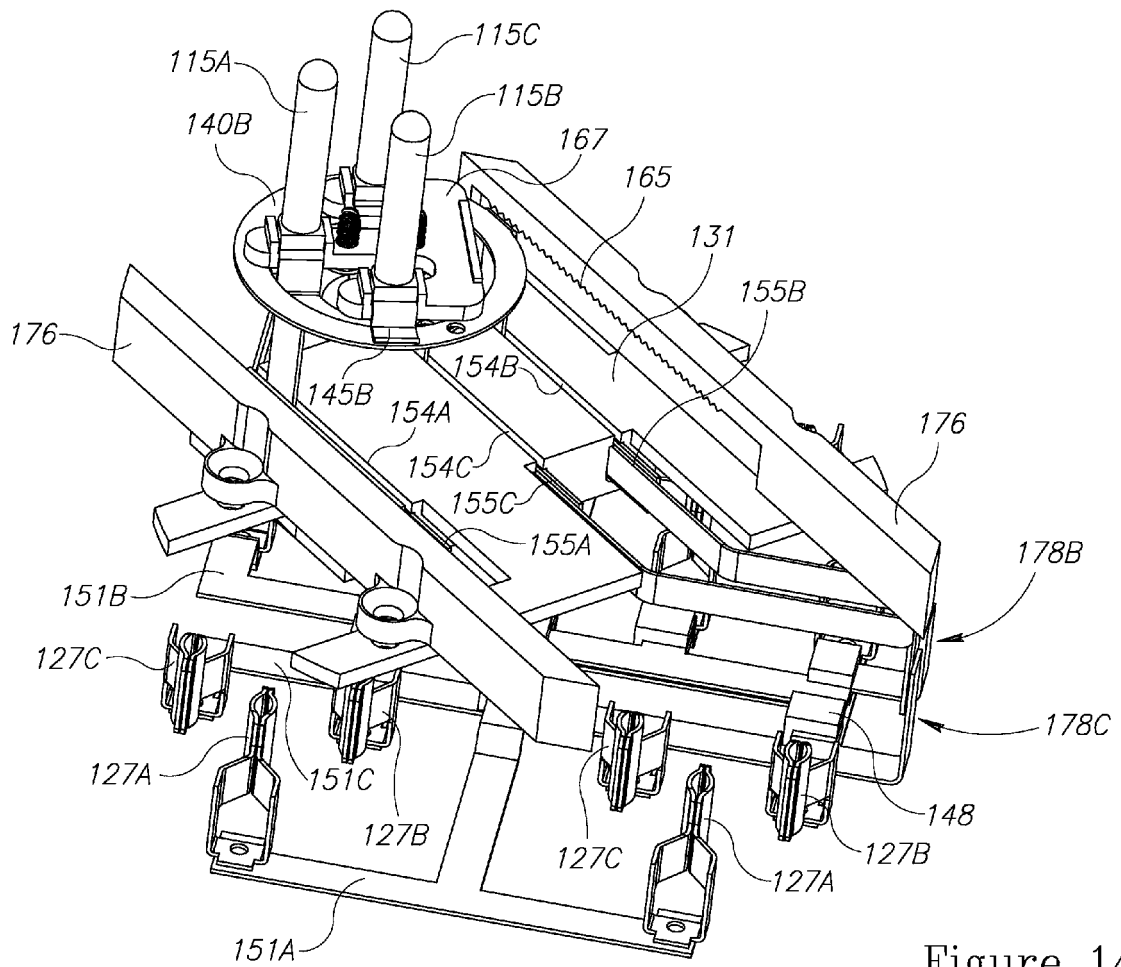


Figure 14

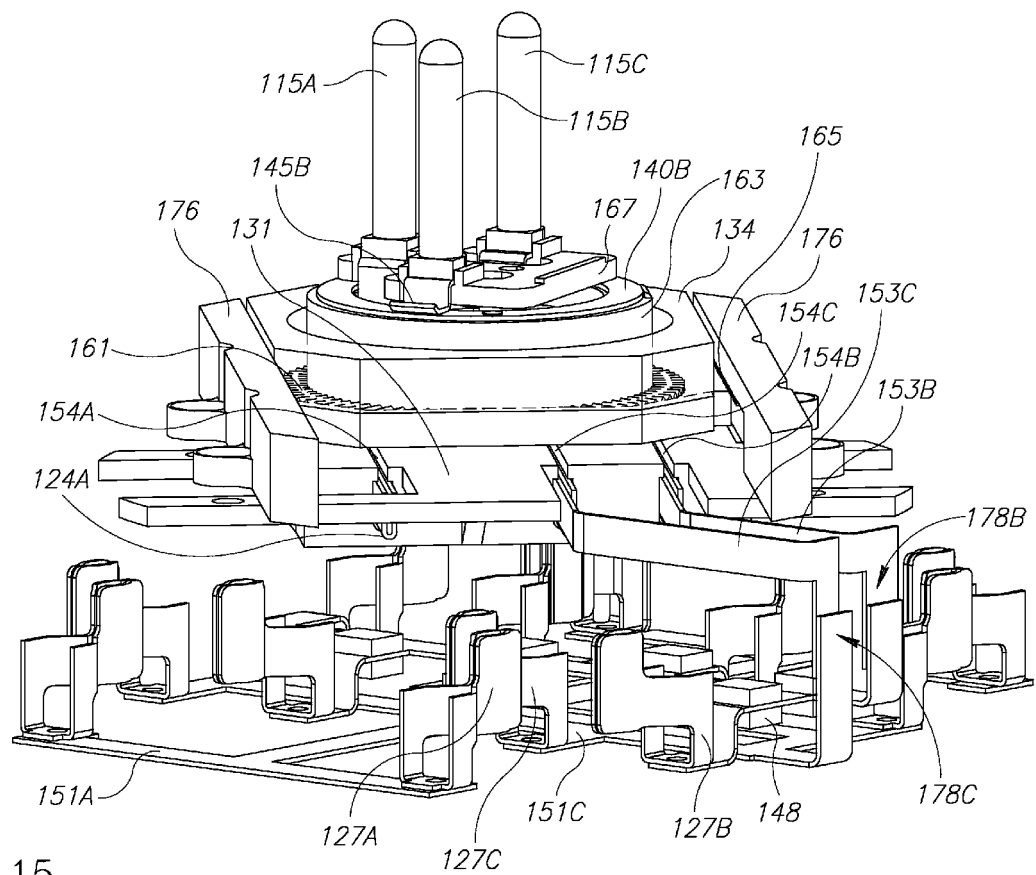


