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(71) Applicant: **TVS MOTOR COMPANY LIMITED** [IN/IN]; "Chaitanya" No. 12 Khader Nawaz Khan Road, Nungambakkam Chennai, Tamil Nadu - 600006 (IN).

(72) Inventors: **SAVARIRAJAN, Charlesbenadict**; TVS Motor Company Limited, "Chaitanya" No. 12 Khader Nawaz Khan Road, Nungambakkam Chennai, Tamil Nadu - 600006 (IN). **DUTTA, Shatyajit**; TVS Motor Company Limited, "Chaitanya" No. 12 Khader Nawaz Khan Road, Nungambakkam Chennai, Tamil Nadu - 600006 (IN). **GOVINDRAJAN, Srinivasan**; TVS Motor Company Limited, "Chaitanya" No. 12 Khader Nawaz Khan Road, Nungambakkam Chennai, Tamil Nadu - 600006 (IN). **MURTHY, Anirudh**; TVS Motor Company Limited, "Chaitanya" No. 12 Khader Nawaz Khan Road, Nungambakkam Chennai, Tamil Nadu - 600006 (IN). **PRASAD, Raghavendra**; TVS Motor Company Limited, "Chaitanya" No. 12 Khader Nawaz Khan Road, Nungambakkam Chennai, Tamil Nadu - 600006 (IN). **RAJARAM SAGARE, Datta**; TVS Motor Company Limited, "Chaitanya" No. 12 Khader Nawaz Khan Road, Nungambakkam Chennai, Tamil Nadu - 600006 (IN).

(54) **Title:** A PROTECTIVE CAP FOR A BATTERY CONNECTOR OF A VEHICLE

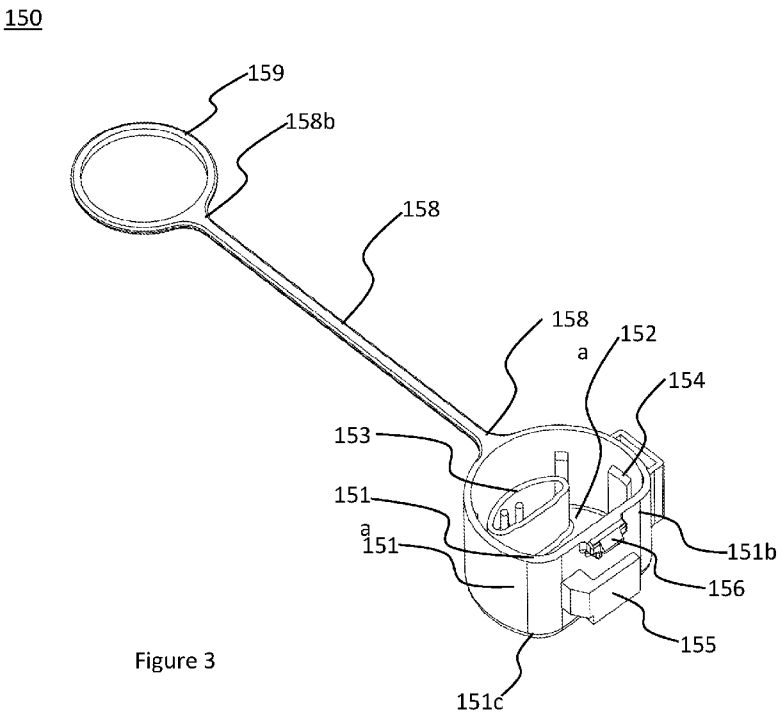


Figure 3

(57) **Abstract:** The present invention relates to a protective cap (150) for a battery connector (100) of a vehicle (10). The protective cap (150) includes a housing (151) having an opening (151a) configured to be detachably attached to the battery connector (100). Further, a cavity (152) being configured to receive a sensing element (153) which is configured to generate an input signal based on an attachment or detachment state of the protective cap (150) with the battery connector (100). The protective cap (150) includes at least one attachment member (155), at least one locking member (156) and an elastic support member (158). The at least one attachment member (155) and the at least one locking member (156) are formed on one of plurality of outer side portions (151b) of the housing (151). The elastic support member (158) has a mounting element (159).

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(74) **Agent: ADHEESH NARGOLKAR**; Khaitan & Co, One Indiabulls Centre, 13th Floor, 841, Senapati Bapat Marg, Elphinstone Road, Mumbai 400013, Maharashtra (IN).

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TITLE OF INVENTION

A PROTECTIVE CAP FOR A BATTERY CONNECTOR OF A VEHICLE

FIELD OF THE INVENTION

[001] The present invention relates to battery connectors of a vehicle. More particularly, the present invention relates to a protective cap for a battery connector of the vehicle.

BACKGROUND OF THE INVENTION

[002] Electric vehicles (EVs) as well as the hybrid vehicles have gained significant popularity and high demands due to their environmental benefits and cost-effectiveness. In hybrid vehicles, apart from the internal combustion usages, an electric propulsion system with additional batteries is provided to drive the vehicle in predefined conditions. The electric vehicles are powered by one or more batteries, to provide the necessary energy for propulsion whereas the number of batteries depends upon the power requirements and configuration of the vehicle. With the advent in renewable technologies, battery systems were developed to introduce the provision of removable rechargeable batteries which can be replaced and/or used in conjunction with other charged batteries, if required. The removed battery can also be charged separately from the vehicle while the vehicle may run on another battery. Such batteries are designed to be easily removable, allowing for convenient replacement or recharging.

[003] In existing configuration of vehicles, removable batteries are connected to each other through battery connectors. Battery connectors electrically connect terminals of one battery with terminals of another battery through power terminals. While removing or replacing batteries, the battery connector of one battery is required to be detached from another battery connector. It has been observed that when one of the batteries is removed from the electrical vehicle, the power terminals of the remaining battery connectors are exposed and pose safety concerns.

[004] Moreover, the electric vehicles are designed and manufactured with multiple variants possessing different configurations in specifications of battery storage as well as the traction power. Some variants of the vehicles and especially, the lower variants are assembled with lesser number of batteries as compared to higher variants of the same vehicle. Due to mass manufacturing, the general configuration of the battery storage and battery connectors remains the same to avoid additional costs and reduce assembly time and due to which a storage space for additional battery is left vacant and the power terminals of the battery connectors are left open or exposed in lying condition inside the battery storage space. In such situations, a battery current from the available and/or stored battery

keeps flowing through the exposed power terminals and an accident contact with these power terminals can lead to short circuits, or other hazards.

[005] Further, it has also been observed that in vehicles whereas the battery storage compartment is adjacent and/or being used or shared commonly with utility storage compartment, the exposed power terminals of the battery connectors may contact stored metal objects, articles therein and thus are susceptible to cause damage to the articles or the components of the battery system and including the vehicle itself. Furthermore, when the power terminals of the battery connector are in open condition, dust and/or water particles enters and accumulates inside the battery connector which leads to power terminal corrosion and causes further damage to the battery connector as well as the battery.

[006] In view of the foregoing, there is a need to provide a protective cap for protecting a battery connector which solve at least one of the aforesaid problems.

SUMMARY OF THE INVENTION

[007] In one aspect of the invention, a protective cap for a battery connector of an electric vehicle is disclosed. The protective cap includes a housing having an opening, a sensing element, at least one attachment member, at least one locking member, and an elastic support member. The opening being configured to be detachably attached to the battery connector. The housing includes a cavity and a plurality of outer side portions. The cavity being configured to receive a sensing element. The sensing element being configured to generate an input signal based on an attachment or detachment state of the protective cap with the battery connector. The at least one attachment member and the the at least one locking member being formed on one of the plurality of outer side portions of the housing. The elastic support member extends away from the housing. The elastic support member includes a distal end being configured to receive a mounting element.

[008] In an embodiment, the mounting element of the elastic support member being configured to be attached to a wiring harness of the battery connector and hangably mount the protective cap when detached from the battery connector.

[009] In an embodiment, the at least one attachment member being configured to be attached to a mounting bracket of the electric vehicle.

[010] In an embodiment, the at least one locking member being configured to be lockably attached to the battery connector.

[011] In an embodiment, the sensing element of the protective cap includes a plurality of electrical pins. Each of the plurality of electrical pins being configured to be operably attached to the battery connector.

[012] In an embodiment, the protective cap includes a plurality of protruded slide members formed on an inner surface of the housing and a grip member formed on one of the plurality of outer side portions of the housing.

[013] In an embodiment, the elastic support member includes an attachment end being opposite to the distal end. The attachment end being integrally attached to one of the plurality of outer side portions of the housing.

[014] In another aspect of the invention, an electric vehicle is disclosed. The electric vehicle includes a plurality of batteries removably disposed inside the vehicle. Each of the plurality of batteries being configured to supply an electric power to drive the vehicle. The electric vehicle includes a control unit being operably connected with the plurality of batteries and configured to control the supply of the electric power. The electric vehicle includes a plurality of battery connectors being operably connected with each other and configured to electrically connect a first battery of the plurality of batteries with a second battery of the plurality of batteries. Each of the plurality of battery connectors being configured to detachably and lockably receive a protective cap. The protective cap includes a sensing element. The sensing element being operably connected to the control unit of the vehicle and configured to generate an input signal based on an attachment or detachment state of the protective cap with one of the plurality of battery connectors.

[015] In an embodiment, each of the plurality of battery connectors includes a housing having a first end, a second end, and a pair of electrical contact members disposed inside the housing. The pair of electrical contact members being configured to receive terminals of one of the plurality of batteries and configured to electrically connect the first battery of the plurality of batteries with the second battery of the plurality of batteries.

[016] In an embodiment, each of the second ends of the housing of the plurality of battery connectors includes an attachment portion and a plurality of slot members. The attachment portion being configured to detachably receive the protective cap. The plurality of slot members being formed on an outer surface of the attachment portion.

[017] In an embodiment, the electric vehicle includes a mounting bracket. The mounting bracket being rigidly attached to the vehicle. The mounting bracket being configured to detachably receive the at least one attachment member of the protective cap.

