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(54) **COAXIAL CABLE EXTENDER**

(57) The invention relates to a coaxial cable extender comprising a first connector; a first cable, wherein the first connector is arranged to couple a first end of the first cable with an end of a second cable, the coaxial cable extender being mountable in an outlet box terminating the second cable; and the coaxial cable extender further comprising a male connector or a female connector coupled to a second end of the first cable.

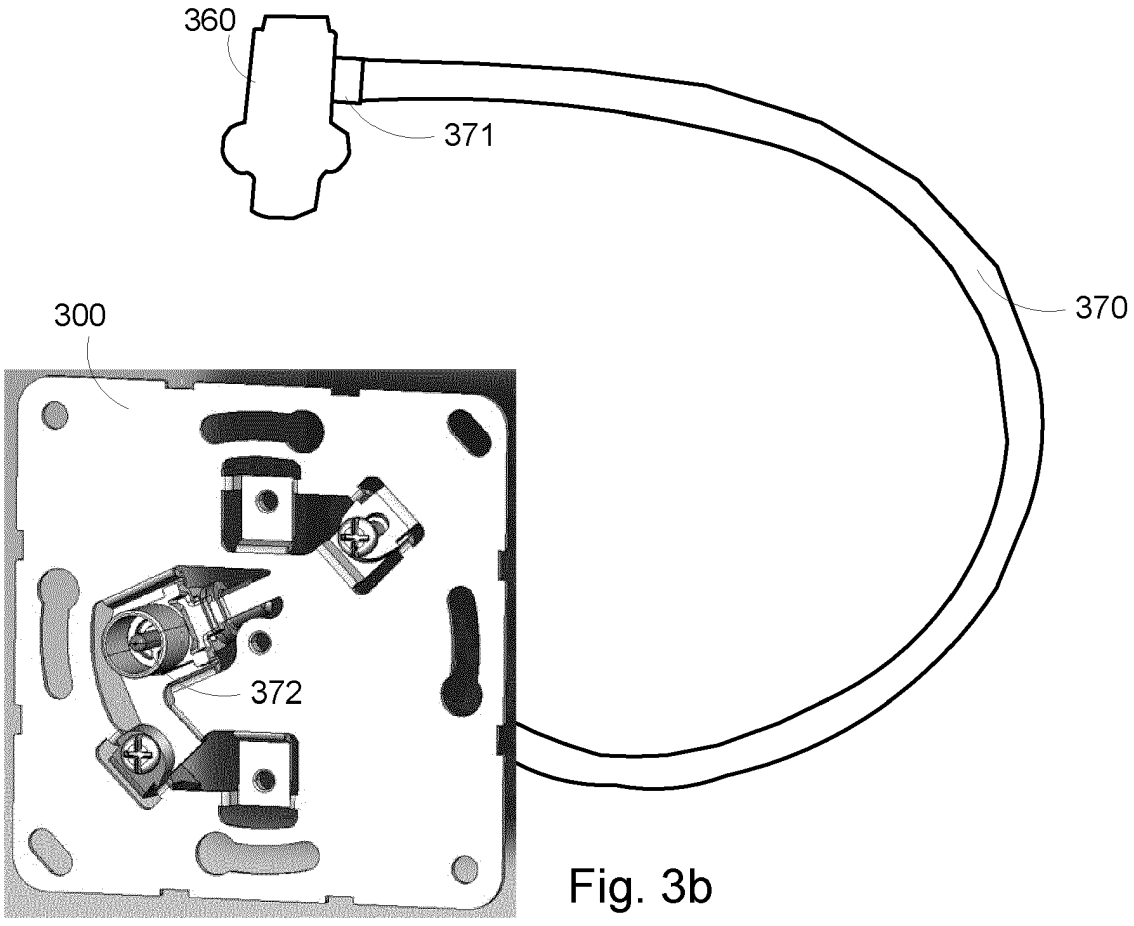


Fig. 3b

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Description

Technical field

[0001] The invention relates to an arrangement for extending a coaxial cable, especially a pre-assembled coaxial cable.