Figure 15

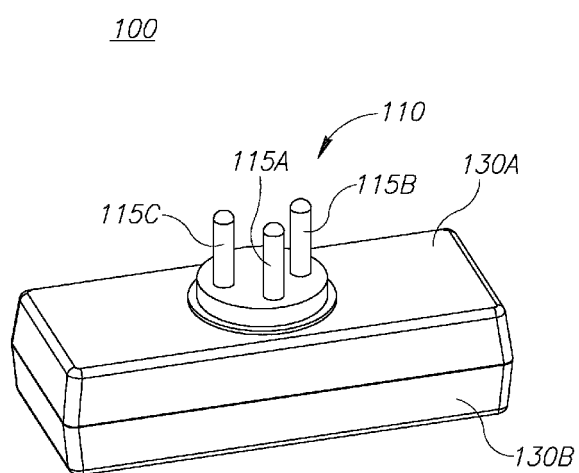


Figure 16

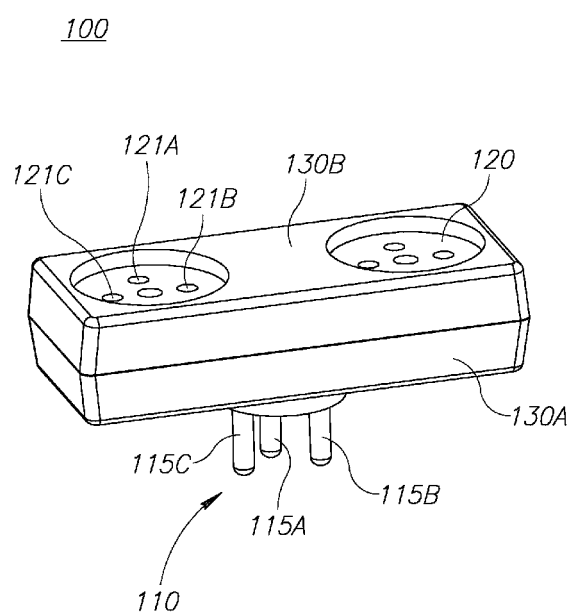


Figure 17