[018] In an embodiment, each of the plurality of battery connectors includes a locking mechanism mounted on the second end of the housing. The locking mechanism being configured to receive the locking member of the protective cap.

[019] In an embodiment, the elastic support member includes a mounting element. The mounting element being configured to be attached to a wiring harness of one of the plurality of battery

connectors and supportably mount the protective cap when detached from one of the plurality of battery connectors.

[020] In an embodiment, each of the second ends of the plurality of battery connectors includes a connection port. The connection port being configured to receive the plurality of electrical pins of the sensing element.

[021] In an embodiment, each of the plurality of slot members of the second ends of the plurality of battery connectors being configured to receive one of the plurality of protruded slide members of the protective cap.

[022] In an embodiment, the control unit being configured to receive the input signal from the sensing element and disconnect the supply of the electric power when the second battery is disconnected from the first battery and the protective cap is detached from the second end of one of the plurality of battery connectors.

BRIEF DESCRIPTION OF THE DRAWINGS

[023] Reference will be made to embodiments of the invention, examples of which may be illustrated in accompanying figures. These figures are intended to be illustrative, not limiting. Although the invention is generally described in context of these embodiments, it should be understood that it is not intended to limit the scope of the invention to these particular embodiments.

Figure 1a is a block diagram of an exemplary vehicle illustrating a first configuration of the batteries of the vehicle, in accordance with an embodiment of the present invention.

Figure 1b is a block diagram of an exemplary vehicle illustrating a second configuration of the battery of the vehicle, in accordance with an embodiment of the present invention.

Figure 2 illustrates a top perspective view of the battery connector mounted on the vehicle, in accordance with an embodiment of the present invention.

Figure 3 illustrates a top perspective cap of the protective cap, in accordance with an embodiment of the vehicle.

Figure 4 illustrates a front perspective view of the battery connector with the protective cap in an attachment state, in accordance with an embodiment of the present invention.

Figure 5 illustrates a perspective view of the battery connector with the protective cap in a detached state, in accordance with an embodiment of the present invention.

Figure 6 illustrates another perspective view of the battery connector with the protective cap in a detached state, in accordance with an embodiment of the present invention.

Figure 7(a)-(c) illustrate a top, bottom and side view of the protective cap, in accordance with an embodiment of the present invention.

Figure 8 illustrates a top view of the mounting bracket of the electric vehicle, in accordance with an embodiment of the present invention.

Figure 9a illustrates a cross sectional view of the mounting bracket taken along Section A-A of the mounting bracket shown in Figure 8, in accordance with an embodiment of the present invention.

Figure 9b illustrates a cross sectional view of the mounting bracket taken along Section B-B of the mounting bracket shown in Figure 8, in accordance with an embodiment of the present invention.

Figure 10 illustrates a mounting configuration of the protective cap with the mounting bracket, in accordance with an embodiment of the present invention.

Figure 11 illustrates a top view of the mounting bracket shown in Figure 10, in accordance with an embodiment of the present invention.

Figure 12 illustrates a cross sectional view of the mounting bracket taken along Section A-A of the mounting bracket shown in Figure 11, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[024] Various features and embodiments of the present invention here will be discernible from the following further description thereof, set out hereunder.

[025] The present invention relates to a vehicle having a protective cap for battery connectors of the vehicle.

[026] Figure 1a is a block diagram of an exemplary vehicle illustrating a first configuration of batteries of the vehicle, in accordance with an embodiment of the present invention. The exemplary vehicle is an electric vehicle 10. The electric vehicle 10 includes a first battery (B1), a second battery (B2), a powertrain (P), and a control unit (C). The first battery (B1) and the second battery (B2) being configured to be removably stored inside the vehicle 10. Each of the powertrain (P) and the control unit (C) being operably connected with the first battery (B1) and the second battery (B2). Each of the first battery (B1) and the second battery (B2) being configured to supply an electric power to the powertrain (P) to drive the vehicle 10. The control unit (C) being configured to control the supply of the electric power being provided to the powertrain (P) of the vehicle 10. In a non-limiting example, the electric vehicle 10 includes one or more driving wheels (not shown) being configured to be driven through the powertrain (P) of the vehicle 10. The vehicle 10 includes a plurality of battery connectors 100 being operably connected with each other and configured to electrically connect the first battery (B1) with the second battery (B2). Each of the first battery (B1) and the second battery (B2) includes

terminals i.e., a positive terminal and a negative terminal. Each of the plurality of battery connectors 100 includes a housing 101 (as shown in Figure 2). The housing 101 includes a first end 110 and a second end 140 and a pair of electrical contact members 130 (as shown in Figure 5) disposed inside the housing 101. The pair of electrical contact members 130 of one of the plurality of battery connectors 100 of the first battery (B1) being configured to receive the terminals of the first battery (B1) through the first end 110. Similarly, the pair of electrical contact members 130 of one of the plurality of battery connectors 100 of the second battery (B2) being configured to receive terminals of the second battery (B2) through the first end 110. To electrically connect the first battery (B1) with the second battery (B2), the second ends 140 of the plurality of battery connectors 100 are connected with each other to make an electrical contact between the pairs of electrical contact members 130.

[027] Figure 1b is a block diagram of an exemplary vehicle 10 illustrating a second configuration of the battery of the vehicle 10, in accordance with an embodiment of the present invention. In the second configuration of the vehicle 10, the second battery B2 is disconnected and/or removed out from the vehicle 10 by disconnecting the second end 140 of one of the plurality of battery connectors 100 of the second battery (B2) (shown in Figure 1a) from the second end 140 of the one of the plurality of battery connectors 100 of the first battery (B1). As shown, the second end 140 of one of the plurality of battery connectors 100 of the first battery (B1) is configured to detachably receive a protective cap 150 (as shown in Figure 3). The protective cap 150 being hermetically attached to the second end 140 of one of the plurality of battery connectors 100 to cover the pair of electrical contact members 130 from outside. In such configuration, one of the plurality of battery connectors 100 is also protected from entry of dust, water particles inside the second end 140 of one of the plurality of battery connectors 100 and extends protection to the pair of electrical contact members 130 of the first battery (B1) when the second battery (B2) is disconnected and/or removed from the vehicle 10 or vice-versa. The protective cap 150 includes a sensing element 153 (as shown in Figure 3). The sensing element 153 includes, not being limited to, a sensor, switch etc. The sensing element 153 being operably connected to the control unit (C) of the vehicle 10 through the battery connector 100. The control unit (C) being configured to generate and send an input signal to the control unit (C) based on an attachment or detachment state of the protective cap 150 with one of the plurality of battery connectors 100. The attachment state of the protective cap 150 is the state when the protective cap 150 is connected to the second end 140 of one of the plurality of battery connectors 100 whereas the detachment state of the protective cap 150 is the state when the protective cap 150 is disconnected or removed out from the second end 140 of one of the plurality of battery connectors 100. The control unit (C) being configured to receive the input signal from the sensing element 153 and disconnect the supply of the electric power to the powertrain (P) when the second battery (B2) is

disconnected from the first battery (B1) and the protective cap 150 is detached from the second end 140 of one of the plurality of battery connectors 100. In a non-limiting example, the control unit (C) may be an electronic control module (ECM) of the vehicle, or a separate controller mounted on the vehicle 10 and configured to control the supply of the electric power to the powertrain of the vehicle 10.

[028] Figure 2 illustrates a top perspective view of the battery connector 100 mounted on the vehicle 10, in accordance with an embodiment of the present invention. As shown, the battery connector 100 being one of the plurality of battery connectors 100. The vehicle 10 includes a mounting bracket 20 being rigidly attached to the vehicle 10 and disposed in vicinity to a battery storage compartment and/or adjacent to the plurality of battery connectors 100 (shown in Figure 1a). The mounting bracket 20 includes a first surface 21 and a second surface 29 opposite to the first surface 29. The first surface 21 includes one or more mounting holes 22 and attachment means 24. The one or more mounting holes 22 being configured to mount the mounting bracket 20 on the vehicle 10. The attachment means 24 being configured to detachably receive the protective cap 150. The attachment means 24 being a structure configured to receive the protective cap 150. As shown, the battery connector 100 includes the housing 101 having the first end 110 and the second end 140. The first end 110 of one of the plurality of battery connectors 100 being configured to receive wiring harness of one of the first battery (B1) or the second battery (B2). The protective cap 150 is detachably attached to the second end 140 of one of the plurality of battery connectors 100. The protective cap 150 includes an attachment member 155. The attachment member 155 being configured to be received by the attachment means 24 of the mounting bracket 20 (shown in Figure 2) of the vehicle 10.

[029] As shown in figure 3, the protective cap 150 includes an elastic support member 158 having a distal end 158b being configured to receive a mounting element 159. The mounting element 159 being configured to be attached to the wiring harness connected with the first end 110 of one of the plurality of battery connectors 100 to hangably secure the protective cap 150 when not in use or detached from one of the plurality of battery connectors 100 i.e., a condition when both the first battery (B1) and the second battery (B2) are in electrical connection with each other.

[030] Further, figure 3 illustrates a top perspective cap of the protective cap 150, in accordance with an embodiment of the vehicle. As shown, the protective cap 150 includes a housing 151 having an opening 151a, a bottom portion 151c and a plurality of outer side portions 151b extending between the bottom portion 151a and the opening 151a. The opening portion 151a being configured to be detachably attached to the second end 140 (as shown in Figure 2) of the battery connector 100. The protective cap 150 includes a plurality of protruded slide members 154 formed on an inner surface of the housing 151. The housing 151 includes a cavity 152. The cavity 152 being configured to receive

the sensing element 153. In a non-limiting example, the sensing element 153 includes a switch being molded with a portion of the bottom portion 151c. The switch includes electrical pins configured to be operably attached to one of the plurality of battery connectors 100 to generate the input signal. In a non-limiting example, the electrical pins being configured to be received inside a connection port 148 (as shown in Figure 5) of the battery connector 100 and generate and send the input signal to the control unit (C) of the vehicle 10 (as shown in Figure 1b) based on the attachment of the protective cap 150 with one of the plurality of battery connectors 100.