Background

[0002] Coaxial cable is a type of cable that has an inner conductor surrounded by an insulating layer and a conducting shield. Usually, the cable is further protected by an outer insulating jacket. Coaxial cable may be used as a transmission line for radio frequency (RF) signals. Common applications of coaxial cable are video and cable television distribution, RF and microwave transmission, and computer and instrumentation data connections.

[0003] For cable television distribution, coaxial cables are typically pre-assembled in building constructions such that a coaxial cable terminates at a wall outlet. When carrying out installation or maintenance of coaxial cable and/or wall outlet assemblies, it is a common problem that the center conductor of the coaxial cable breaks. It may happen that an end of a broken coaxial cable terminating in an outlet box mounted on a wall of a building is too short to extend to a baseplate of a wall-outlet. In certain occasions, it may be possible to pull out more cable from the constructions. However, this requires a lot of work, and sometimes pulling out the cable is not possible, and the problem of too short a cable remains. Sometimes one needs to tear down the constructions or even dig the cable up in the garden to be able to get additional length to that part of the cable which is visible in the outlet box terminating the coaxial cable. Considering a rather simple task of, for example, installing a new wall outlet, the work needed to extend the coaxial cable such that it reaches the base plate is far too excessive. Therefore, a solution is needed to enable extending the coaxial cable conveniently.

Summary

[0004] Now, an improved arrangement has been developed to reduce the above-mentioned problems. As aspects of the invention, we present a coaxial cable extender, which is characterized in what will be presented in the independent claim.

[0005] The dependent claims disclose advantageous embodiments of the invention.

[0006] According to an aspect of the invention, there is provided a coaxial cable extender comprising a first connector; a first cable, wherein the first connector is arranged to couple a first end of the first cable with an end of a second cable, the coaxial cable extender being mountable in an outlet box terminating the second cable; and the coaxial cable extender further comprising a male connector or a female connector coupled to a second end of the first cable.

[0007] According to an embodiment, the first cable is of length of 15 to 45 cm, preferably 20 to 40 cm.

[0008] According to an embodiment, the first connector comprises a first part and a second part being attached to each other with a hinge so that the first part and the second part are bendable in respect to each other.

[0009] According to an embodiment, the first connector further comprises an opening for the end of the second cable when the first part and the second part are bent to a closed position, the opening being of adjustable diameter.

[0010] According to an embodiment, the first part and the second part comprise a first projecting part and a second projecting part, respectively, for supporting the second cable and for forming a lining of the opening, wherein the first projecting part fits at least partially inside the second projecting part.

[0011] According to an embodiment, the lining comprises one or more grooves, the one or more grooves being oriented in different direction than the longitudinal direction of the second cable.

[0012] According to an embodiment, the coaxial cable extender further comprises a baseplate, on which the male connector or the female connector is mounted.

[0013] According to an embodiment, the baseplate comprises at least one aperture for the connector, the at least one aperture being formed to receive the connector.

[0014] According to an embodiment, the baseplate comprises a clip, wherein the clip is bendable by applying a pushing or a bending force to the clip.

[0015] According to an embodiment, when the clip is bent from its original state, the at least one aperture is arranged to receive the connector, and when the connector has been inserted in the aperture, the clip is arranged to be bent back to its original state such that the clip locks the connector to the baseplate.

Brief description of the drawings

[0016] The invention will now be described in more detail in connection with preferred embodiments with reference to the appended drawings, in which:

Fig. 1 a and 1 b show an example of a coaxial cable extender according to an embodiment and an example of an outlet box;

Fig. 2a and 2b show an example of a first connector and an example of a male connector according to an embodiment;

Fig. 2c and 2d show examples of a first part and a second part of a first connector;

Fig. 3a and 3b show an example of a baseplate and an example of a coaxial cable extender comprising a baseplate according to an embodiment;

Fig. 4a, 4b, 4c, 4d, 4e, 4f and 4g show examples of applications where the coaxial cable extender ac-

cording to an embodiment is usable; and

Fig. 5a and 5b show examples of a block diagram of a coaxial cable extender and a push-on filter, and a coaxial cable extender according to an embodiment.

Fig. 6 shows an example of a galvanic isolated module.