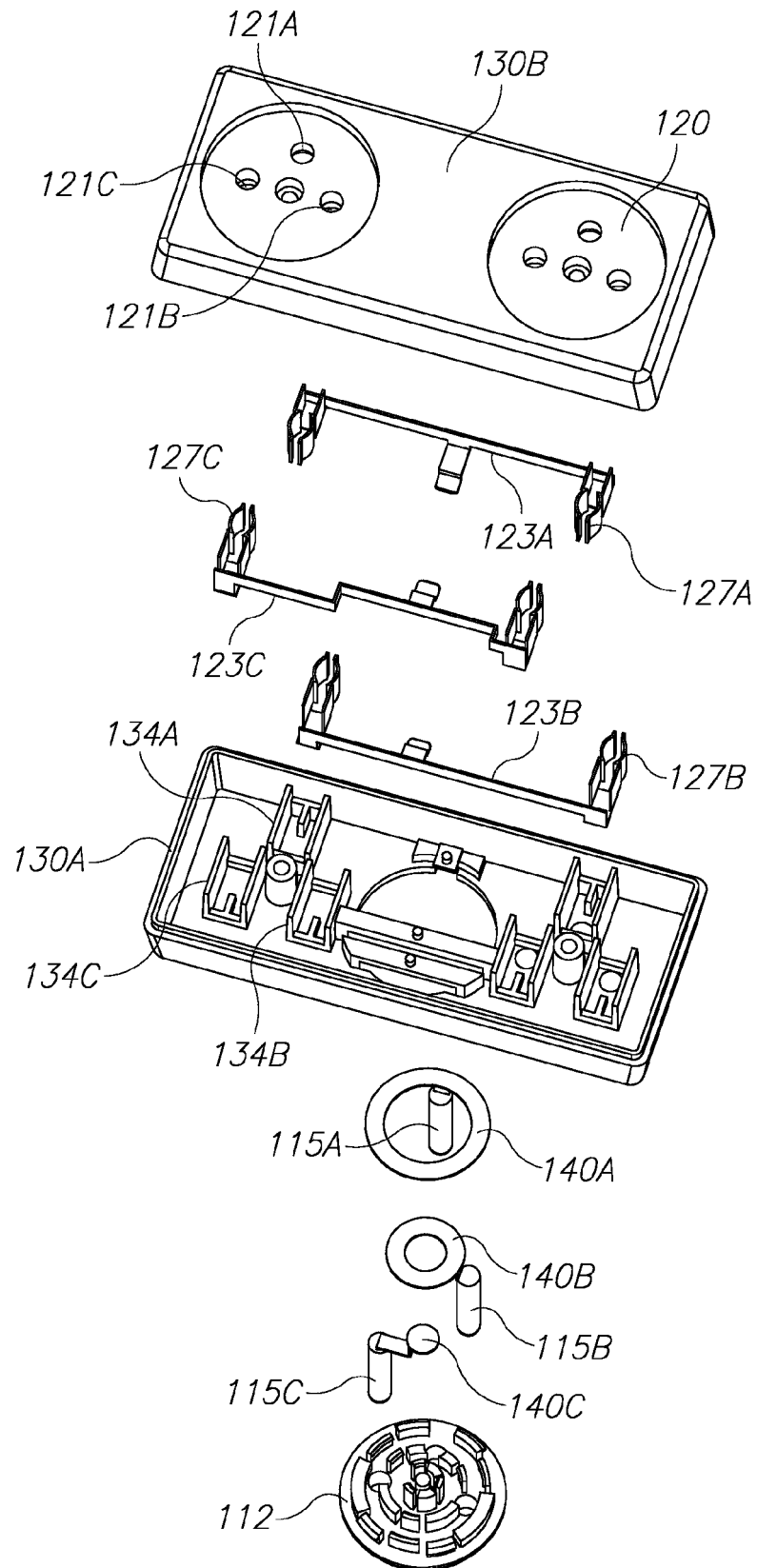
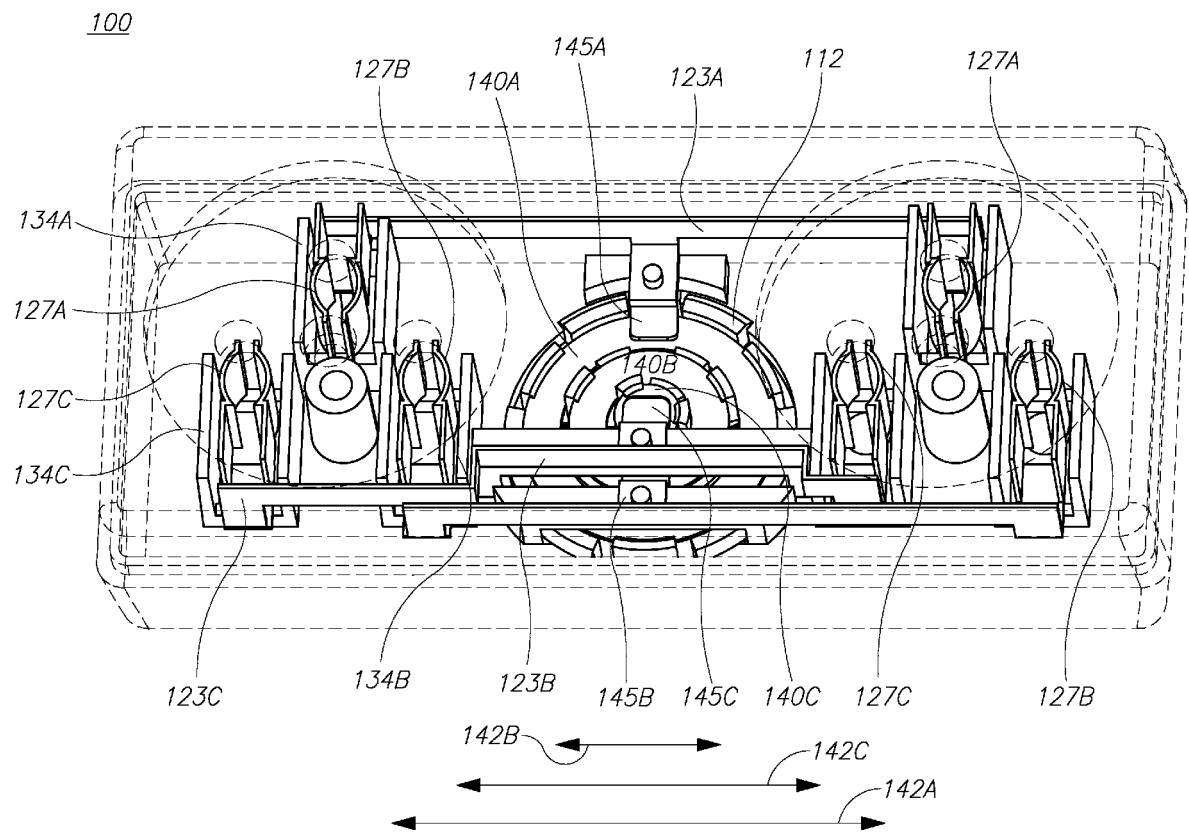