[031] In an embodiment, the protective cap 150 includes the attachment member 155 being integrally formed on one of the plurality of outer side portions 151b of the housing 151. In a non-limiting example, the attachment member 155 being an L-shaped member which is configured to correspond to the configuration of the attachment means 24 of the mounting bracket 20 (as shown in Figure 2).

[032] In an embodiment, a locking member 156 is formed on one of the plurality of outer side portions 151b of the housing 151 on which the attachment member 155 is formed. The locking member 156 being a stud-like structure having a protruded engagement portion. The locking member 156 being configured to lockably attach the protective cap 150 with the second end 140 of one of the plurality of battery connectors 100.

[033] In an embodiment, the protective cap 150 includes the elastic support member 158 extending away from the housing 151. The elastic support member 158 includes an attachment end 158a being opposite to the distal end 158b. The attachment end 158a being integrally attached to one of the plurality of outer side portions 151b at a position being opposite to one of the plurality of outer side portions 151b on which the locking member 156 is formed. The distal end 158b of the elastic support member 158 being configured to receive the mounting element 159. In a non-limiting example, the mounting element 159 includes, but not limited to, a mounting ring, snap hook ring, latch hook etc. The mounting element 159 being configured to engage with a portion of the wiring harness connected to the first end 110 of the battery connector 100 and hangably secure or mount the protective cap 150 when detached from one of plurality of battery connectors 100. Such configuration allows an easy and convenient usage of the protective cap 150 and further eliminates chances of misplacing the cap 150 when detached from one of the plurality of battery connectors 100.

[034] Figure 4 illustrates a front perspective view of the battery connector 100 with the protective cap 150 in an attachment state, in accordance with an embodiment of the present invention. The battery connector 100 being one of the plurality of battery connectors 100 (shown in Figure 1a). As shown, the battery connector 100 includes the housing 101 having the first end 110 and the second end 140. The battery connector 100 includes a locking mechanism 124 mounted on the first end 110

of the housing 101. The locking mechanism 124 includes a base pivot plate 124a, a pair of support members 124b and a locking lever 125 being pivotally mounted on the base pivot plate 124a. The pair of support members 124b being configured to engage with the locking lever 125 and removably hold the locking lever 125. The locking lever 125 includes a recess portion 125a. The recess portion 125a being configured to slidably receive the locking member 156 of the protective cap 150. In connection state, the locking mechanism 124 provides a firm and/or fluid tight connection between the battery connector 100 and the protective cap 150. The locking mechanism 124 of the battery connector 100 being also configured to release the protective cap 150 by operating the locking lever 125 to disengage the recess portion 125a from the locking member 156 of the protective cap 150.

[035] In an embodiment, when the protective cap 150 is lockably secured to the second end 140 of one of the plurality of battery connectors 100, the attachment means 155 of the protective cap 150 enables mounting of one of the plurality of battery connectors 100 on the mounting bracket 20 (as shown in Figure 2).

[036] Figure 5 and Figure 6 illustrate perspective view(s) of the battery connector 100 with the protective cap 150 in a detached state, in accordance with an embodiment of the present invention. As shown, the second end 140 includes an attachment portion 141. The attachment portion 141 includes a plurality of slot members 144 formed on an outer surface of the attachment portion 141. Each of the plurality of slot members 144 being configured to receive one of the plurality of protruded slide members 154 of the protective cap 150.

[037] As shown, the battery connector 100 being one of the plurality of battery connectors 100 and includes the connection port 148 being disposed adjacent to the pair of electrical contact members 130 inside the attachment portion 141 of the second end 140 of the housing 101. The connection port 148 being configured to receive the sensing element 153 of the protective cap 150 when the protective cap 150 is attached to the second end 140 of the battery connector 100. The connection port 148 being in Controller Area Network (CAN) communication with the control unit (C) of the vehicle 10.

[038] In an embodiment, the connection port 148 being configured to generate a signal basis the connection between the sensing element 153 of the protective cap 150 and the connection port 148 and send the signal to the control unit (C). For instance, upon removal of the protective cap 150 from the second end 140 of one of the plurality of battery connectors 100, the connection port 148 is configured to generate a disconnection signal to the control unit (C).

[039] In an embodiment, the control unit (C) is configured to disconnect the supply of the electric power to the powertrain (P) if the second ends 140 of both the battery connectors 100 are disconnected from each other and the protective cap 150 is detached from the second end 140 of one of the plurality of battery connectors 100.

[040] Figure 7(a)-(c) illustrate a top, bottom and side view of the protective cap 150, in accordance with an embodiment of the present invention. As shown in Figure 7(a), the protective cap 150 includes the plurality of protruded slide members 154a, 154b, 154c, 154d. Each of the plurality of protruded slide members 154a, 154b, 154c, 154d engage with one of the plurality of slot members 144 of the second end 140 of one of the plurality of battery connectors 100 to firmly secure the protective cap 150 with one of the plurality of battery connectors 100. The protective cap 150 includes a grip member 157 formed on one of plurality of outer side portions 151b of the housing 151. The grip member 157 enables a user to attach or detach the protective cap 150 with one of the plurality of battery connectors 100.

[041] As shown in Figure 7(b), the housing 151 of the protective cap 150 being integrally formed with the opening 151a, the plurality of outer side portions 151b and the bottom portion 151c. One of the plurality of outer side portions 151b of the housing 151 being flat in shape and other two of plurality of outer side portions 151b being semi-circular in shape. In a non-limiting example, the housing 151 may include other geometric shape/ configuration depending upon the shape/ configuration of the second ends 140 of the plurality of battery connectors 100.

[042] As shown in Figure 7(c), the locking member 156 formed on one of the plurality of outer side portions 151b being proximate or adjacent to the opening 151a of the protective cap 150 which enables locking of the opening 151a with respect to the second end 140 of one of the plurality of battery connectors 100. Such locking configuration allows mounting one of the plurality of battery connectors 100 on the mounting bracket 20 (as shown in Figure 2) of the vehicle 10.

[043] Figure 8 illustrates a top view of the mounting bracket 20 of the vehicle 10, in accordance with an embodiment of the present invention. Figure 9a illustrates a cross sectional view of the mounting bracket 20 taken along Section A-A of the mounting bracket shown in Figure 8, in accordance with an embodiment of the present invention. Figure 9b illustrates a cross sectional view of the mounting bracket 20 taken along Section B-B of the mounting bracket shown in Figure 8, in accordance with an embodiment of the present invention. As shown, the mounting bracket includes one or more mounting holes 22 for attaching the mounting bracket 20 with the vehicle 10. The mounting bracket 20 includes a support member 25 being formed adjacent to the attachment means 24 of the mounting bracket 20. The support member 25 includes a pair of spaced-apart wall members. The support member 25 is configured to supportably receive a portion of the battery connector 100 when the second end 140 of one of the plurality of battery connectors 100 is attached to the protective cap 150 and the attachment member 155 of the protective cap 150 is mounted on the attachment means 24 of the mounting bracket 20.

[044] Figure 10 illustrates a mounting configuration of the protective cap 150 with the mounting bracket 20, in accordance with an embodiment of the present invention. Figure 11 illustrates a top view of the mounting bracket 20 as shown in Figure 10, in accordance with an embodiment of the present invention. Figure 12 illustrates a cross sectional view of the mounting bracket 20 taken along Section A-A of the mounting bracket 20 as shown in Figure 11, in accordance with an embodiment of the present invention. As shown in Figure 10 and Figure 12, the attachment means 24 of the mounting bracket 20 includes a housing configured to receive the attachment member 155 of the protective cap 150. The housing corresponds to the shape and/or configuration of the attachment member 155 of the protective cap 150 and allows easy attachment and detachment.

[045] Advantageously, the present invention provides a protective cap for a battery connector of a vehicle. The protective cap is configured to hermetically seal and/or cover the electrical contact members of the battery connector and prevents risks associated with battery connectors when left in exposed state and further increases safety of the customer as well as the vehicle. The present invention provides attachment member and locking member for securing the battery connector with the protective cap and further mount the same on a mounting bracket of the vehicle. The protective cap has a sensing element configured to generate and send an input signal to a control unit of the vehicle based on attachment or detachment state of the protective cap with the battery connector. Based on the received input signal, the control unit may control the supply of electric power of batteries of the vehicle being supplied to the powertrain. The protective cap of the present invention has an elastic support member having a mounting element which allows easy and convenient handing of the protective cap when not in use. The protective cap and the battery connector are simple in construction and convenient in use and/or operation.

[046] While the present invention has been described with respect to certain embodiments, it will be apparent to those skilled in the art that various changes and modification may be made without departing from the scope of the invention as defined in the following claims.