Detailed description

[0017] Fig. 1a and Fig. 1b show an example of a coaxial cable extender 100 according to an embodiment and an example of an outlet box 150. The coaxial cable extender 100 may comprise a first connector 110 and a first cable 120 which serves as an output cable for distributing an output signal, for example, from a coaxial cable of a cable TV network to one or more receiving equipment. The first cable 120 comprises a first end 125 and a second end 127. The first connector 110 is arranged to couple the first end 125 of the first cable 120 with an end of a second cable 160. The second cable 160 may be a coaxial cable pre-assembled in a house or other building.

[0018] Fig. 1 b shows an outlet box 150 wherein the end of the second cable 160 resides, i.e. the outlet box 150 terminating the second cable 160. The center conductor 165 of the second cable 160 (coaxial cable) has been pre-assembled in its place, and the cable is stripped such that the insulating layer 166 and a conducting shield (not shown) are removed around a short section of the center conductor 165. Typically, the outer insulating jacket, made for example of PVC, is stripped further for a longer section. While residing in a location shown in Fig. 1 b, a standard baseplate 170 of a wall outlet may be installed in the outlet box 150 such that the center conductor 165 is connected to a back connector (not shown) of the baseplate 170, and the RF signal transmitted via the center conductor 165 is further transferred to one or more connectors 171, typically male-/female-type IEC 169-2 connectors, residing in the front wall of the baseplate and enabling to connect a user equipment, such as a television set or a set-top-box, via a further coaxial cable to receive the RF signal.

[0019] The problem is that, for example when carrying out installation or maintenance of coaxial cable and/or wall outlet assemblies in a building, such as when removing the old baseplate 170, the center conductor 165 breaks easily, and thus the cable 160 may become too short to extend to the back connector of the baseplate 170. Thereby, the pre-assembled coaxial cable 160 cannot be connected to the wall outlet, and no RF signal can be transmitted via the wall outlet to a user equipment anymore.

[0020] Now, in order to enable the maintenance personnel to solve the problem quickly and in a straightforward manner, without tearing down any constructions of the building, the second cable 160 may be extended using the coaxial cable extender 100 as disclosed in various embodiments herein. The coaxial cable extender 100 may be mountable in the outlet box 150 terminating the second cable 160, since the extender is small enough to fit in the outlet box 150. The coaxial cable extender 100 may further comprise a male connector 130 or a female connector coupled to the second end 127 of the first cable 120. The male/female connector may be, for example, IEC 169-2 standard connector or any other type of standard connector.

[0021] Hence, the maintenance personnel may just strip another short section of the insulating layer 166 and the conducting shield around the center conductor 165, and simply connect the first connector 110 of the coaxial cable extender 100 to the revealed section of the center conductor 165. The mechanical structure of the first connector 110 enables a quick and easy installation and a firm mechanical connection to the second cable 160. The electrical structure of the first connector 110 ensures good RF signal performance and electrical conductivity, as well as prevents RF leakage and provides a good ground connection. The structure of the first connector is discussed more in detail further below. Now the male/female connector 130 coupled to the second end 127 of the first cable 120 may be used for supplying the RF signal from the pre-assembled second coaxial cable 160 to a user equipment.

[0022] According to an embodiment, the coaxial cable extender may further comprise a baseplate. The male/female connector may be mounted on the baseplate. In most occasions, the original baseplate of the wall outlet is not usable any more, since the shortened center connector of the pre-assembled second coaxial cable 160 does not reach to the back connector of the original baseplate. Thus, the original baseplate of the wall outlet may be replaced by the baseplate of the coaxial cable extender. The structure of the baseplate is discussed more in detail further below.

[0023] Alternatively, the coaxial cable extender may be used without the baseplate, and the male/female connector may be used as hanging from the end of the first cable 110. Yet alternatively, the male/female connector may be mounted on the another baseplate, for example to a handmade baseplate or another type of baseplate.

[0024] The length of the first cable 120 may be such that the coaxial cable extender is easy to install, the male/female connector of the first cable extends at least to the wall surface of the wall outlet and yet the first cable fits within the cavity of the outlet box 150. According to an embodiment, the length may be 15 to 45 cm, essentially 20 to 40 cm. Alternatively, the length may be longer, e.g. 100 cm.

