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(54) **A plug and a connector assembly comprising a plug**

(57) A plug (100) is designed for being plugged into a connector assembly (200). The plug comprises an inner end (101), an outer end (102) and a contact section (130) that is arranged between the inner end and the outer end. The inner end and the outer end are both electrically isolated against the contact section. The plug comprises a fixation means (150) for fixating an electric lead (160) to the plug (100). The fixation means (150) is electrically connected to the contact section (130).

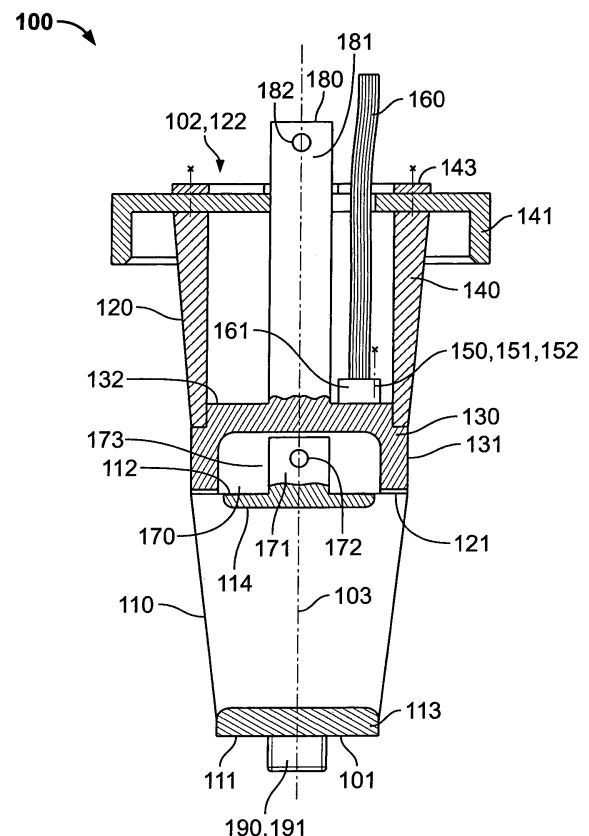


Fig. 1

Description

[0001] The present invention relates to a plug according to claims 1 and 15 and to a connector assembly according to claim 16.

[0002] Connector assemblies for connecting medium voltage cables are known in the state of the art. It is known that during service and installation conditions the cables connected to such connector assemblies may have to be grounded for safety reasons.

[0003] It is an object of the present invention to provide a plug. This objective is achieved by a plug according to claim 1 and by a plug according to claim 15. It is a further object of the present invention to provide a connector assembly. This objective is achieved by a connector assembly according to claim 16. Preferred embodiments are disclosed in the dependent claims.

[0004] A plug is designed for being plugged into a connector assembly. The plug comprises an inner end, an outer end and a contact section that is arranged between the inner end and the outer end. The inner end and the outer end are both electrically isolated against the contact section. The plug comprises a fixation means for fixing an electric lead to the plug. The fixation means is electrically connected to the contact section. Advantageously, this plug allows to connect an electric lead to the fixation means of the plug before the plug is plugged into a connector assembly. The electric lead can be connected to a ground contact. This ensures that the plug and the connector assembly are grounded at all times while plugging the plug into the connector assembly. Advantageously this increases the safety of the plug and the connector assembly and the safety for the personnel to install the plug.

[0005] In an embodiment of the plug, the plug comprises an electric lead that is fixated to the fixation means. The electric lead is electrically connected to the contact section. Advantageously the electric lead connected to the fixation means of the plug can be electrically connected to a ground contact to electrically ground the plug. This ensures that the plug is grounded at all times while plugging the plug into a connector assembly. The electric lead may for example be at least one flexible wire with an insulating cover.

[0006] In an embodiment of the plug, the electric lead is at least partially arranged inside the plug. The electric lead emerges from the plug at the outer end of the plug. Advantageously this allows to electrically connect the electric lead to an external ground contact.

[0007] In an embodiment of the plug, the plug comprises an inner portion and an outer portion. A front side of the inner portion forms the inner end of the plug. A rear side of the outer portion forms the outer end of the plug. This allows to adapt the shape of the plug to the shape of a socket of a connector assembly.

[0008] In an embodiment of the plug, the inner portion can be rotated around a longitudinal axis of the inner portion without rotation of the outer portion. Advanta-

geously this allows to screw the inner portion of the plug into a socket of a connector assembly without rotation of the outer portion. This prevents an electric lead connected to the outer portion of the plug from being twisted while the plug is plugged into a connector assembly.

[0009] In an embodiment of the plug, the inner portion and the outer portion are separable. Advantageously this allows to insert the inner portion and the outer portion of the plug into a connector assembly one after another. This prevents an electric lead connected to the outer portion of the plug from being twisted while the inner portion of the plug is inserted in a connector assembly.

[0010] In an embodiment of the plug, the inner portion and the outer portion can be connected with a bayonet mount. Advantageously this allows to easily connect the inner portion and the outer portion of the plug. Connecting the inner portion and the outer portion of the plug can advantageously also be carried out from the distance using an operating rod. This allows to plug the plug into a connector assembly that is located at a position that is difficult to access, for example in the underground.

[0011] In an embodiment of the plug, the inner portion and the outer portion are connected with a swivel joint. Advantageously this allows to rotate the inner portion and the outer portion of the plug independently from each other. This for example allows to screw the inner portion of the plug into a connector assembly without rotating the outer portion of the plug. Advantageously this prevents an electric lead connected to the outer portion of the plug from being twisted.

[0012] In an embodiment of the plug, the plug comprises a shaft that extends through the outer portion to the outer end of the plug. Advantageously the shaft allows to handle the plug while plugging the plug into a connector assembly.

[0013] In an embodiment of the plug, the outer end of the plug comprises at least one pin for forming a bayonet mount. Advantageously this allows to connect an operating rod to the outer end of the plug for handling the plug from a distance. This allows to plug the plug into a connector assembly that is not easily accessible.

[0014] In an embodiment of the plug, the at least one pin is arranged on the shaft. Advantageously this allows to handle the plug with an operating rod that is connected to the shaft using a bayonet mount.

[0015] In an embodiment of the plug, a connection means is arranged at the inner end of the plug. The connection means allows to connect the plug to a connector assembly.

[0016] In an embodiment of the plug, the connection means comprises a threaded boss. Advantageously this allows to screw the plug into a connector assembly to firmly fix the plug in the connector assembly.

[0017] In an embodiment of the plug, the contact section comprises a cylindrical surface. Advantageously this allows to establish an electric connection between the contact section of the plug and a contact area of a connector assembly that is arranged on an inner wall of the

socket of that connector assembly. The cylindrical surface of the contact section ensures a reliable electric contact that is independent of an angular orientation of the plug.

[0018] A connector assembly comprises a plug of the aforementioned kind and a socket. A contact area is formed at a part of the inner surface of the socket. The plug can be arranged in the socket such that the contact section of the plug is electrically connected to the contact area of the socket. Advantageously the plug allows to electrically connect the contact area of the socket of the connector assembly to a ground contact in a reliable manner.

[0019] Another plug is designed for being plugged into a connector assembly. This plug comprises an inner end, an outer end and a contact section that is arranged between the inner end and the outer end. The outer end is electrically isolated against the contact section. The plug comprises a fixation means for fixating an electric lead to the plug. The fixation means is electrically connected to the inner end and the contact section. This plug allows to electrically connect a cable terminal of a connector assembly to an external ground contact and to simultaneously connect a busbar of the connector assembly to the external ground contact. Advantageously, the plug allows to connect an electric lead to the fixation means of the plug before the plug is plugged into the connector assembly. The electric lead can be connected to a ground contact. This ensures that the plug and the connector assembly are grounded at all times while plugging the plug into the connector assembly. Advantageously this increases the safety of the plug and the connector assembly and the safety for the personnel to install the plug.

[0020] The invention will now be explained in more detail with reference to the Figures in which:

Figure 1 shows a schematic sectional view of a first plug;

Figure 2 shows a schematic sectional view of the first plug arranged in a socket of a connector assembly;

Figure 3 shows a schematic sectional view of a second plug;

Figure 4 shows a schematic sectional view of a third plug;

Figure 5 shows a schematic sectional view of a fourth plug; and

Figure 6 shows a schematic sectional view of a fifth plug.

[0021] Figure 1 shows a schematic and partially sliced side view of a first plug 100. The first plug 100 can be used to provide a ground contact (earthing contact) for

an electric connector assembly. To this end, the first plug 100 can be arranged in a socket of that connector assembly.

[0022] The first plug 100 comprises an elongate shape with an inner end 101 and an outer end 102 that is opposed to the inner end 101. The first plug 100 is substantially rotationally symmetric with respect to a longitudinal axis 103 of the first plug 100. In the example shown in Figure 1 the first plug 100 comprises a partially conical shape such that a diameter of the first plug 100 in a direction perpendicular to the longitudinal axis 103 decreases from the outer end 102 towards the inner end 101 of the first plug 100. The first plug 100 could however be designed with a cylindrical shape or another shape.

[0023] The first plug 100 comprises an inner portion 110 and an outer portion 120. The inner portion 110 and the outer portion 120 are arranged one after another along the longitudinal axis 103 of the first plug 100. The inner portion 110 comprises a front side 111 and an opposed rear side 112. The front side 111 of the inner portion 110 forms the inner end 101 of the first plug 100. The outer portion 120 comprises a front side 121 and a rear side 122 that is opposed to the front side 121. The front side 121 of the outer portion 120 faces the rear side 112 of the inner portion 110. The rear side 122 of the outer portion 120 forms the outer end 102 of the first plug 100.