List of Reference Numerals

10 – Vehicle

20 – Mounting bracket of the vehicle

21 – First surface of the mounting bracket

22 – Mounting holes of the mounting bracket

24 – Attachment means of the mounting bracket

25 – Support member of the mounting bracket

29 – Second surface of the mounting bracket

100 – Battery connector

101 – Housing of the battery connector

110 – First end of the housing

124 – Locking mechanism of the battery connector

124a – Base pivot plate of the locking mechanism

124b – Pair of support members of the locking mechanism

125 – Locking lever of the locking mechanism

125a – Recess portion of the locking mechanism

130 – Pair of electrical contact members

140 – Second end of the housing

141 – Attachment portion of the second end of the housing

144 – Plurality of slot members

148 – Connection port

150 – Protective cap

151 – Housing of the protective cap

151a- Opening of the protective cap

151b – Plurality of outer side portions of the housing of the protective cap

151c – Bottom portion of the housing of the protective cap

152 – Cavity of the protective cap

153 – Sensing element of the protective cap

154, 154a, 154b, 154c, 154d – Plurality of protruded slide members

155 – Attachment member of the protective cap

156 – Locking member of the protective cap

157 – Grip member of the protective cap

158 – Elastic support member of the protective cap

158a – Attachment end of the elastic support member

158b – Distal end of the elastic support member

159 – Mounting element of the elastic support member

B1– A first battery of the vehicle

B2– A second battery of the vehicle

C – Control unit of the vehicle

P – Powertrain of the vehicle

Claims:

1. A protective cap (150) for a battery connector (100) of a vehicle (10), the protective cap (150) comprises:
a housing (151) having an opening (151a) configured to be detachably attached to the battery connector (100), a plurality of outer side portions (151b) and a cavity (152) being configured to receive a sensing element (153), the sensing element (153) being configured to generate an input signal based on an attachment or detachment state of the protective cap (150) with the battery connector (100);
at least one attachment member (155) and at least one locking member (156) formed on one of the plurality of outer side portions (151b) of the housing (151); and
an elastic support member (158) extending away from the housing (151), the elastic support member (158) having a distal end (158b) being configured to receive a mounting element (159).

2. The protective cap (150) as claimed in claim 1, wherein the mounting element (159) of the elastic support member (158) being configured to be attached to a wiring harness of the battery connector (100) and hangably mount the protective cap (150) when detached from the battery connector (100).

3. The protective cap (150) as claimed in claim 1, wherein the at least one attachment member (155) being configured to be attached to a mounting bracket (20) of the vehicle (10).

4. The protective cap (150) as claimed in claim 1, wherein the locking member (156) being configured to be lockably attached to the battery connector (100).

5. The protective cap (150) as claimed in claim 1, wherein the sensing element (153) comprises a plurality of electrical pins, each of the plurality of electrical pins being configured to be operably attached to the battery connector (100).

6. The protective cap (150) as claimed in claim 1, comprises a plurality of protruded slide members (154) formed on an inner surface of the housing (151) and a grip member (157) formed on one of the plurality of outer side portions (151b) of the housing (151).

7. The protective cap (150) as claimed in claim 1, wherein the elastic support member (158) comprises an attachment end (158a) being opposite to the distal end (158b), the attachment end

(158a) being integrally attached to one of the plurality of outer side portions (151b) of the housing (151).

8. An electric vehicle (10) comprising:
a plurality of batteries (B1, B2) removably disposed inside the vehicle (10), each of the plurality of batteries (B1, B2) being configured to supply an electric power to drive the vehicle (10);
a control unit (C) operably connected with the plurality of batteries (B1, B2) and being configured to control the supply of the electric power; and
a plurality of battery connectors (100) operably connected with each other and configured to electrically connect a first battery (B1) of the plurality of batteries (B1, B2) with a second battery (B2) of the plurality of batteries (B1, B2), each of the plurality of battery connectors (100) being configured to detachably and lockably receive a protective cap (150) having a sensing element (153), the sensing element (153) being operably connected to the control unit (C) of the vehicle (10) and configured to generate an input signal based on an attachment or detachment state of the protective cap (150) with one of the plurality of battery connectors (100).

9. The electric vehicle (10) as claimed in claim 8, wherein each of the plurality of battery connectors (100) comprises a housing (101) having a first end (110), a second end (140), and a pair of electrical contact members (130) disposed inside the housing (101), the pair of electrical contact members (130) being configured to receive terminals of one of the plurality of batteries (B1, B2) and configured to electrically connect the first battery (B1) of the plurality of batteries (B1, B2) with the second battery (B2) of the plurality of batteries (B1, B2).

10. The electric vehicle (10) as claimed in claim 9, wherein each of the second ends (140) of the housing (101) of the plurality of battery connectors (100) comprises an attachment portion (141) configured to detachably receive the protective cap (150) and a plurality of slot members (144) formed on an outer surface of the attachment portion (141).

11. The electric vehicle (10) as claimed in claim 8, wherein the protective cap (150) comprises:
a housing (151) having an opening (151a) configured to be detachably attached to the second end (140) of the housing (101) of one of the plurality of battery connectors (100), a plurality of outer side portions (151b) and a cavity (152) being configured to receive the sensing element (153);

at least one attachment member (155) and at least one locking member (156) formed on one of the plurality of outer side portions (151b) of the housing (151); and

an elastic support member (158) extending away from the housing (151), the elastic support member (158) being configured to receive a mounting element (159).

12. The electric vehicle (10) as claimed in claim 11, comprises a mounting bracket (20) being rigidly attached to the vehicle (10), the mounting bracket (20) being configured to detachably receive the at least one attachment member (155) of the protective cap (150).

13. The electric vehicle (10) as claimed in claim 11, wherein each of the plurality of battery connectors (100) comprises a locking mechanism (124) mounted on the second end (140) of the housing (101), the locking mechanism (124) being configured to receive the locking member (156) of the protective cap (150).

14. The electric vehicle (10) as claimed in claim 11, wherein the elastic support member (158) comprises a mounting element (159), the mounting element (159) being configured to be attached to a wiring harness of one of the plurality of battery connectors (100) and supportably mount the protective cap (150) when detached from one of the plurality of battery connectors (100).

15. The electric vehicle (10) as claimed in claim 8, wherein the control unit (C) being configured to receive the input signal from the sensing element (153) and disconnect the supply of the electric power when the second battery (B2) is disconnected from the first battery (B1) and the protective cap (150) is detached from the second end (140) of one of the plurality of battery connectors (100).

16. The electric vehicle (10) as claimed in claim 11, wherein the sensing element (153) includes a plurality of electrical pins.

17. The electric vehicle (10) as claimed in claim 11, wherein the protective cap (150) comprises a plurality of protruded slide members (154) formed on an inner surface of the housing (151) and a grip member (157) formed on one of the plurality of outer side portions (151b) of the housing (151).

18. The electric vehicle (10) as claimed in claim 16, wherein each of the second ends (140) of the plurality of battery connectors (100) comprises a connection port (148), the connection port (148) being configured to receive the plurality of electrical pins of the sensing element (153).

19. The electric vehicle (10) as claimed in claim 17, wherein each of the plurality of slot members (144) being configured to receive one of the plurality of protruded slide members (154) of the protective cap (150).

20. The electric vehicle (10) as claimed in claim 11, wherein the elastic support member (158) comprises an attachment end (158a) being integrally attached to one of the plurality of outer side portions (151b) of the housing (151).