[0025] Fig. 2a and 2b show an example of the first connector 200 of the coaxial cable extender and an example of a male connector 250 of the coaxial cable extender according to an embodiment. The first connector 200 may comprise a first part 210 and a second part 220 being attached to each other with a hinge 215 so that the first part 210 and the second part 220 are bendable in respect to each other.

[0026] When the first part 210 and the second part 220 are bent to a closed position, an opening 230, or a clamp, for the second cable 160 may be formed. The clamp or the opening enables secure fastening and coupling of the cable. According to an embodiment, the opening 230 is of adjustable diameter, i.e. the first connector may be suitable for extending coaxial cables of variable diameters.

[0027] According to an embodiment, the first part 210 and the second part 220 of the first connector 200 comprise a first projecting part 232 and a second projecting part 233 between which parts the opening 230 may be formed. The projecting parts 232 and 233 may form a lining 231 of the opening 230. The projecting parts 232 and 233 have a function to support the second cable 160 when the first part 210 and the second part 220 are bent to the closed position. The length of the projecting parts 232 and 233 is such that it prevents the second cable 160 to bend and snap, preferably 3 to 6 mm.

[0028] The diameter of the opening 230 may be from 3 mm to 10 mm, preferably from 4 mm to 7.5 mm. The opening 230 may be adjustable since the structure of the projecting parts 232 and 233 is such that the first projecting part 232 fits at least partly inside the second projecting part 233. Because of the adjustability, cables of different sizes may be coupled or fastened to the opening 230. The form of the opening 230 may be round or irregular. The form of the opening 230 may be such that it is suitable for receiving the second cable 160. The structure of the clamp/opening 230 may be such that the coaxial cable to be extended is squeezed between the bending parts tightly. The first connector 200 may comprise fastening means, e.g. screws 235, 236 or pins to tighten the parts 210 and 220 to the closed position. The first connector 200 may be connected to the first cable 120 through a connector 240.

[0029] The male connector 250 in Fig. 2b or the female connector may be connected to the first cable 120 through a connector 260. Further, the male connector 250 may comprise a protruding surface 270 which is compatible with a fastening element of a baseplate (see Fig. 3a). The male connector 250 comprising the protruding surface 270 may be according to a standard (IEC 61169-2) or some other design. The protruding surface 270 may be compatible with a baseplate having a cover thickness of approximately 10 mm. The form and length of the protruding surface may vary along with the baseplate in question.

[0030] According to an embodiment, there may be one or more grooves 241 in the lining 231 of the opening 230 to prevent the cable slipping out from the clamp. In this way, the coupling is secure. Fig. 2c and 2d show the first part 210 and the second part 220 of the first connector 200 separately from each other. The one or more grooves 241 may be positioned in a way that they are oriented in different direction than the longitudinal direction of the cable. For example, the grooves 241 may be positioned perpendicularly to the cable, i.e. parallel to the rim of the opening 230. Alternatively, the grooves may be positioned diagonally.

[0031] The first connector 200 may have features to improve the electromagnetic compatibility (EMC), RF performance and safety. The groove construction 241 may provide additional contact between the first part 210 and the second part 220 other than merely via a braiding of the coaxial cable. This enables achieving an improved screening effectiveness of Class A+ according to the CENELEC (European Committee for Electrotechnical Standardization) standard. The first part 210 may move parallel to the second part 220, i.e. the hinge construction may be a free floating construction in contrast to a fixed position hinge. The free floating construction may have various advantages. For example, the contact between the first part 210 and the second part 220 may provide better EMC and RF performance. Alternatively or in addition, cables of a wide range of diameters may fit inside the clamp construction, i.e. between the first part 210 and the second part 220.