[0024] The inner portion 110 is partially or entirely composed out of an electrically insulating material to ensure that the front side 111 of the inner portion 110 is electrically insulated against the rear side 112 of the inner portion 110. At the front side 111 the inner portion 110 may comprise a front element 113. At the rear side 112 the inner portion 110 may comprise a rear element 114. The front element 113 and the rear element 114 may comprise a mechanically robust material for providing an improved mechanical behaviour. The front element 113 and the rear element 114 may also comprise an electrically conductive material for an improved electrical behaviour. The front element 113 and the rear element 114 may for example comprise a metal or a plastic material that is coated with a conductive material.

[0025] A connection means 190 is arranged at the front side 111 of the inner portion 110. The connection means 190 serves to mechanically connect the first plug 100 to a socket of a connector assembly. In the example depicted in Figure 1 the connection means 190 comprises a threaded boss 191 that is arranged in parallel to the longitudinal axis 103 of the first plug 100. The connection means 190 may comprise a mechanically robust material, for example a metal.

[0026] The outer portion 120 of the first plug 100 comprises a contact section 130 and a shell 140. The contact section 130 adjoins the front side 121 of the outer portion 120. The shell 140 extends from the contact section 130 towards the rear side 122 of the outer portion 120.

[0027] The contact section 130 comprises a contact area 131 that forms a part of the lateral area of the outer

portion 120 of the first plug 100. The contact area 131 is preferably ring-shaped but may comprise other shapes as well. The contact section 130 further comprises a rear face 132 that is oriented towards the rear side 122 of the outer portion 120.

[0028] The contact area 131 of the contact section 130 comprises an electrically conductive material, preferably a metal. The contact area 131 of the contact section 130 is electrically connected to the rear face 132 of the contact section 130. To this end the entire contact section 130 may be composed out of an electrically conductive material, for example a metal. The contact section 130 may however also comprise other materials.

[0029] The shell 140 is connected to the contact section 130. The shell 140 is arranged around a preferably at least partially hollow interior of the outer portion 120. The shell 140 may for example be of tubular shape. The shell 140 may comprise an electrically conducting or insulating material. At the rear side 122 of the outer portion 120 the shell 140 may be closed with a cap 141 and a fixing ring 142 as shown in Figure 1. The rear side 122 of the outer portion 120 of the first plug 100 and thus the outer end 102 of the first plug 100 are electrically insulated against the contact section 130 of the outer portion 120. If the shell 140 comprises an electrically conductive material, the cap 141 comprises an electrically insulating material to electrically isolate the rear side 122 of the outer portion 120 against the contact section 130.

[0030] A fixation means 150 is arranged at the rear face 132 of the contact section 130 of the outer portion 120 of the first plug 100. The fixation means 150 may for example comprise a threaded bore 151 but can also be designed as an area designated for welding or soldering. The fixation means 150 is electrically connected to the rear face 132 of the contact section 130 and thus also electrically connected to the contact area 131 of the outer portion 120 of the first plug 100.

[0031] The fixation means 150 can be used to mechanically and electrically connect an electric lead 160 to the contact section 130 of the outer portion 120 of the first plug 100. The electric lead 160 may for example be designed as a flexible wire that comprises an insulating cover. The electric lead 160 may comprise a connector 161 that is arranged at an end of the electric lead 160 and can be fixated to the fixation means 150 of the first plug 100, for example using a screw 152. The electric lead 160 may also be connected to the fixation means 150 by welding or soldering.

[0032] The connection between the electric lead 160 and the fixation means 150 creates an electric connection between the electric lead 160 and the contact area 131 of the contact section 130 of the outer portion 120 of the first plug 100. An opposed end of the electric lead 160 may for example be connected to a ground contact. The electric lead 160 runs from the fixation means 150 arranged at the rear face 132 of the contact section 130 of the outer portion 120 of the first plug 100 through the hollow interior space of the outer portion 120 that is en-

closed by the shell 140 and emerges from the outer portion 120 of the first plug 100 through an opening in the cap 141 at the rear side 112 of the outer portion 120 of the first plug 100.

[0033] Alternatively, the electric lead 160 may be molded-in in the material of shell 140. In this case the electric lead 160 extends from the rear face 132 of the contact section 130 of the outer portion 120 of the first plug 100 through the shell 140 and emerges from the outer portion 120 at the rear side 112 of the outer portion 120 of the first plug 100. Outside the outer portion 120 of the first plug 100 the electric lead 160 may be connectable to a further electric lead. In this case the shell 140 does not need to be partially hollow.

[0034] The inner portion 110 and the outer portion 120 of the first plug 100 can be connected to each other using an inner bayonet mount 170. An inner shaft 171 is arranged at the rear side 112 of the inner portion 110. The inner shaft 171 is oriented along the longitudinal axis 103 of the first plug 100. The inner shaft 171 comprises one or more inner pins 172. The outer portion 120 of the first plug 100 comprises one or more inner slots 173 arranged at the front side 121 of the outer portion 120. The inner slots 173 may for example be arranged in the contact section 130 of the outer portion 120. The one or more inner pins 172 of the inner portion 110 and the one or more inner slots 173 of the outer portion 120 together form the inner bayonet mount 170 that allows to connect the inner portion 110 and the outer portion 120 of the first plug 100 to each other and to disconnect the outer portion 120 from the inner portion 110 of the first plug 100.

[0035] The first plug 100 further comprises an outer shaft 181 that extends from the rear face 132 of the contact section 130 of the outer portion 120 through the outer portion 120 to the outer end 102 of the first plug 100. The outer shaft 181 extends through a part of the outer portion 120 that is enclosed by the shell 140 of the outer portion 120. The outer shaft 181 extends through an opening in the cap 141 of the shell 140.

[0036] The outer shaft 181 preferably comprises an electrically insulating material such that at least an outer end of the outer shaft 181 at the outer end 102 of the first plug 100 is electrically insulated against the contact section 130 of the outer portion 120 of the first plug 100.

[0037] The outer shaft 181 of the first plug 100 comprises one or more outer pins 182 arranged at the outer end of the outer shaft 181. The one or more outer pins 182 may form parts of an outer bayonet mount 180. The outer bayonet mount 180 can be used to connect an operating rod to the outer shaft 181 of the first plug 100. The operating rod can be used to handle the first plug 100 from the distance.

[0038] The outer shaft 181 and the one or more outer pins 182 preferably comprise the same sizes as the inner shaft 171 and the one or more inner pins 172 of the inner bayonet mount 170. In this case the operating rod that can be connected to the outer shaft 181 using the outer bayonet mount 180 can also be connected to the inner

shaft 171 using the inner bayonet mount 170 to handle the inner portion 110 of the first plug 100 when the outer portion 120 of the first plug 100 is not connected to the inner portion 110 of the first plug 100.

[0039] Figure 2 shows a schematic sectional view of a part of a connector assembly 200. The connector assembly 200 comprises the first plug 100 of Figure 1. The connector assembly 200 may serve to provide an electrical connection between a plurality of medium voltage cables. The connector assembly 200 may for example serve to provide an electrical connection between cables that are designed for voltages between 1 kV and 72 kV. The electrical connections between the cables provided by the connector assembly 200 can be interrupted for service, installation, monitoring or the like. The first plug 100 serves to electrically connect one of the cables to a ground contact during such a service, installation, monitoring or the like.

[0040] The connector assembly 200 comprises a busbar 230. The busbar 230 comprises an electrically conductive material, preferably a metal. The connector assembly 200 further comprises a cable terminal 220 that is designed to be connected to one cable. The cable terminal 220 also comprises an electrically conductive material, preferably a metal. The cable terminal 220 and the busbar 230 are both arranged in a housing 240 of the connector assembly 200 such that the cable terminal 220 and the busbar 230 are spaced apart from each other. The housing 240 comprises an electrically insulating material. The connector assembly 200 may comprise further cable terminals to be connected to further cables that are not depicted in Figure 2.

[0041] The housing 240 of the connector assembly 200 comprises a socket 210. The socket 210 extends from an outer opening of the housing 240 to the busbar 230. The socket 210 comprises an inner surface 211. In a middle section of the socket 210 a contact area 221 of the cable terminal 220 is accessible at the inner surface 211 of the socket 210. To this end the socket 210 may for example extend through a contact ring of the cable terminal 220. The busbar 230 comprises a connection means 231 that is accessible at the socket 210 of the connector assembly 200. The connection means 231 may for example comprise a threaded bore 232.

[0042] The first plug 100 can be arranged in the socket 210 of the connector assembly 200 to electrically connect the cable terminal 220 to a ground contact, as is shown in Figure 2. When the first plug 100 is arranged in the socket 210 of the connector assembly 200, the contact area 131 of the contact section 130 of the outer portion 120 of the first plug 100 is in electric contact to the contact area 221 of the cable terminal 220 of the connector assembly 200. The contact section 130 of the first plug 100 is electrically connected to a ground contact via the electric lead 160. The cable terminal 220 of the connector assembly 200 is electrically insulated against the busbar 230 of the connector assembly 200 by the electrically insulating inner portion 110 of the first plug 100.