10

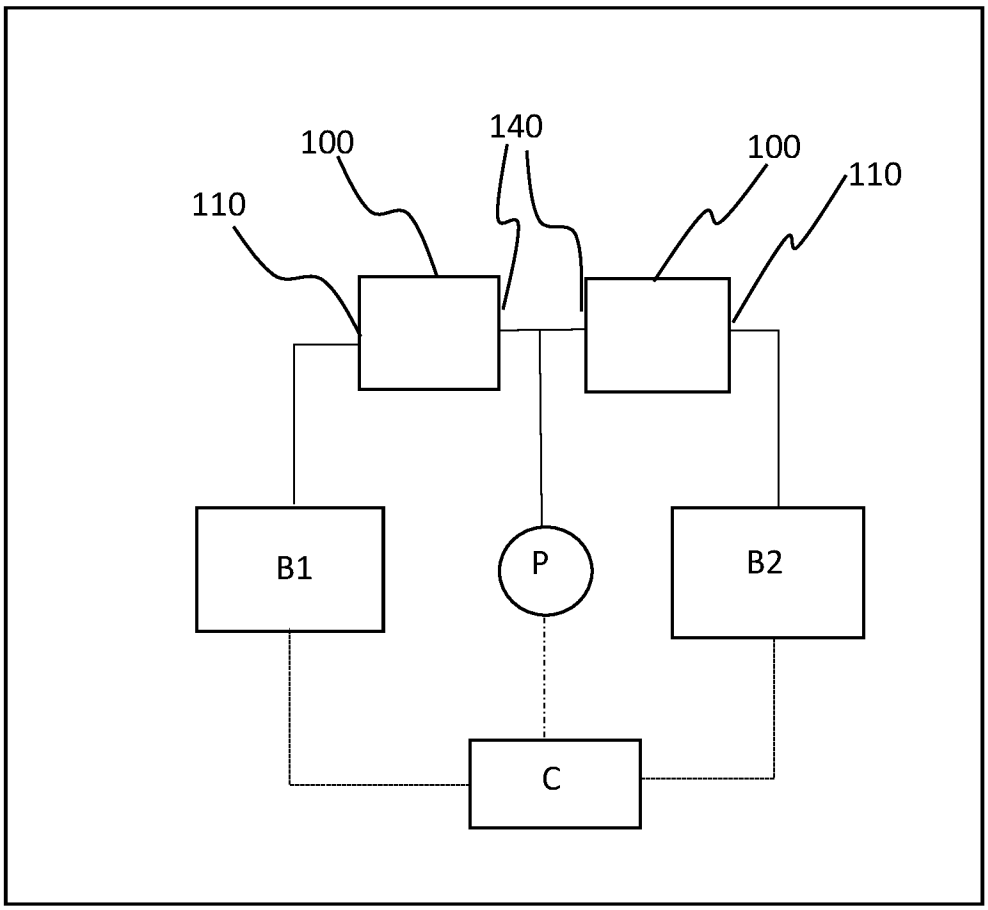


Figure 1a

10

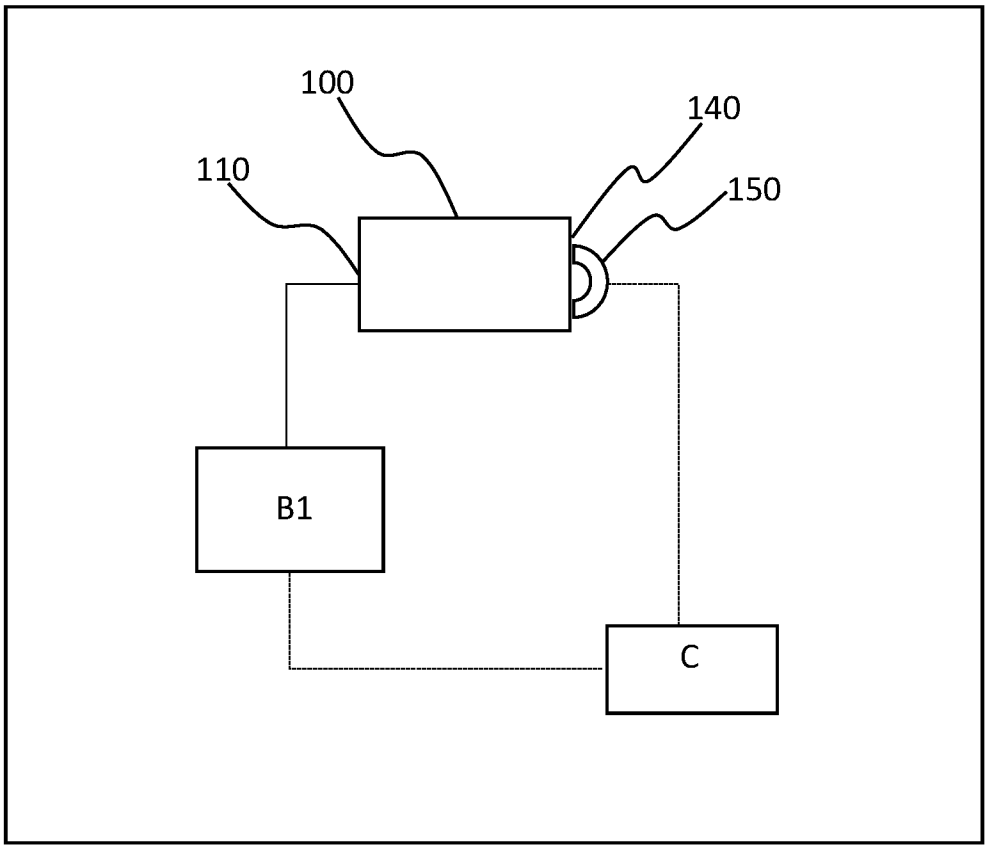


Figure 1b

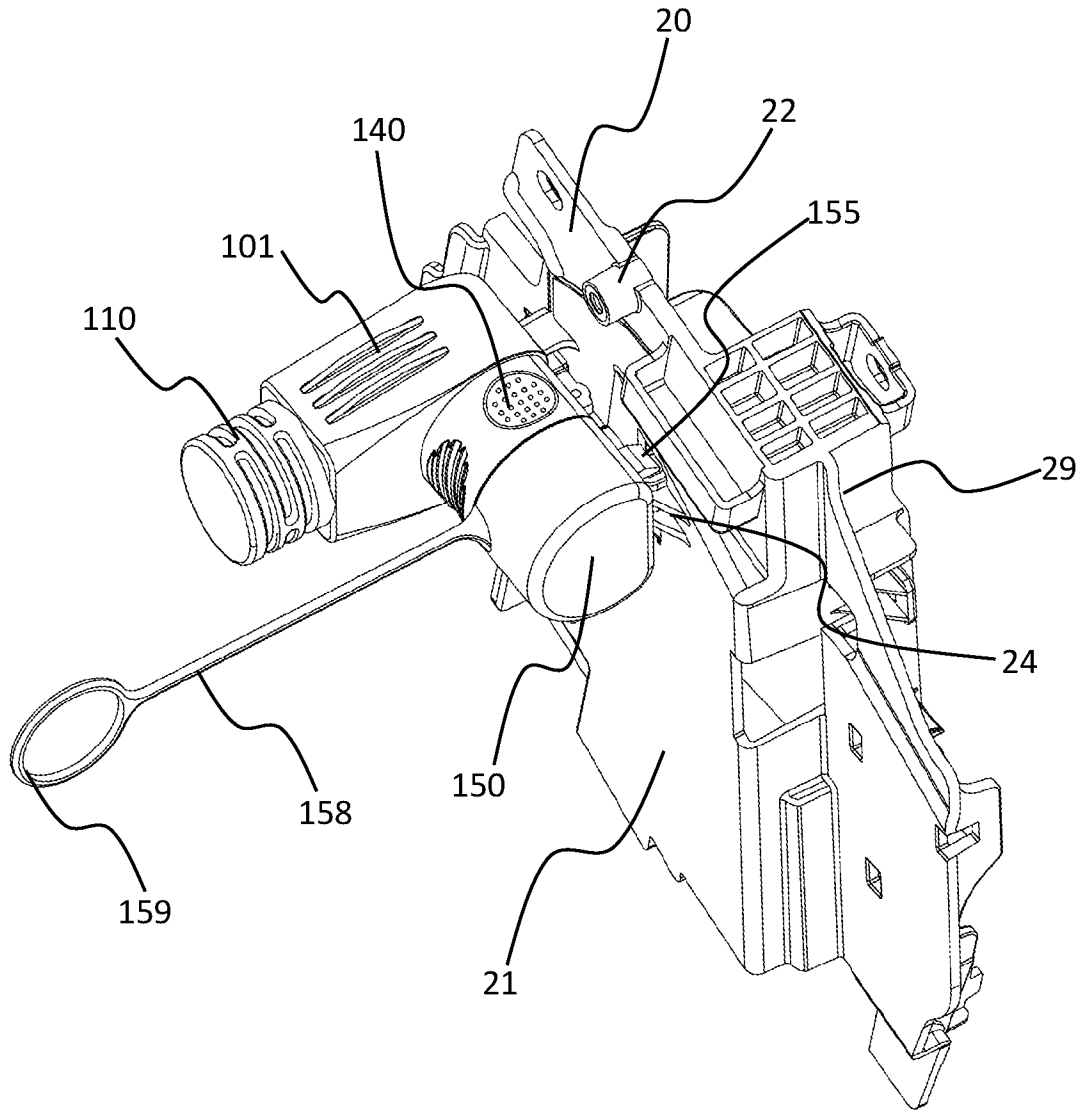


Figure 2

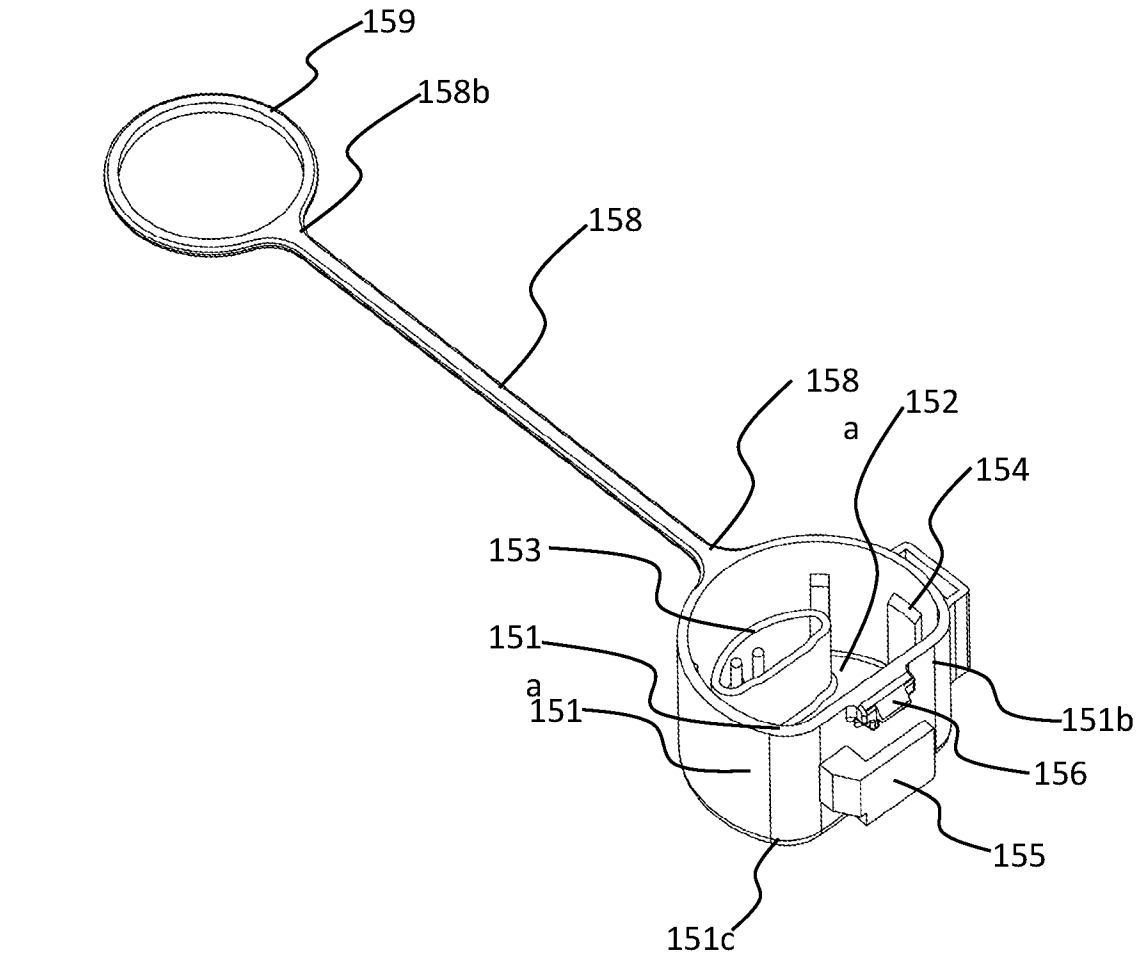