Figure 18



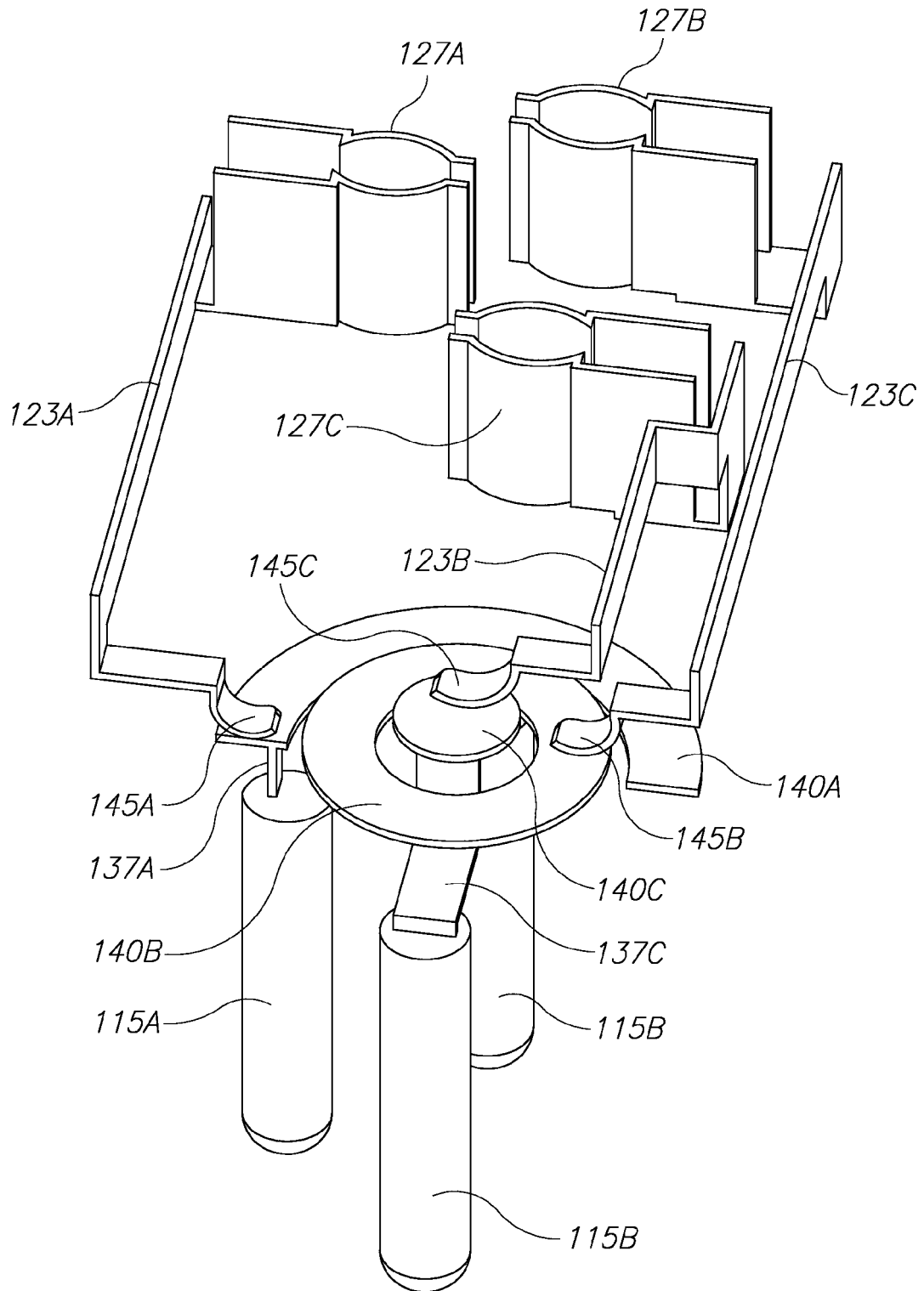


Figure 20