[0043] In order to arrange the first plug 100 in the socket 210 of the connector assembly 200, the inner portion 110 and the outer portion 120 of the first plug 100 are first separated from each other by opening the inner bayonet mount 170. An operating rod is connected to the inner shaft 171 of the inner portion 110 using the inner bayonet mount 170. The inner portion 110 is then inserted into the socket 210 of the connector assembly 200. The connection means 190 at the front side 111 of the inner portion 110 is connected to the connection means 231 of the busbar 230 of the connector assembly 200. In case that the connection means 190 of the inner portion 110 comprises a threaded boss 191 and that the connection means 231 of the busbar 230 comprises a threaded bore 232, the threaded boss 191 of the inner portion 110 of the first plug 100 is screwed into the threaded bore 232 of the busbar 230 of the connector assembly 200 by rotating the inner portion 110 of the first plug 100 around the longitudinal axis 103 of the first plug 100.

[0044] Once the inner portion 110 of the first plug 100 is installed in the socket 210 of the connector assembly 200, the outer portion 120 of the first plug 100 can be inserted into the socket 210 of the connector assembly 200. The electric lead 160 is fixated to the fixation means 150 of the outer portion 120 of the first plug 100. The electric lead 160 is also connected to an external ground contact. Then the operating rod is connected to the outer shaft 181 of the outer portion 120 of the first plug 100 using the outer bayonet mount 180. The outer portion 120 is inserted into the socket 210 and connected to the inner portion 110 using the inner bayonet mount 170. Connecting the outer portion 120 to the inner portion 110 using the inner bayonet mount 170 requires only a slight rotation of the outer portion 120 around the longitudinal axis 103 that does not twist the electric lead 160 around an undesirably large angle. Once the outer portion 120 is arranged in the socket 210 of the connector assembly 200 the cable terminal 220 of the connector assembly 200 is immediately connected to the external ground contact via the contact section 130 of the first plug 100 and the electric lead 160.

[0045] Removal of the first plug 100 from the socket 210 of the connector assembly 200 follows the same handling steps in opposite order.

[0046] Figure 3 shows a schematic sectional drawing of a second plug 300. The second plug 300 can be plugged into the socket 210 of the connector assembly 200 instead of the first plug 100 to electrically connect the cable terminal 220 of the connector assembly 200 to an external ground contact. The second plug 300 is similar to the first plug 100. The following description will focus on the differences between the second plug 300 and the first plug 100. Components that are not explained in detail can be assumed to be similar to the respective components of the first plug 100 such that the description of the first plug 100 applies also to the respective components of the second plug 300.

[0047] The second plug 300 comprises an inner portion

310 and an outer portion 320. The inner portion 310 comprises a front side 311 and a rear side 312 that is opposed to the front side 311. The outer portion 320 comprises a front side 321 and a rear side 322 that is opposed to the front side 321. The inner portion 310 and the outer portion 320 are arranged one after another along a longitudinal axis 303 of the second plug 300 such that the front side 321 of the outer portion 320 faces the rear side 312 of the inner portion 310. The front side 311 of the inner portion 310 forms an inner end 301 of the second plug 300. The rear side 322 of the outer portion 320 forms an outer end 302 of the second plug 300.

[0048] A connection means 390 is arranged at the front side 311 of the inner portion 310. The connection means 390 may for example comprise a threaded boss 391. The connection means 390 is electrically isolated against the rear side 312 of the inner portion 310.

[0049] The outer portion 320 comprises a contact section 330 with an electrically conductive contact area 331 that forms part of the lateral surface of the outer portion 320. The contact area 331 of the contact section 330 is electrically connected to a rear face 332 of the contact section 330 that is oriented towards the rear side 322 of the outer portion 320.

[0050] A shell 340 of the outer portion 320 extends from the contact section 330 of the outer portion 320 to the rear side 322 of the outer portion 320. The shell 340 is preferably at least partially hollow. At the rear side 322 of the outer portion 320 the outer portion 320 can be closed by a cap 341 and a fixing ring 342. The shell 340 and/or the cap 341 electrically isolate the contact section 330 of the outer portion 320 against the rear side 322 of the outer portion 320.

[0051] A fixation means 350 is arranged at the rear face 332 of the contact section 330 of the outer portion 320. The fixation means 350 may comprise a threaded bore 351 but can also be designed as an area designated for welding or soldering. The fixation means 350 is electrically connected to the contact area 331 of the contact section 330. An electric lead 360 with a connector 361 can be connected to the fixation means 350, for example using a screw 352 or by means of soldering or welding, such that the electric lead 360 is electrically connected to the contact area 331 of the contact section 330.

[0052] The electric lead 360 extends through the partially hollow outer portion 320 and emerges from the outer portion 320 through an opening in the cap 341 at the outer end 302 of the second plug 300.

[0053] The inner portion 310 and the outer portion 320 are connected to each other using a swivel joint 370. The inner portion 310 and the outer portion 320 of the second plug 300 can not be separated from each other. The swivel joint 370 of the second plug 300 however allows to rotate the inner portion 310 of the second plug 300 around the longitudinal axis 303 without rotation of the outer portion 320 of the second plug 300.

[0054] The swivel joint 370 comprises a shaft 371 that extends from the rear side 312 of the inner portion 310

along the longitudinal axis 303 through the entire outer portion 320 of the second plug 300. The shaft 371 enters the outer portion 320 through an opening 372 of the contact section 330 at the front side 321 of the outer portion 320 and exits from the outer portion 320 through an opening in the cap 341 of the outer portion 320 at the rear side 322 of the outer portion 320. A flange 373 is rigidly connected to the shaft 371 such that the part of the contact section 330 of the outer portion 320 comprising the opening 372 is arranged between the rear side 312 of the inner portion 310 and the flange 373 connected to the shaft 371. This prevents the inner portion 310 from being separated from the outer portion 320. The shaft 371 can rotate freely around the longitudinal axis 303 in the opening 372 of the contact section 330 of the outer portion 320, allowing the inner portion 310 and the outer portion 320 of the second plug 300 to rotate independently around the longitudinal axis 303.

[0055] An outer end of the shaft 371 is arranged at the outer end 302 of the second plug 300. The outer end of the shaft 371 comprises one or more outer pins 381 that form part of an outer bayonet mount 380. The outer bayonet mount 380 can be used to connect an operating rod to the shaft 371 of the second plug 300. The operating rod can be used to plug the second plug 300 into the socket 210 of the connector assembly 200. The operating rod connected to the shaft 371 using the outer bayonet mount 380 allows to screw the connection means 390 of the inner portion 310 into the connection means 231 of the connector assembly 200 by rotating the shaft 371 and the inner portion 310 of the second plug 300 around the longitudinal axis 303. The swivel joint 370 of the second plug 300 allows the inner portion 310 of the second plug 300 to rotate independently of the outer portion 320 of the second plug 300 and thus prevents the electric lead 360 from being twisted while the inner portion 310 of the second plug 300 is screwed into the socket 210 of the connector assembly 200.

[0056] Figure 4 shows a schematic sectional view of a third plug 400. The third plug 400 can be used instead of the first plug 100 to electrically connect the cable terminal 220 of the connector assembly 200 to an external ground contact. The third plug 400 is similar to the first plug 100 and the second plug 300. The following description will focus on the differences between the third plug 400 and the first and second plugs 100, 300. Components of the third plug 400 that are not described in detail can be assumed to be similar to the respective components of the first and second plugs 100, 300, such that the description of the respective components of the first and second plugs 100, 300 equally applies to these components of the third plug 400.

[0057] The third plug 400 comprises an inner portion 410 and an outer portion 420. The inner portion 410 comprises a front side 411 and a rear side 412 that is opposed to the front side 411. The outer portion 420 comprises a front side 421 and a rear side 422 that is opposed to the front side 421. The inner portion 410 and the outer portion

420 of the third plug 400 are arranged one after another along a longitudinal axis 403 of the third plug 400 such that the front side 421 of the outer portion 420 faces the rear side 412 of the inner portion 410. The front side 411 of the inner portion 410 forms an inner end 401 of the third plug 400. The rear side 422 of the outer portion 420 forms an outer end 402 of the third plug 400.

[0058] A connection means 490 is arranged at the front side 411 of the inner portion 410. The connection means 490 may comprise a threaded boss 491. The connection means 490 is electrically insulated against the rear side 412 of the inner portion 410.

[0059] The outer portion 420 of the third plug 400 is at least partially hollow and comprises a shell 440. The shell 440 comprises an electrically conductive material, preferably a metal. An inner wall 441 of the shell 440 encloses the hollow space arranged inside the outer portion 420 of the third plug 400. The shell 440 extends from the front side 421 of the outer portion 420 to the rear side 422 of the outer portion 420. A part of the shell 440 adjoining the front side 421 of the outer portion 420 forms a contact section 430 of the outer portion 420. The contact section 430 comprises a contact area 431 that forms a part of an outer lateral surface of the outer portion 420 of the third plug 400. At the front side 421 of the outer portion 420, the shell 440 is closed except for a central opening 472. At the rear side 422 of the outer portion 420 of the third plug 400 the shell 440 may be closed by an electrically insulating cap 442 and a fixing ring 443. A fixation means 450 is arranged at the inner wall 441 of the shell 440 of the outer portion 420 of the third plug 400. The fixation means 450 may for example comprise a threaded bore 451 but can also be designed as an area designated for welding or soldering. The fixation means 450 is electrically connected to the contact section 430 via the shell 440. An electric lead 460 comprising a connector 461 can be connected to the fixation means 450, for example using a screw 452 or by welding or soldering, such that the electric lead 460 is electrically connected to the contact section 430 and the contact area 431 of the outer portion 420 of the third plug 400. The electric lead 460 extends from the fixation means 450 through the outer portion 420 of the third plug 400 and emerges from the outer portion 420 through an opening in the cap 442 at the outer end 402 of the third plug 400.