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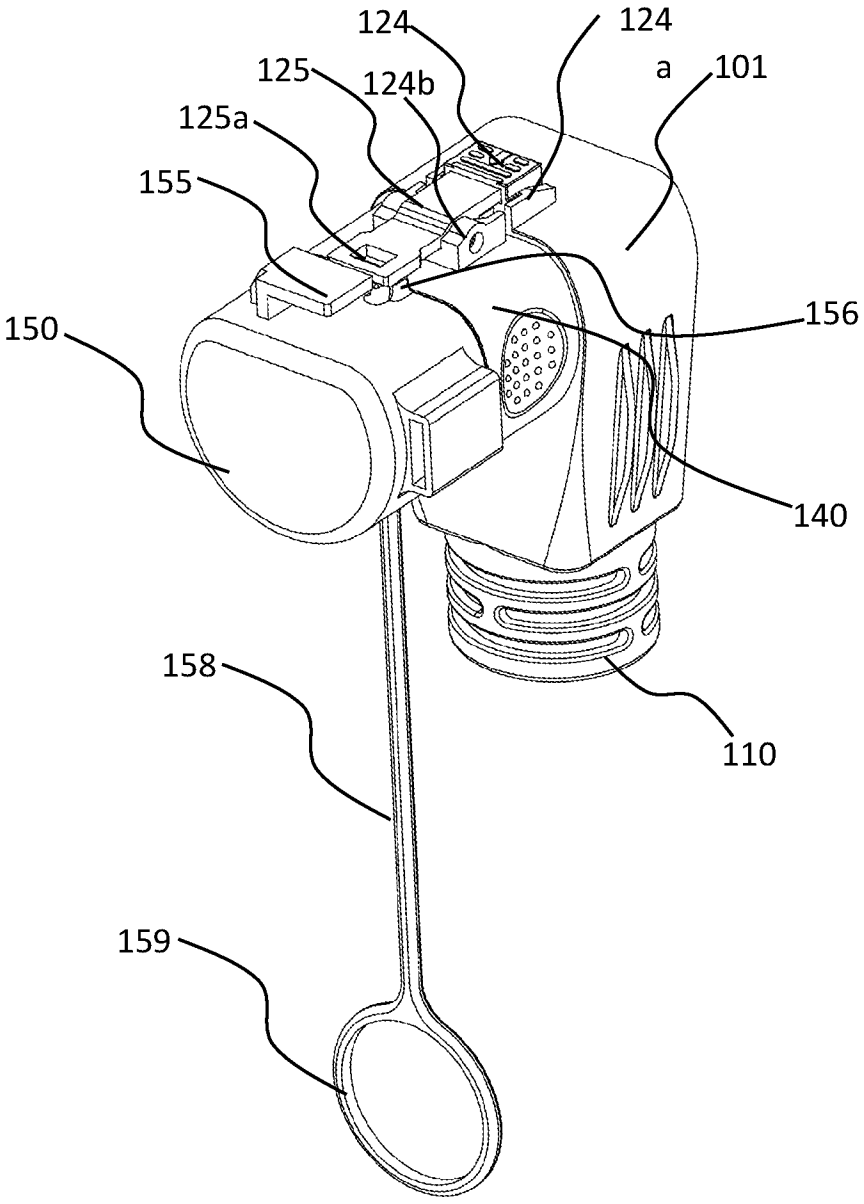


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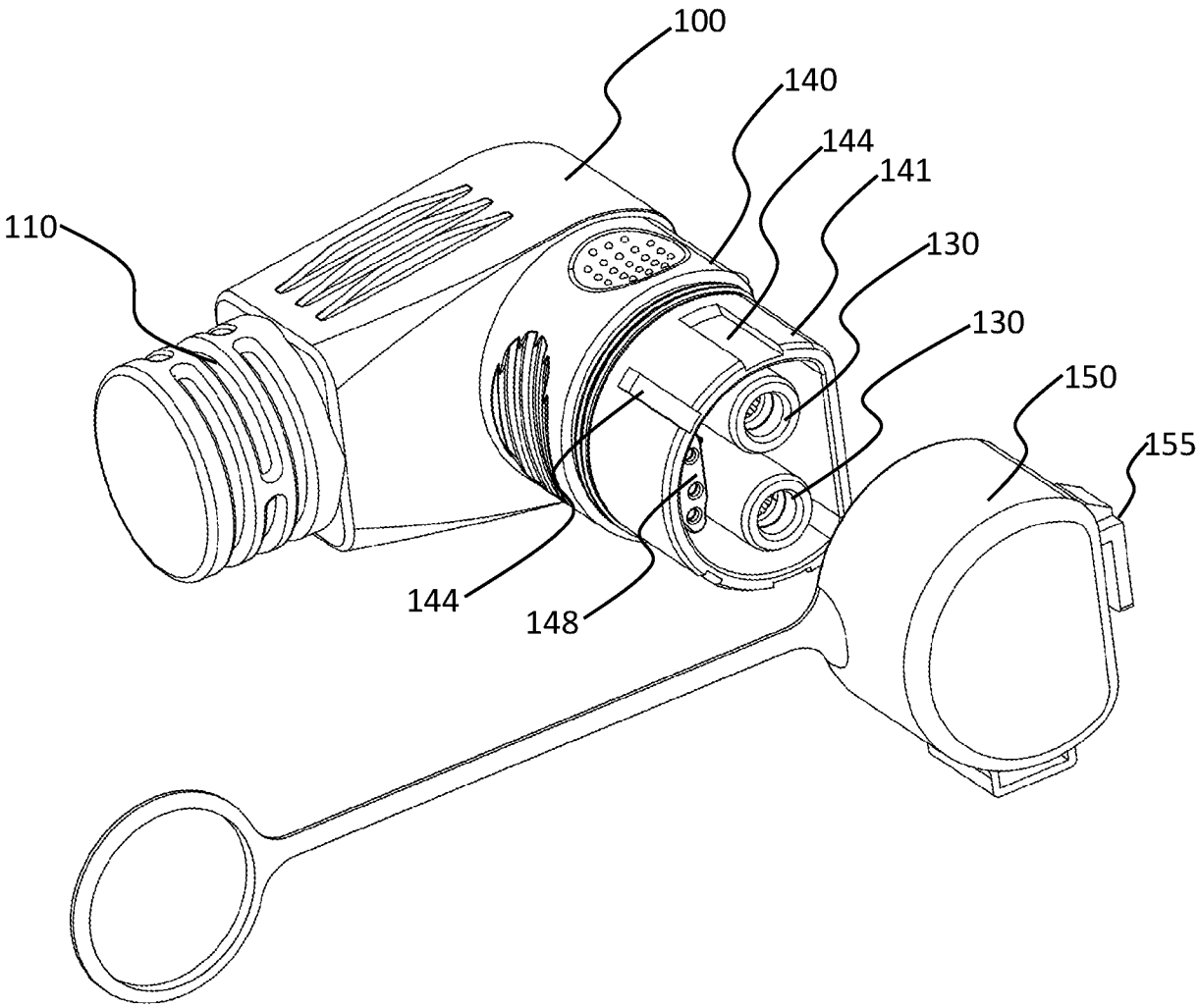