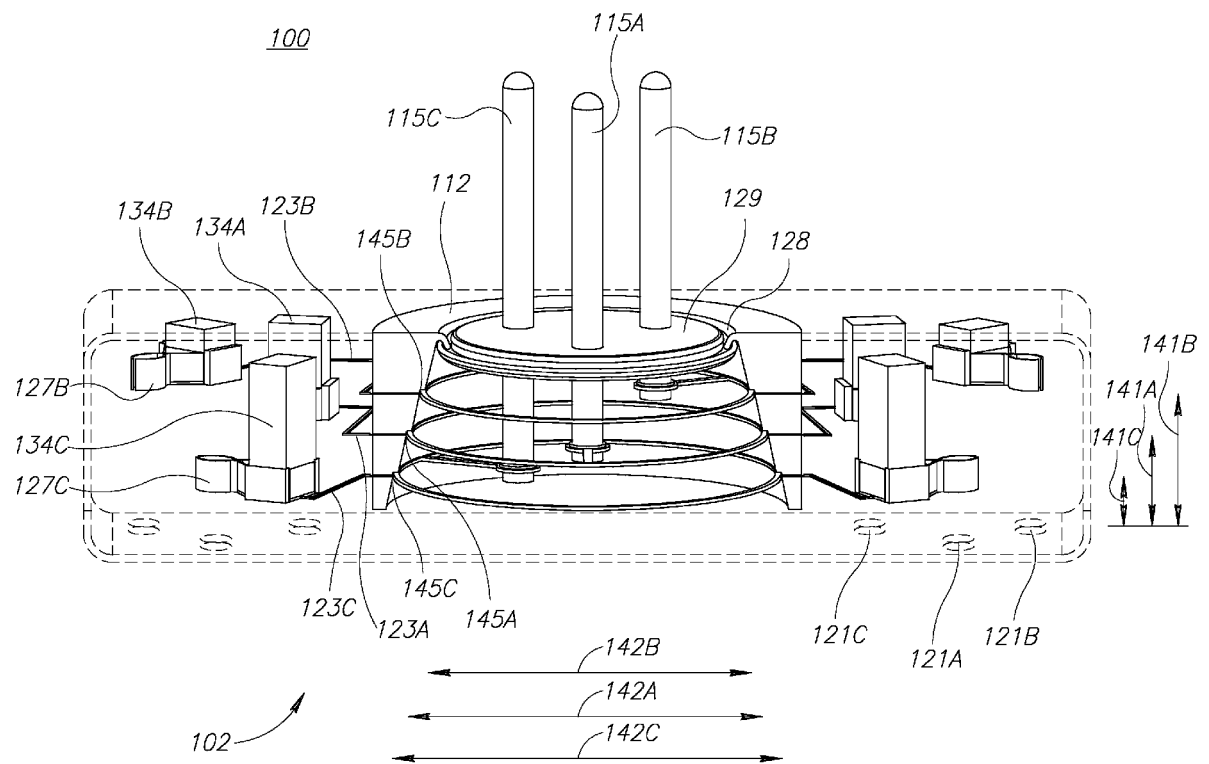


Figure 21

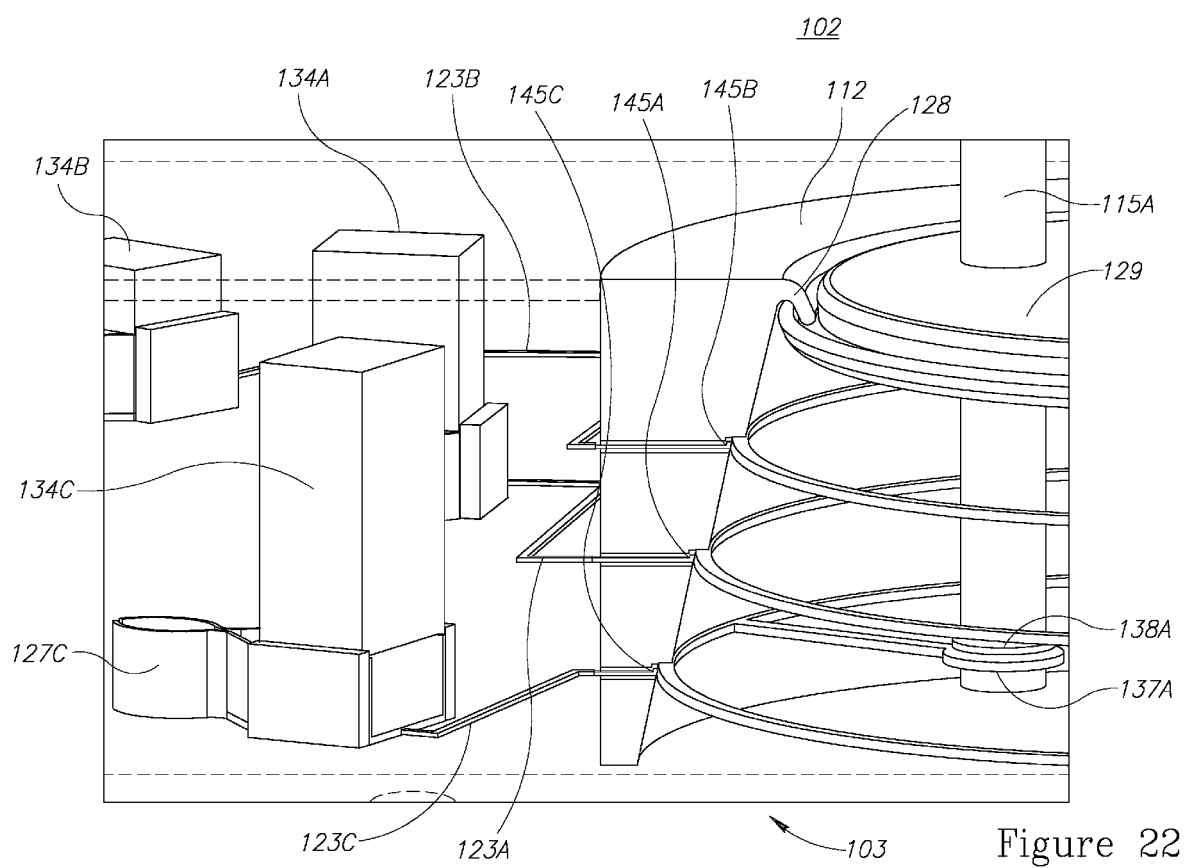


Figure 22