[0060] A shaft 471 is arranged at the rear side 412 of the inner portion 410 and extends along the longitudinal axis 403 through the outer portion 420 of the third plug 400. The shaft 471 enters the outer portion 420 through the opening 472 and exits from the outer portion 420 through a further opening in the cap 442 of the outer portion 420. The shaft 471 comprises an outer end that is arranged at the outer end 402 of the third plug 400.

[0061] A flange 473 is rigidly connected to the shaft 471 such that the part of the shell 440 surrounding the opening 472 is arranged between the flange 473 and the rear side 412 of the inner portion 410.

[0062] The shaft 471, the opening 472 and the flange

473 form a swivel joint 470 that connects the inner portion 410 and the outer portion 420 of the third plug 400 to each other. The swivel joint 470 prevents the inner portion 410 and the outer portion 420 from being separated. The swivel joint 470 however allows the inner portion 410 and the outer portion 420 to rotate around the longitudinal axis 403 of the third plug 400 independently.

[0063] The outer end of the shaft 471 comprises one or more outer pins 481 that form parts of an outer bayonet mount 480. The outer bayonet mount 480 allows to connect an operating rod to the shaft 471 of the third plug 400. The operating rod can be used to plug the third plug 400 into the socket 210 of the connector assembly 200 and to rotate the inner portion 410 of the third plug 400 around the longitudinal axis 403 to connect the connection means 490 of the third plug 400 to the connection means 231 of the connector assembly 200. Rotating the inner portion 410 of the third plug 400 around the longitudinal axis 403 by rotating the shaft 471 around the longitudinal axis 403 does not require rotation of the outer portion 420 of the third plug 400 around the longitudinal axis 403. Consequently, the electric lead 460 connected to the outer portion 420 is not twisted while the inner portion 410 of the third plug 400 is screwed into the socket 210 of the connector assembly 200.

[0064] Figure 5 shows a schematic sectional drawing of a fourth plug 500. The fourth plug 500 can be plugged into the socket 210 of the connector assembly 200 instead of the first plug 100 to electrically connect the cable terminal 220 of the connector assembly 200 to an external ground contact and to simultaneously connect the busbar 230 to the external ground contact.

[0065] The fourth plug 500 is similar to the first plug 100. The following description will focus on the differences between the fourth plug 500 and the first plug 100. Components that are not explained in detail can be assumed to be similar to the respective components of the fourth plug 500 such that the description of the first plug 100 applies also to the respective components of the fourth plug 500.

[0066] The fourth plug 500 comprises an inner end 501 and an outer end 502 that is opposed to the inner end 501. The fourth plug 500 is substantially rotationally symmetric with respect to a longitudinal axis 503 of the fourth plug 500. In the example shown in Figure 5 the fourth plug 500 comprises a partially conical shape such that a diameter of the fourth plug 500 in a direction perpendicular to the longitudinal axis 503 decreases from the outer end 502 towards the inner end 501 of the fourth plug 500. The fourth plug 500 could however be designed with a cylindrical shape or another shape.

[0067] The fourth plug 500 comprises an inner shell 510 and an outer shell 520. The inner shell 510 and the outer shell 520 are arranged one after another along the longitudinal axis 503 of the fourth plug 500 such that the inner shell 510 is arranged adjacently to the inner end 501 and the outer shell 520 is arranged adjacently to the outer end 502 of the fourth plug 500. The inner shell 510

and the outer shell 520 are fixedly connected to each other.

[0068] The inner shell 510 and the outer shell 520 are each at least partially hollow. At the outer end 502 of the fourth plug 500, the outer shell 520 can be closed by a cap 541 and a fixing ring 542.

[0069] The inner shell 510 comprises an electrically conductive material, for example a metal. The outer shell 520 preferably comprises an electrically isolating material, for example a plastic material. The outer shell 520 may however also comprise an electrically conductive material. In this case the cap 541 should comprise an electrically isolating material.

[0070] The inner shell 510 comprises an inner contact section 511 at the inner end 501. The inner contact section 511 is arranged at a front face of the inner shell 510. The inner shell 510 further comprises a contact section 530 with an electrically conductive contact area 531 that forms part of the lateral surface of the inner shell 510. The contact area 531 of the contact section 530 is electrically connected to the inner contact section 511.

[0071] The contact area 531 of the contact section 530 is also electrically connected to a rear face 532 of the inner shell 510. The rear face 532 of the inner shell 510 is oriented towards the outer end 502 of the fourth plug 500 and towards a space enclosed by the partially hollow outer shell 520.

[0072] A fixation means 550 is arranged at the rear face 532 of the inner shell 510. The fixation means 550 may comprise a threaded bore 551 but can also be designed as an area designated for welding or soldering. The fixation means 550 is electrically connected to the contact area 531 of the contact section 530 and to the inner contact section 511 of the inner shell 510.

[0073] An electric lead 560 with a connector 561 can be connected to the fixation means 550, for example using a screw 552 or by means of soldering or welding, such that the electric lead 560 is electrically connected to the contact area 531 of the contact section 530 and to the inner contact section 511 of the inner shell 510. The electric lead 560 extends through the partially hollow outer shell 520 and emerges from the outer shell 520 through an opening in the cap 541 at the outer end 502 of the fourth plug 500.

[0074] The fourth plug 500 comprises a shaft 571 that extends along the longitudinal axis 503 through the inner shell 510 and the outer shell 520 of the entire fourth plug 500. The shaft 571 enters the inner shell 510 through an opening 572 at the front face of the inner shell 510 at the inner end 501 of the fourth plug 500 and exits from the fourth plug 500 through an opening in the cap 541 of the outer shell 520 at the outer end 502 of the fourth plug 500.

[0075] Near the inner end 501 of the fourth plug 500, the shaft 571 comprises a second flange 574. The second flange 574 extends circumferentially around the shaft 571. The second flange 574 is arranged inside the inner shell 510 between the front face of the inner shell and an internal first flange 573 of the inner shell 510 such that a

swivel joint 570 is formed. The swivel joint 570 allows the shaft 571 to rotate freely around the longitudinal axis 503 with respect to the inner shell 510 and the outer shell 520.

[0076] A connection means 590 is arranged at an inner longitudinal end of the shaft 571 that extends through the opening 572 beyond the inner end 501 of the fourth plug 500. The connection means 590 may for example comprise a threaded boss 591.

[0077] An outer end of the shaft 571 is arranged at the outer end 502 of the second plug 500. The outer end of the shaft 571 comprises one or more outer pins 581 that form part of an outer bayonet mount 580. The outer bayonet mount 580 can be used to connect an operating rod to the shaft 571 of the second plug 500.

[0078] The operating rod can be used to plug the fourth plug 500 into the socket 210 of the connector assembly 200. The operating rod connected to the shaft 571 using the outer bayonet mount 580 allows to screw the connection means 590 into the connection means 231 of the connector assembly 200 by rotating the shaft 571 around the longitudinal axis 503.

[0079] The swivel joint 570 of the fourth plug 500 allows the shaft 571 of the fourth plug 500 to rotate independently of the inner shell 510 and the outer shell 520 of the fourth plug 500 and thus prevents the electric lead 560 from being twisted while the connection means 590 of the fourth plug 500 is screwed into the socket 210 of the connector assembly 200.

[0080] Figure 6 shows a schematic sectional drawing of a fifth plug 600. The fifth plug 600 can be plugged into a socket of a connector assembly similar to the connector assembly 200 depicted in Figure 2 to electrically connect a cable terminal of that connector assembly to an external ground contact.

[0081] The fifth plug 600 is similar to the first plug 100. The following description will focus on the differences between the fifth plug 600 and the first plug 100. Components of the fifth plug 600 which are not explained in detail can be assumed to be similar to the respective components of the first plug 100 such that the description of the first plug 100 applies to the respective components of the fifth plug 600, as well.

[0082] The fifth plug 600 comprises an inner portion 610 and an outer portion 620. The inner portion 610 comprises a front side 611 and a rear side 612 which is opposed to the front side 611. The outer portion 620 comprises a front side 621 and a rear side 622 which is opposed to the front side 621. The inner portion 610 and the outer portion 620 are arranged one after another along a longitudinal axis 603 of the fifth plug 600 such that the front side 621 of the outer portion 620 faces the rear side 612 of the inner portion 610. The front side 611 of the inner portion 610 forms an inner end 601 of the fifth plug 600. The rear side 622 of the outer portion 620 forms an outer end 602 of the fifth plug 600.

[0083] The outer portion 620 of the fifth plug 600 comprises a contact section 630 with an electrically conductive contact area 631. The contact area 631 forms a part

of the front side 621 of the outer portion 620 and is oriented perpendicularly to the longitudinal axis 603. At its front side 621, the outer portion 620 comprises a larger diameter than the inner portion 610 at its rear side 612. Consequently, a ring-shaped section of the front side 621 of the outer portion 620 does not face the rear side 612 of the inner portion 610 and forms the contact area 631 of the contact section 630.