Figure 5

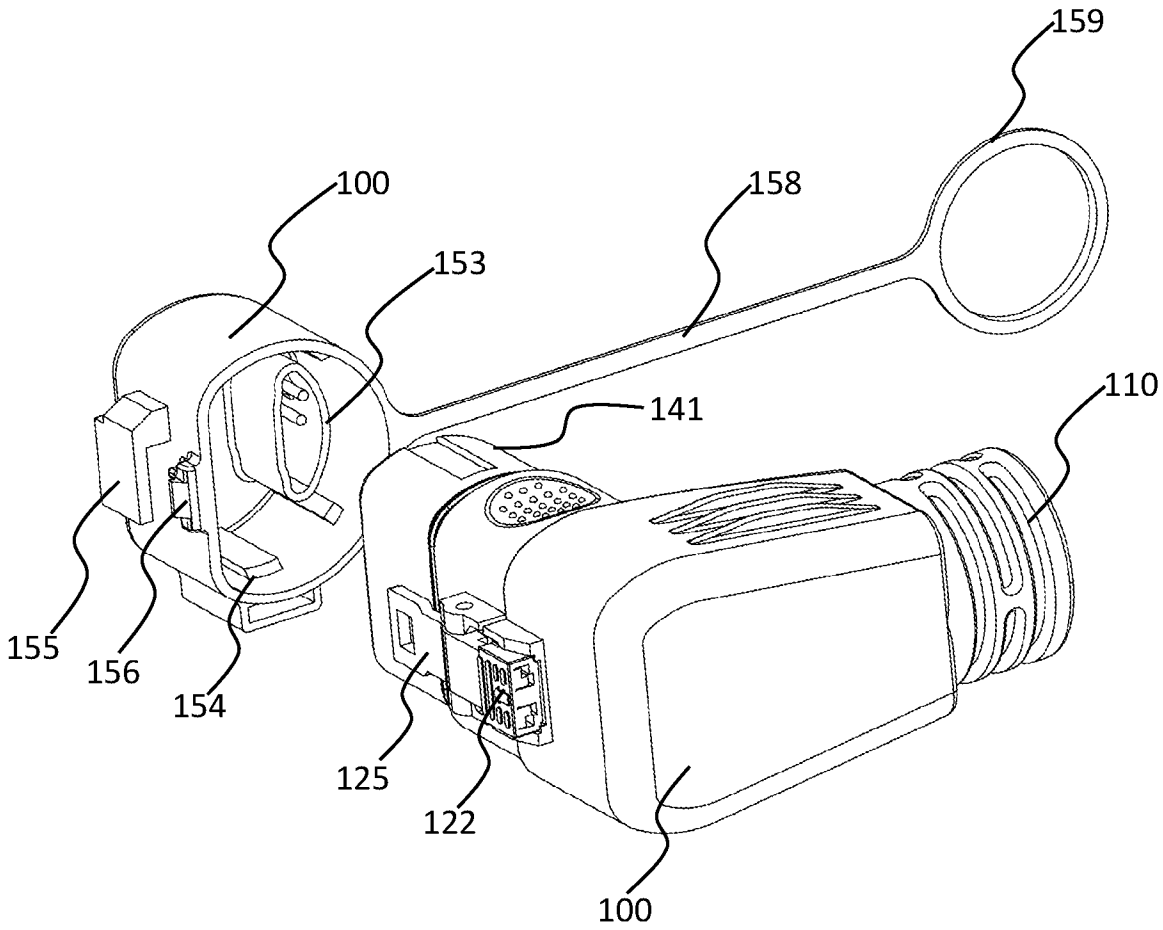


Figure 6

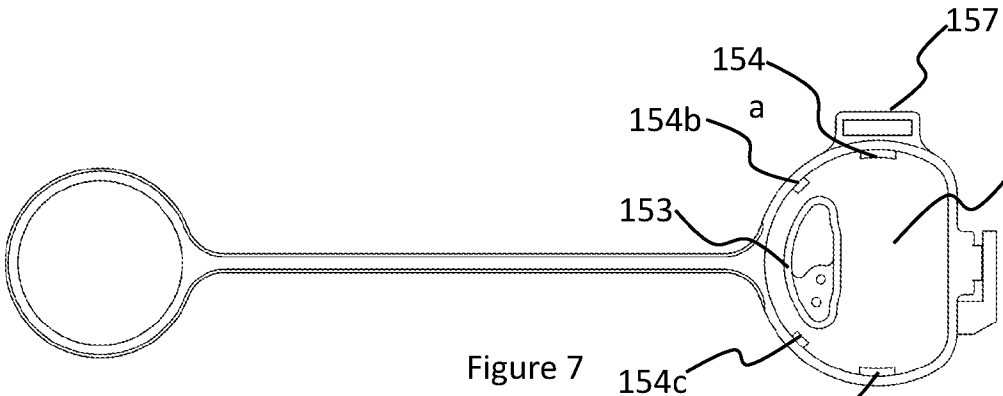


Figure 7 (a)

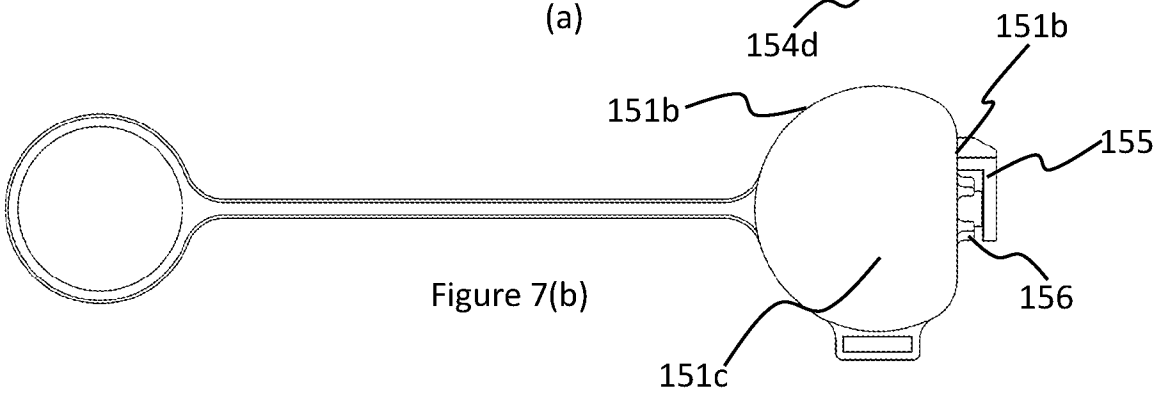


Figure 7(b)

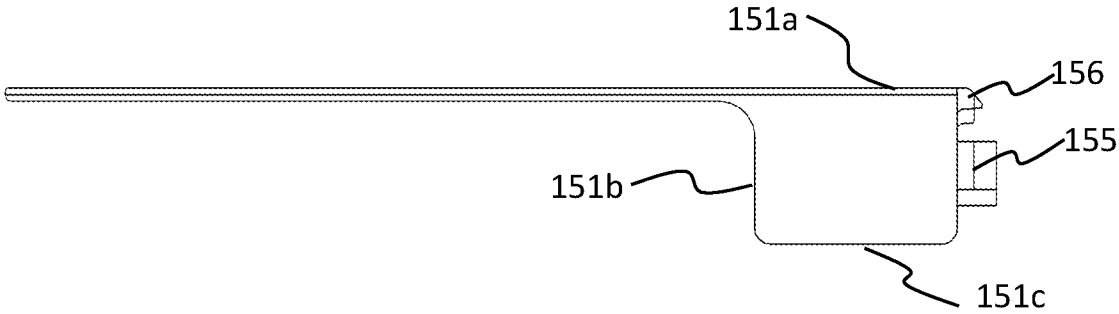


Figure 7(c)

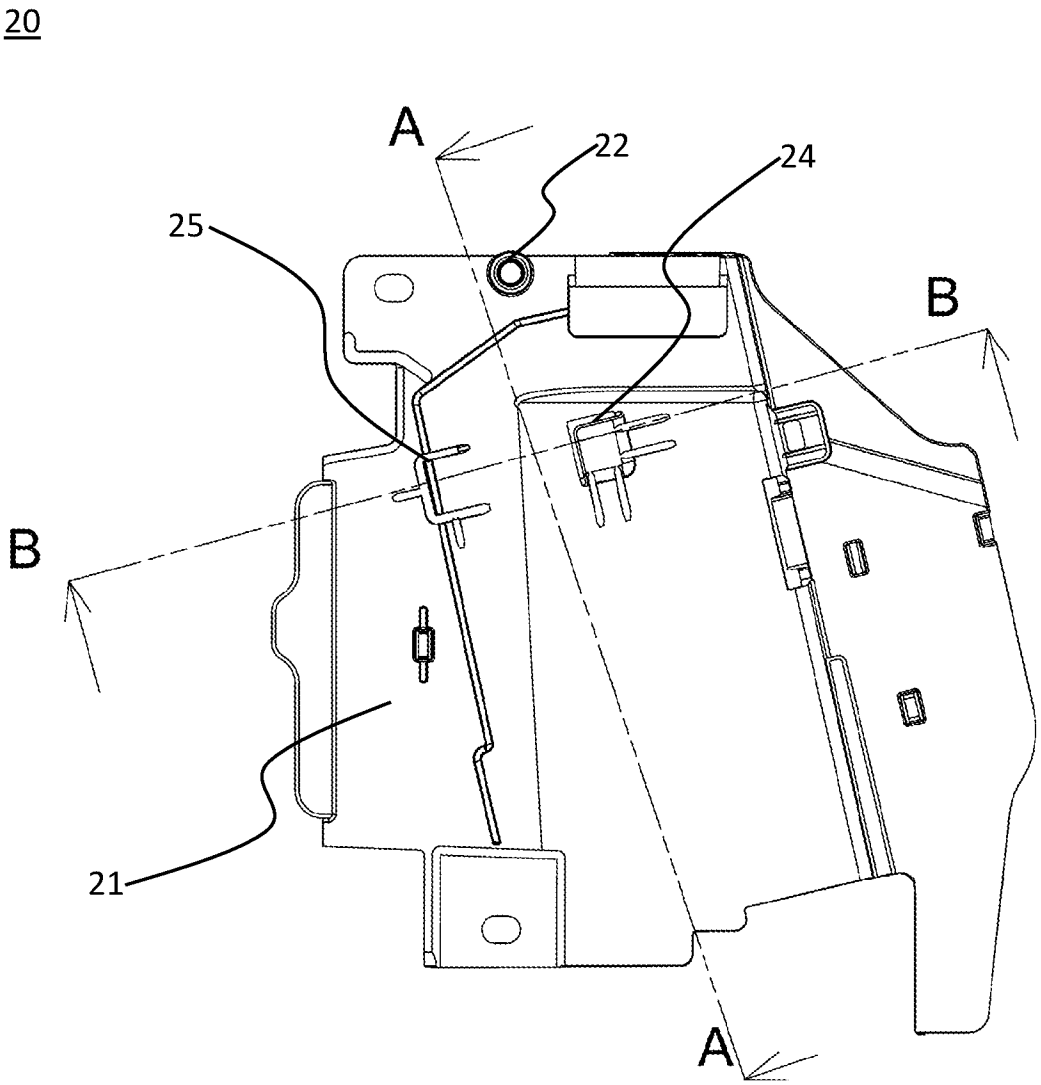
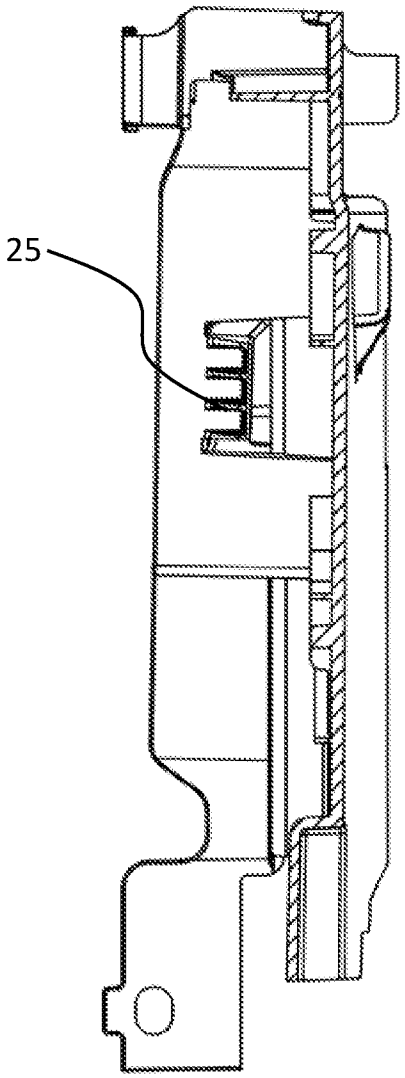
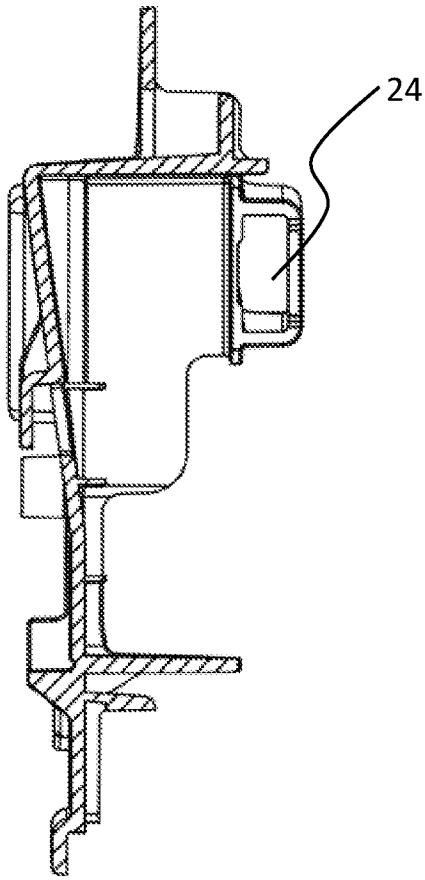