[0084] The contact section 630 of the outer portion 620 of the fifth plug 600 comprises an outer screw thread 633 that forms part of the lateral surface of the outer portion 620. The outer screw thread 633 is provided for being screwed into a matching screw thread of a cable terminal 220 of a connector assembly similar to the connector assembly 200 shown in Figure 2.

[0085] The cable terminal of that connector assembly comprises a contact area which is constructed as a pedestal oriented perpendicularly to the screw thread and in parallel to the contact area 631 of the contact section 630 of the fifth plug 600. When the outer screw thread 633 of the contact section 630 of the fifth plug 600 is screwed into the matching screw thread of the cable terminal of the connector assembly, the contact area 631 of the contact section 630 may be pressed against the contact area of the cable terminal of the connector assembly to provide an electric connection between the contact area 631 of the contact section 630 of the fifth plug 600 and the contact area of the cable terminal of the connector assembly. It is also possible to arrange a conductive circular coil spring between the contact area 631 of the contact section 630 of the fifth plug 600 and the opposed contact area of the cable terminal of the connector assembly to provide an electric connection between the contact section 630 of the fifth plug 600 and the cable terminal of the connector assembly.

[0086] The contact area 631 of the contact section 630 is electrically connected to a rear face 632 of the contact section 630 that is opposed to the contact area 631 and is oriented towards the rear side 622 of the outer portion 620.

[0087] A shell 640 of the outer portion 620 extends from the contact section 630 of the outer portion 620 to the rear side 622 of the outer portion 620. The shell 640 is preferably at least partially hollow. At the rear side 622 of the outer portion 620, the outer portion 620 can be closed by a cap 641 and a fixing ring 642. The shell 640 and/or the cap 641 electrically isolate the contact section 630 of the outer portion 620 against the rear side 622 of the outer portion 620.

[0088] A fixation means 650 is arranged at the rear face 632 of the contact section 630 of the outer portion 620. The fixation means 650 may comprise a threaded bore 651 but can also be designed as an area designated for welding or soldering. The fixation means 650 is electrically connected to the contact area 631 of the contact section 630. An electric lead 660 with a connector 661 can be connected to the fixation means 650, for example using a screw 652 or by means of soldering or welding,

such that the electric lead 660 is electrically connected to the contact area 631 of the contact section 630.

[0089] The electric lead 660 extends through the partially hollow outer portion 620 and emerges from the outer portion 620 through an opening in the cap 641 at the outer end 602 of the fifth plug 600.

[0090] The inner portion 610 and the outer portion 620 are connected to each other using a swivel joint 670. The inner portion 610 and the outer portion 620 of the fifth plug 600 cannot be separated from each other. The swivel joint 670 of the fifth plug 600, however, allows for rotating the inner portion 610 of the fifth plug 600 around the longitudinal axis 603 without rotation of the outer portion 620 of the fifth plug 600.

[0091] The swivel joint 670 comprises an inner shaft 671 that extends from the rear side 612 of the inner portion 610 along the longitudinal axis 603 through an opening 672 of the contact section 630 at the front side 621 of the outer portion 620 into the outer portion 620 of the fifth plug 600. At a longitudinal end of the inner shaft 671 that is arranged inside the outer portion 620 of the fifth plug 600, the inner shaft 671 comprises a flange 673 that is rigidly connected to the inner shaft 671 such that the part of the contact section 630 of the outer portion 620 comprising the opening 672 is arranged between the rear side 612 of the inner portion 610 and the flange 673 connected to the inner shaft 671. This prevents the inner portion 610 from being separated from the outer portion 620. The inner shaft 671 can rotate freely around the longitudinal axis 603 in the opening 671 of the contact section 630 of the outer portion 620, allowing the inner portion 610 and the outer portion 620 of the fifth plug 600 to rotate independently around the longitudinal axis 603.

[0092] The fifth plug 600 furthermore comprises an outer shaft 682 which is rigidly connected to the contact section 630 of the outer portion 620 and which extends along the longitudinal axis 603 through the entire outer portion 620 of the fifth plug 600. The outer shaft 682 emerges from the outer portion 620 through an opening in the cap 641 of the outer portion 620 at the rear side 622 of the outer portion 620.

[0093] An outer end of the outer shaft 682 is arranged at the outer end 602 of the fifth plug 600. The outer end of the outer shaft 682 comprises one or more outer pins 681 that form part of an outer bayonet mount 680. The outer bayonet mount 680 can be used to connect an operating rod to the outer shaft 682 of the fifth plug 600. The operating rod can be used to plug the fifth plug 600 into a socket of a connector assembly similar to the connector assembly 200 shown in Figure 2.

[0094] The operating rod connected to the outer shaft 682 using the outer bayonet mount 680 allows for screwing the outer screw thread 633 of the contact section 630 into the matching screw thread of the contact area of the cable terminal of the connector assembly by rotating the outer shaft 682 around the longitudinal axis 603. A small number of rotations may be sufficient to completely screw the outer screw thread 633 of the contact section 630 of

the fifth plug 600 into the matching screw thread of the connector assembly and to provide a reliable electrical connection between the contact area 631 of the contact section 630 of the fifth plug 600 and the contact area of the cable terminal of the connector assembly. While rotating the outer shaft 682 using the operating rod, the electric lead 660 may be wound around the operating rod. The operating rod may, however, be separated from the outer shaft 682 using the outer bayonet mount 680 after the outer screw thread 630 of the contact section 630 of the fifth plug 600 is screwed into the matching screw thread of the connector assembly which will release the electric lead 660 wound around the operating rod.

[0095] The electric leads 160, 360, 460, 560, 660 of the first plug 100, the second plug 300, the third plug 400, the fourth plug 500 and the fifth plug 600 may be connected to a voltage supply contact instead of a ground contact. The voltage supply contact may for example be an external voltage supply contact that is provided in a mobile unit. In this case, the plugs 100, 300, 400, 500, 600 may be used to electrically connect a cable terminal and/or a busbar of a connector assembly to the voltage supply contact rather than to a ground contact. This operation may for example be carried out to temporarily remedy a disruption.

[0096] The swivel joints 370, 470, 670 of the second plug 300, the third plug 400 and the fifth plug 600 may be provided with lubrication to allow an independent rotation of the inner portions 310, 410, 610 with respect to the outer portions 320, 420, 620. Alternatively or additionally, the mating parts of the swivel joints 370, 470, 670 of the second plug 300, the third plug 400 and the fifth plug 600 may comprise different types of metals or appropriate surface coatings to reduce friction. The swivel joints 370, 470, 670 may also be equipped with axial ball bearing devices. The swivel joint 570 of the fourth plug 500 may be designed and equipped accordingly.

Reference symbols

[0097]

100 first plug
101 inner end
102 outer end
103 longitudinal axis
110 inner portion
111 front side
112 rear side
113 front element
114 rear element
120 outer portion
121 front side
122 rear side
130 contact section
131 contact area
132 rear face

140 shell
141 cap
142 fixing ring
150 fixation means
5 151 threaded bore
152 screw
160 electric lead
161 connector
170 inner bayonet mount
10 171 inner shaft
172 inner pin
173 inner slot
180 outer bayonet mount
181 outer shaft
15 182 outer pin
190 connection means
191 threaded boss
200 connector assembly
210 socket
20 211 inner surface
220 cable terminal
221 contact area
230 busbar
231 connection means
25 232 threaded bore
240 housing
300 second plug
301 inner end
302 outer end
30 303 longitudinal axis
310 inner portion
311 front side
312 rear side
35 320 outer portion
321 front side
322 rear side
330 contact section
331 contact area
40 332 rear face
340 shell
341 cap
342 fixing ring
350 fixation means
45 351 threaded bore
352 screw
360 electric lead
361 connector
370 swivel joint
50 371 shaft
372 opening
373 flange
380 outer bayonet mount
381 outer pin
55 390 connection means
391 threaded boss
400 third plug
401 inner end

402 outer end
 403 longitudinal axis
 410 inner portion
 411 front side
 412 rear side
 420 outer portion
 421 front side
 422 rear side
 430 contact section
 431 contact area
 440 shell
 441 inner wall
 442 cap
 443 fixing ring
 450 fixation means
 451 threaded bore
 452 screw
 460 electric lead
 461 connector
 470 swivel joint
 471 shaft
 472 opening
 473 flange
 480 outer bayonet mount
 481 outer pin
 490 connection means
 491 threaded boss
 500 fourth plug
 501 inner end
 502 outer end
 503 longitudinal axis
 510 inner shell
 511 inner contact section
 520 outer shell
 530 contact section
 531 contact area
 532 rear face
 541 cap
 542 fixing ring
 550 fixation means
 551 threaded bore
 552 screw
 560 electric lead
 561 connector
 570 swivel joint
 571 shaft
 572 opening
 573 first flange
 574 second flange
 580 outer bayonet mount
 581 outer pin
 590 connection means
 591 threaded boss
 600 fifth plug
 601 inner end
 602 outer end
 603 longitudinal axis
 610 inner portion

611 front side
 612 rear side
 620 outer portion
 621 front side
 622 rear side
 630 contact section
 631 contact area
 632 rear face
 633 outer screw thread
 640 shell
 641 cap
 642 fixing ring
 650 fixation means
 651 threaded bore
 652 screw
 660 electric lead
 661 connector
 670 swivel joint
 671 inner shaft
 672 opening
 673 flange
 680 outer bayonet mount
 681 outer pin
 682 outer shaft

Claims

1. A plug (100, 300, 400, 600)
 wherein the plug (100, 300, 400, 600) is designed for being plugged into a connector assembly (200), wherein the plug (100, 300, 400, 600) comprises an inner end (101, 301, 401, 601), an outer end (102, 302, 402, 602) and a contact section (130, 330, 430, 630) that is arranged between the inner end (101, 301, 401, 601) and the outer end (102, 302, 402, 602),
 wherein the inner end (101, 301, 401, 601) and the outer end (102, 302, 402, 602) are both electrically isolated against the contact section (130, 330, 430, 630),
 wherein the plug (100, 300, 400, 600) comprises a fixation means (150, 350, 450, 650) for fixating an electric lead (160, 360, 460, 660) to the plug (100, 300, 400, 600),
 wherein the fixation means (150, 350, 450, 650) is electrically connected to the contact section (130, 330, 430, 630).
2. The plug (100, 300, 400, 600) according to claim 1, wherein the plug (100, 300, 400, 600) comprises an electric lead (160, 360, 460, 660) that is fixated to the fixation means (150, 350, 450, 650), wherein the electric lead (160, 360, 460, 660) is electrically connected to the contact section (130, 330, 430, 630).
3. The plug (100, 300, 400, 600) according to claim 2,

- wherein the electric lead (160, 360, 460, 660) is at least partially arranged inside the plug (100, 300, 400, 600),
 wherein the electric lead (160, 360, 460, 660) emerges from the plug (100, 300, 400, 600) at the outer end (102, 302, 402, 602) of the plug (100, 300, 400, 600).
4. The plug (100, 300, 400, 600) according to one of the previous claims,
 wherein the plug (100, 300, 400, 600) comprises an inner portion (110, 310, 410, 610) and an outer portion (120, 320, 420, 620),
 wherein a front side (111, 311, 411, 611) of the inner portion (110, 310, 410, 610) forms the inner end (101, 301, 401, 601) of the plug (100, 300, 400, 600),
 wherein a rear side (122, 322, 422, 622) of the outer portion (120, 320, 420, 620) forms the outer end (102, 302, 402, 602) of the plug (100, 300, 400, 600).
5. The plug (300, 400, 600) according to claim 4,
 wherein the inner portion (310, 410, 610) can be rotated around a longitudinal axis (303, 403, 603) of the inner portion (310, 410, 610) without rotation of the outer portion (320, 420, 620).
6. The plug (100) according to one of claim 4,
 wherein the inner portion (110) and the outer portion (120) are separable.
7. The plug (100) according to claim 6,
 wherein the inner portion (110) and the outer portion (120) can be connected with a bayonet mount (170).
8. The plug (300, 400, 600) according to one of claims 4 and 5,
 wherein the inner portion (310, 410, 610) and the outer portion (320, 420, 620) are connected with a swivel joint (370, 470, 670).
9. The plug (100, 300, 400, 600) according to one of claims 4 to 8,
 wherein the plug (100, 300, 400, 600) comprises a shaft (181, 371, 471, 682) that extends through the outer portion (120, 320, 420, 620) to the outer end (102, 302, 402, 602) of the plug (100, 300, 400, 600).
10. The plug (100, 300, 400, 600) according to one of the previous claims,
 wherein the outer end (102, 302, 402, 602) of the plug (100, 300, 400, 600) comprises at least one pin (182, 381, 481, 681) for forming a bayonet mount (180, 380, 480, 680).
11. The plug (100, 300, 400, 600) according to claims 9 and 10,
 wherein the at least one pin (182, 381, 481, 681) is arranged on the shaft (181, 371, 471, 682).
12. The plug (100, 300, 400) according to one of the previous claims,
 wherein a connection means (190, 390, 490) is arranged at the inner end (101, 301, 401) of the plug (100, 300, 400).
13. The plug (100, 300, 400) according to claim 12,
 wherein the connection means (190, 390, 490) comprises a threaded boss (191, 391, 491).
14. The plug (100, 300, 400) according to one of the previous claims,
 wherein the contact section (130, 330, 430) comprises a cylindrical surface (131, 331, 431).
15. A plug (500)
 wherein the plug (500) is designed for being plugged into a connector assembly (200),
 wherein the plug (500) comprises an inner end (501), an outer end (502) and a contact section (530) that is arranged between the inner end (501) and the outer end (502),
 wherein the outer end (502) is electrically isolated against the contact section (530),
 wherein the plug (500) comprises a fixation means (550) for fixating an electric lead (560) to the plug (500),
 wherein the fixation means (550) is electrically connected to the inner end (501) and the contact section (530).
16. A connector assembly (200)
 comprising a plug (100, 300, 400, 500, 600) according to any one of the previous claims
 and a socket (210),
 wherein a contact area (221) is formed at a part of the inner surface (211) of the socket (210),
 wherein the plug (100, 300, 400, 500, 600) can be arranged in the socket (210) such that the contact section (130, 330, 430, 530, 630) of the plug (100, 300, 400, 500, 600) is electrically connected to the contact area (221) of the socket (210).