Figure 8



SECTION A-A

Figure 9(a)



SECTION B-B

Figure 9(b)

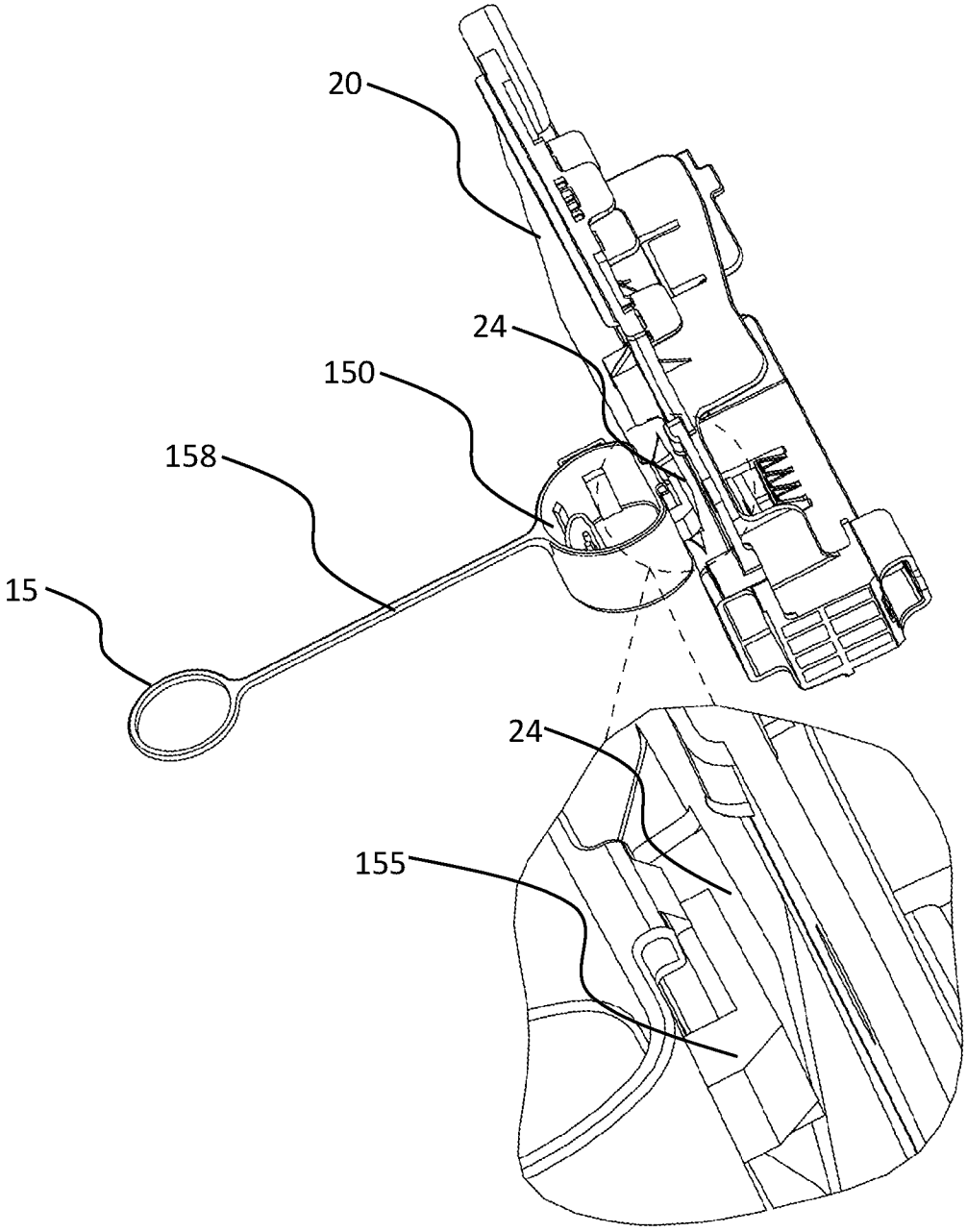


Figure 10

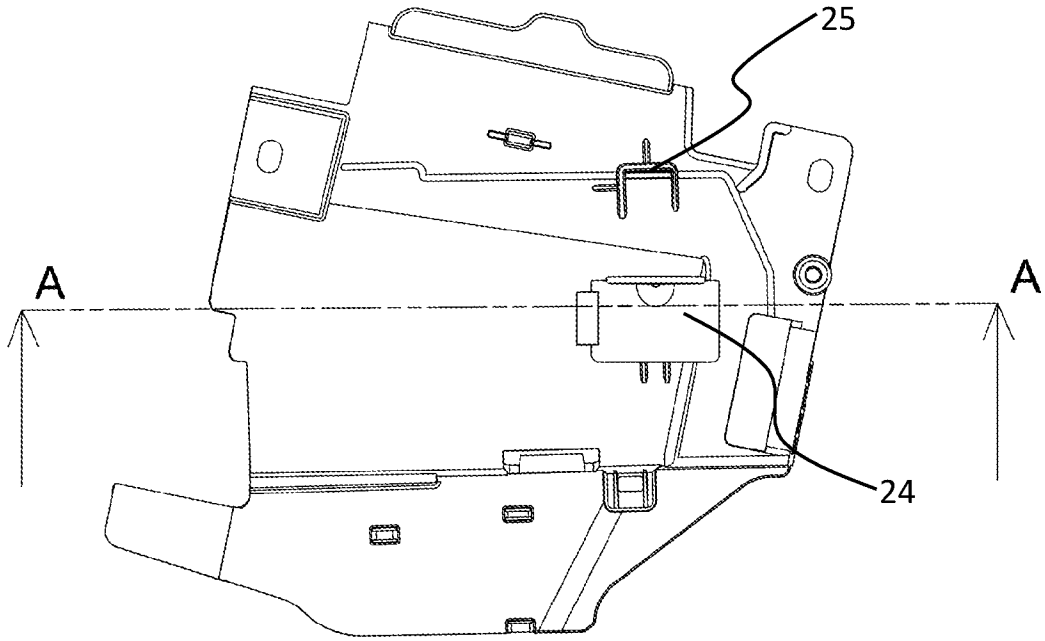
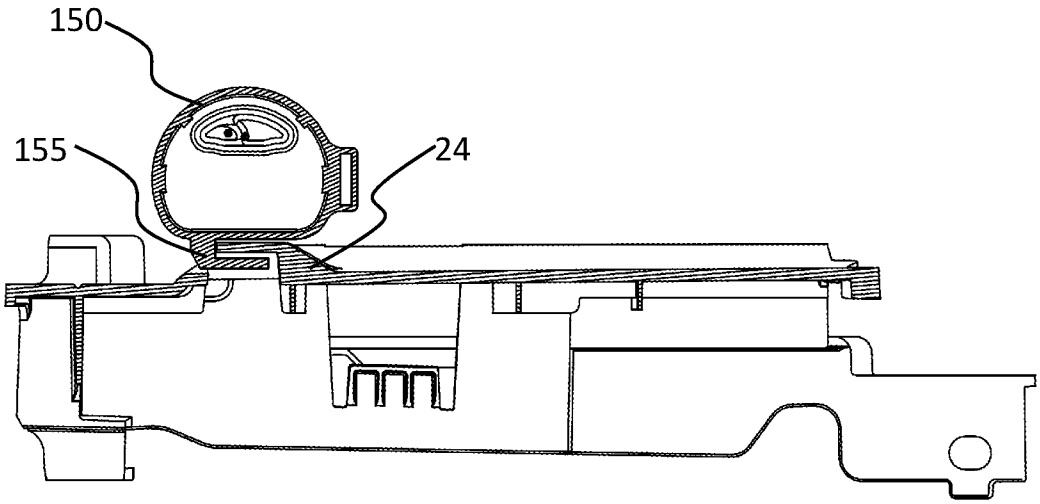


Figure 11



SECTION A-A

Figure 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2024/050414

A. CLASSIFICATION OF SUBJECT MATTER
H01R4/22,H01R4/70,H01M50/543 Version=2024.01

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)

H01R,H01M

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

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP4009426A1 (LG ENERGY SOLUTION LTD) 8 June, 2022(08-06-2022) Abstract, Paragraph [0007, 0011]	1-20
Y	KR20190041750A (HYUNDAI MOTOR CO LTD, KIA MOTORS CORP) (English translation from Espacenet) 23 April, 2019 (23-04-2019) Abstract, Paragraph [0052,0066], Figure 9	1-20

☐ 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
"D" document cited by the applicant in the international application
"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
24-09-2024	24-09-2024
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Authorized officer Ayush Mishra Telephone No. +91-1125300200

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2024/050414

Citation	Pub.Date	Family	Pub.Date
EP 4009426 A1	08-06-2022	JP 7490745 B2	27-05-2024
		US 20220367954 A1	17-11-2022
		WO 2021107517 A1	03-06-2021
		CN 114175389 B	02-08-2024