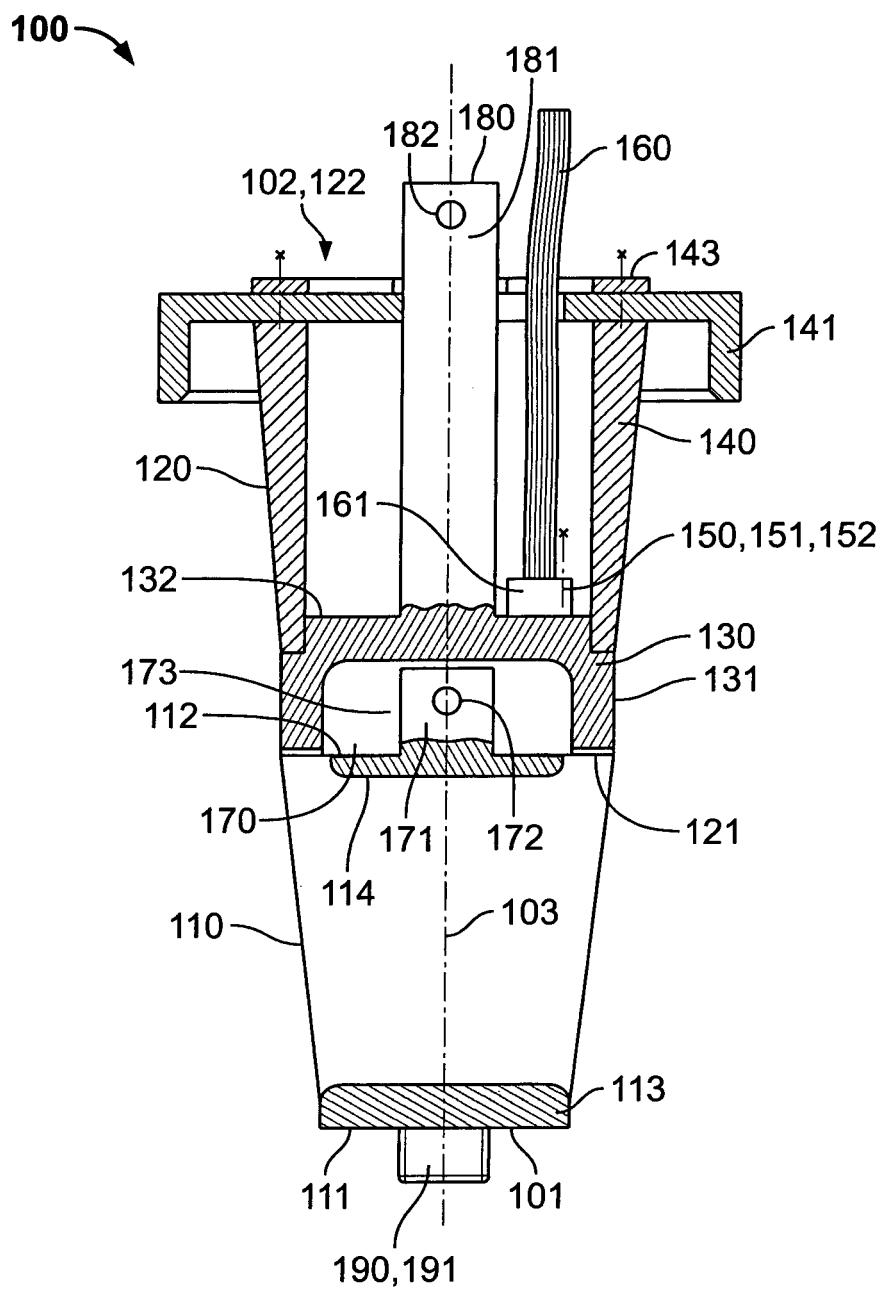


Fig. 1

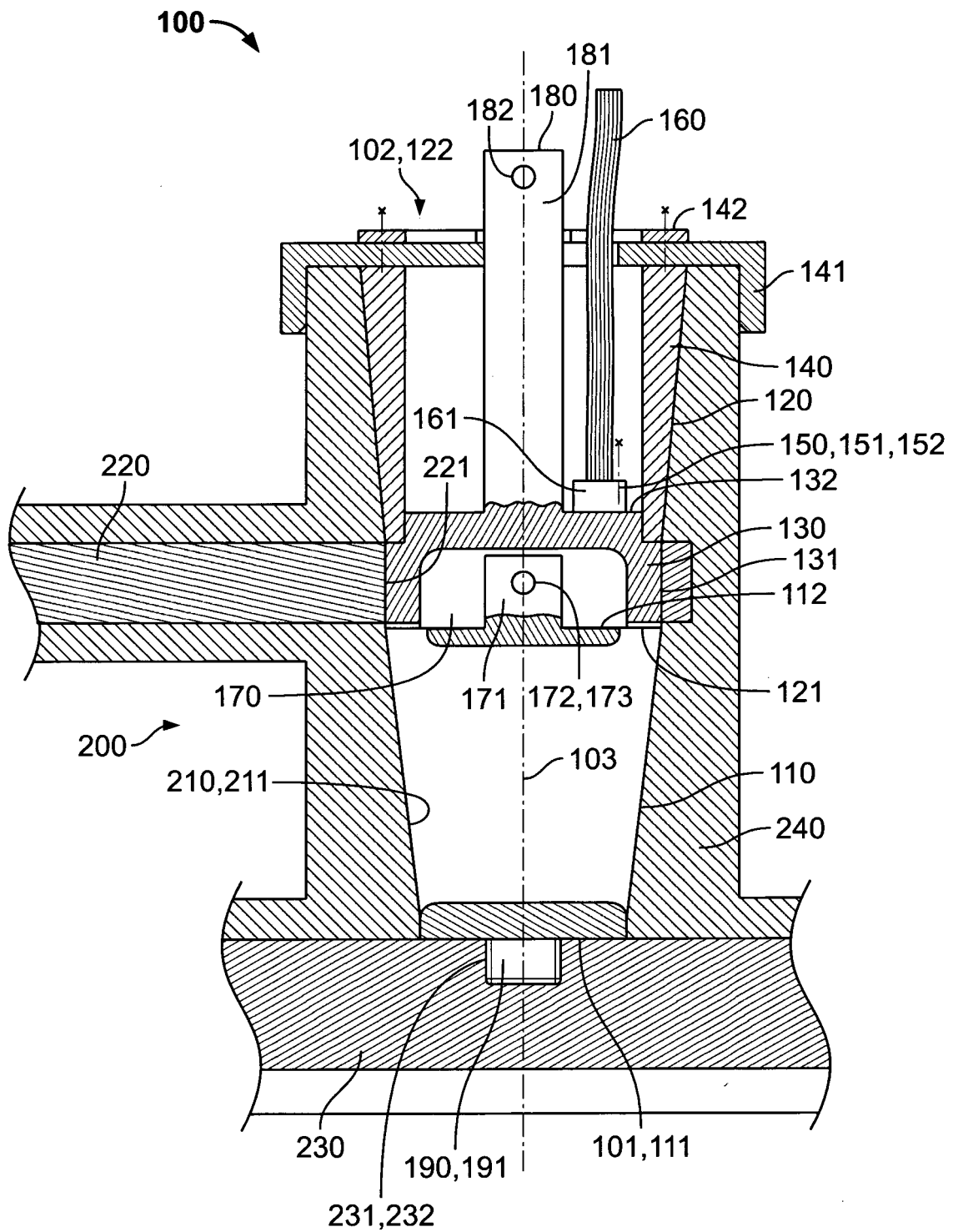


Fig. 2

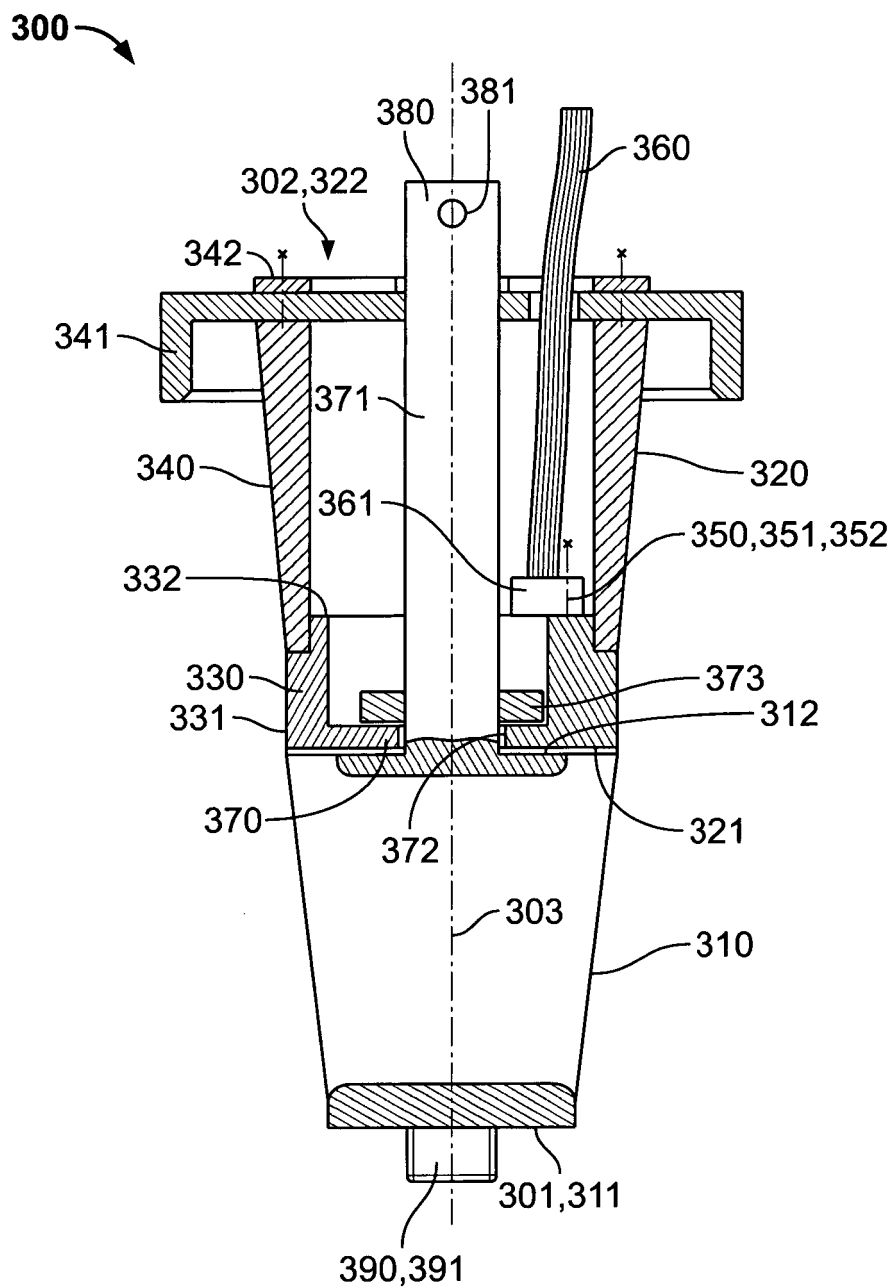


Fig. 3

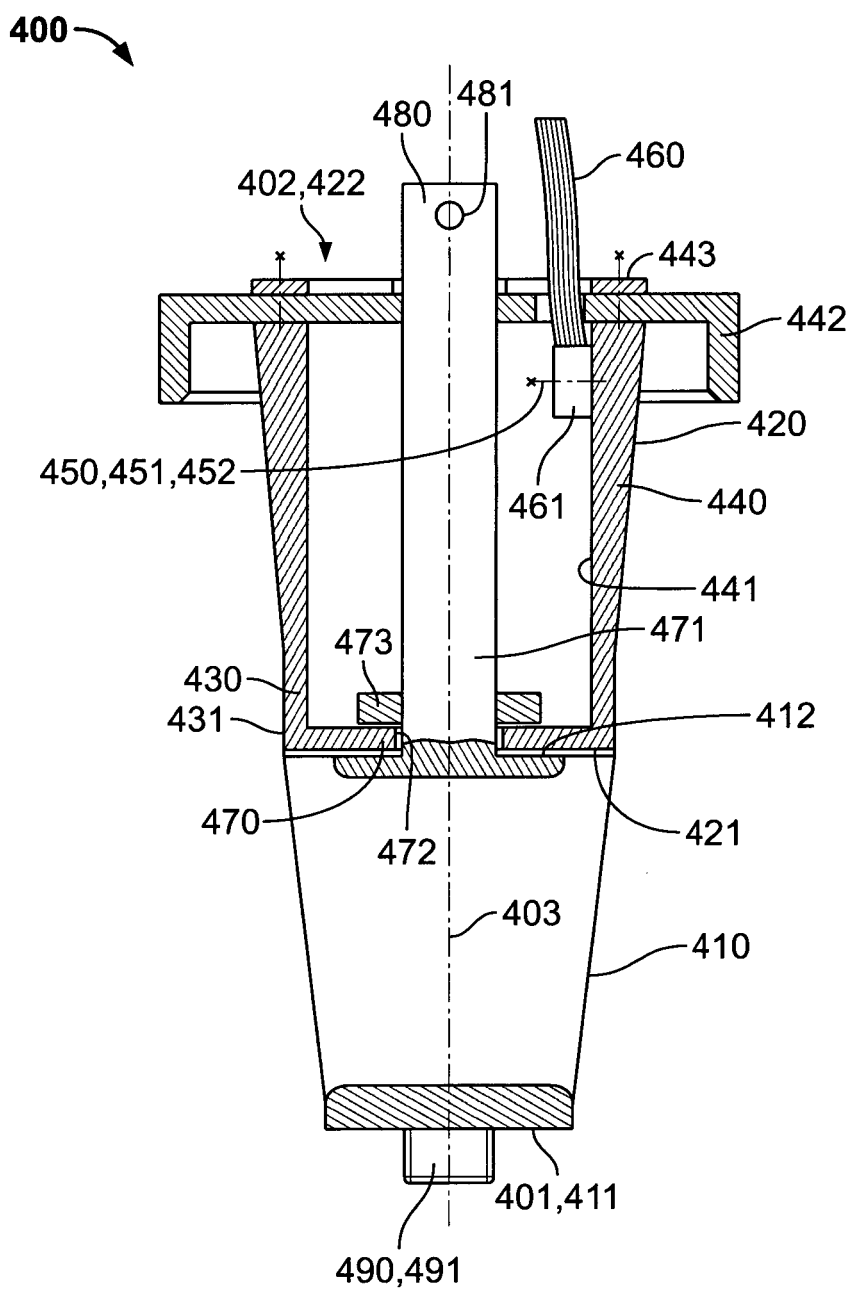


Fig. 4

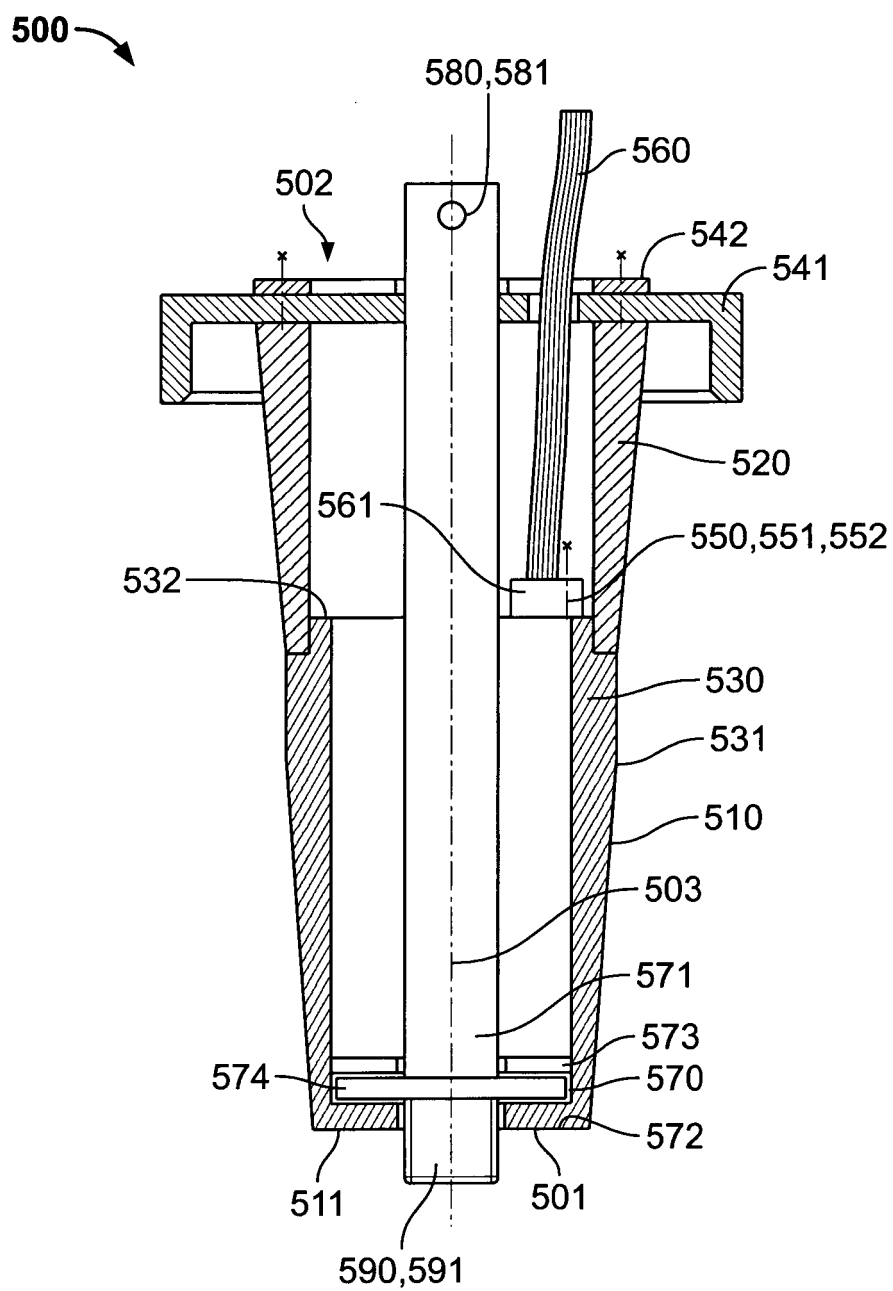


Fig. 5

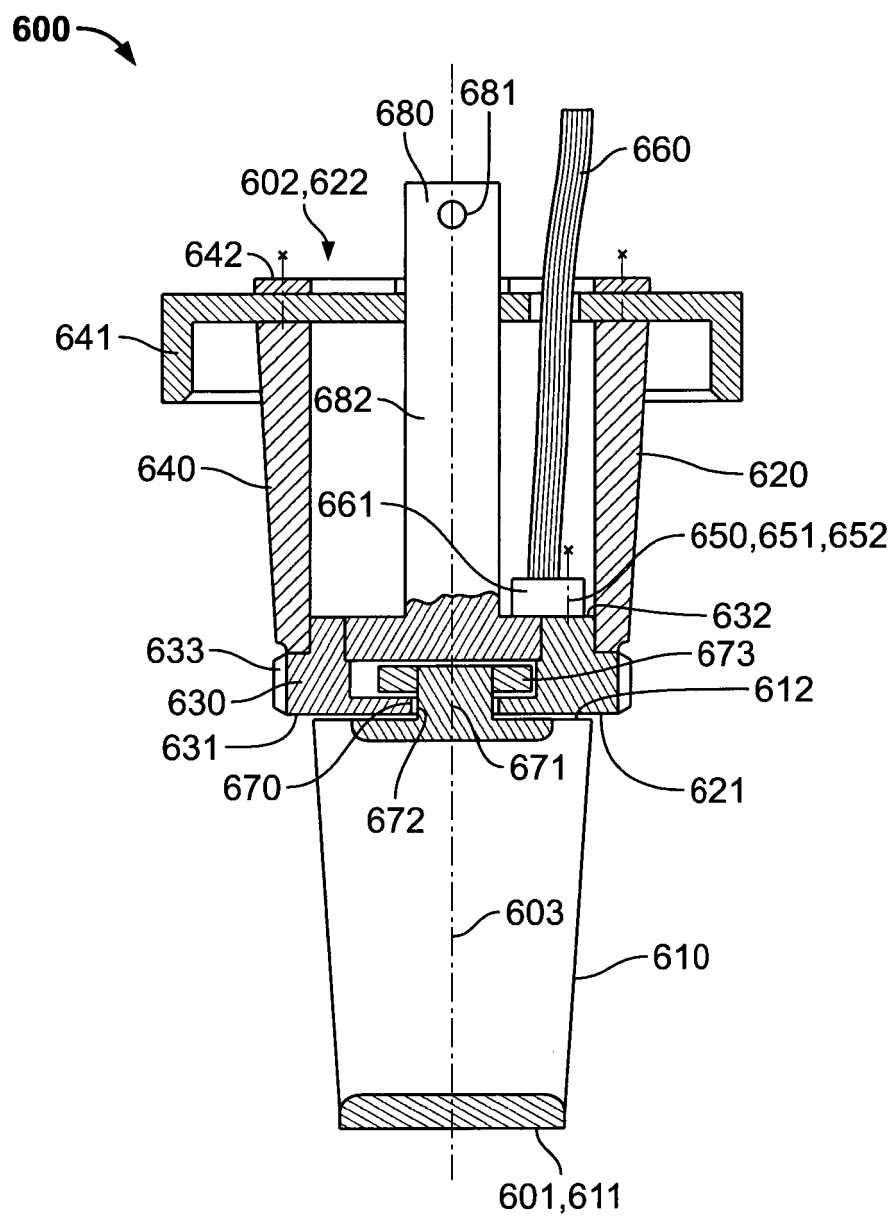


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 13 19 3843

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 647 406 A1 (SORIN CRM SAS [FR]) 9 October 2013 (2013-10-09) * figures 1-2,4-6 *	1-14,16	INV. H01R13/53 H01R13/58 H01R24/58
X	US 8 215 962 B1 (MACHADO MANUEL [US]) 10 July 2012 (2012-07-10) * figures 2a,2b *	1-4	ADD. H01R103/00 H01R101/00 H01R13/502
X	US 4 421 371 A (CLARK KEITH H [US] ET AL) 20 December 1983 (1983-12-20) * figure 4 *	1-4	
A	WO 90/11631 A1 (RAYCHEM LTD [GB]) 4 October 1990 (1990-10-04) * figures 1-3 *	1-14,16	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 April 2014	Examiner Esmiol, Marc-Olivier
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

2
EPO FORM 1503 03.82 (P04C01)



Application Number

EP 13 19 3843

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-14(completely); 16(partially)

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 13 19 3843

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-14(completely); 16(partially)

Plug wherein the inner and outer ends are electrically isolated against the contact section and the fixation means is electrically connected to the contact section.

2. claims: 15(completely); 16(partially)

Plug wherein the outer end is electrically isolated against the contact section and the fixation means is electrically connected to the inner end and the contact section.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 19 3843

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-04-2014

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