[0032] There may be a printed circuit board (PCB) inside the first connector 200. The PCB may comprise a high voltage capacitor to make the product a Semi Isolated System Outlet according to the CENELEC/IEC standard. The high voltage capacitor may withstand voltages of 2120 VDC and 230 VAC not exceeding the maximum leakage currents according to the standard IEC 60728-11. The PCB may comprise a spring construction for coaxial inner conductor. The material of spring construction for coaxial inner conductor may be for example phosphor bronze or beryllium copper. The spring construction may be used instead of a terminal block, since the spring construction may have better RF performance and a good clamping force and resilience. The PCB may comprise a solder facility for coaxial inner conductor which may provide direct soldered contact preventing interruptions due to contact failure and preventing common path distortion (CPD). The solder facility may improve the RF performance. According to an embodiment, the coaxial cable extender may further comprise a baseplate, on which the male connector or the female connector may be mounted. Fig. 3a shows an example of the baseplate 300. In Fig. 3a, the male connector 310 is mounted on the baseplate 300. According to an embodiment, the baseplate may comprise at least one aperture for the connector 310, the aperture being formed to receive the connector.

[0033] According to an embodiment, the baseplate 300 may comprise a clip 320 for securely fastening the male/female connector 310 to the baseplate. The clip 320 is compatible with the protruding surface 270 of the connector (see Fig. 2b). The clip 320 may be bendable e.g. by applying a pushing or a bending force to the clip. Once the clip is bent slightly away from its original state, i.e. a state along the surface of the baseplate, the connector 310 may be inserted in the aperture. The clip is then bent back to its original state such that the clip 230 locks the connector to the baseplate firmly and securely.

Thus, the embodiment provides a fast and simple, yet secure way to attach the connector to the baseplate.

[0034] The baseplate 300 may comprise several holes or slits 301, 302, 303, 304, 305, 306, 307, 308 for variable forms for screws or other fastening means to enable the assembling of the baseplate to various kinds of outlet boxes. The places of the holes and slits in the baseplate are selected such that the baseplate can be assembled practically to any of the commercially available standard outlet boxes.

[0035] Fig. 3b shows an example of a coaxial cable extender according to an embodiment. The coaxial cable extender according to an embodiment may comprise a first connector 360 and a first cable 370, wherein the first connector 360 is arranged to couple a first end 371 of the first cable 370 with an end of a second cable. The coaxial cable extender may be mountable in an outlet box terminating the second cable. The coaxial cable extender according to an embodiment may further comprise a male connector 372 or a female connector coupled to a second end of the first cable 370 and mounted on the baseplate 300.

[0036] In addition to merely extending the (broken) pre-assembled coaxial cable, the coaxial cable extender may be used for installing various kinds of CATV modules to the wall outlets in a very straightforward manner. Fig. 4 shows various examples of applications of the coaxial cable extender. The coaxial cable extender may be used as wide-band modular solution to replace traditional wall-outlet systems. Example in Fig. 4a shows e.g. a stand-alone solution to replace a traditional wall outlet, solution 410 comprising the coaxial cable extender with a male connector 411 and a baseplate covered with a cover plate 412. Alternatively the connector may be a female connector, or any connector type.

[0037] Another example in Fig. 4b discloses the outlet solution 410 with a passive push-on 422. The push-on may be any kind of CATV module, e.g. a splitter, a diplexer and/or a filter module.

[0038] The coaxial cable extender 100 may be deployed in various outlet boxes or frames, e.g. in frame 440 in Fig. 4c or in box 451 in Fig. 4e. The frame 440 may be covered with a cover plate 430 such as in Fig. 4d. The box 451 may be covered with a cover plate 450 such as in Fig. 4e. Further, a push-on 460 may be installed on the cover plate 450 such as in Fig. 4g. One alternative of a push-on is an amplifier 470 such as in Fig. 4g.

[0039] Alternatively or in addition, the CATV module may be a cable modem, an Ethernet-over-coax equipment, or any other communication equipment connectable to a wall outlet terminating a coaxial cable.

[0040] Fig. 5a and 5b show examples of a block diagram of a coaxial cable extender and a coaxial cable extender according to an embodiment. A coaxial cable extender according to an embodiment may comprise a first connector 500 comprising an input 510 for the second cable, a first output 520 for the first cable and a second output 530 for a third cable. The first output 520 for the first cable may be galvanic isolated from the signal path between the input 510 and the second output 530. The galvanic isolation may be single or double isolation. The input signal coming via the input 510 may be redirected to the second output 530 via a splitter / tap / directional coupler 540. The directional coupler 540 enables the signal to be used in another circuit by coupling a defined amount of the electromagnetic power in a transmission line to another port / output, e.g. the output 520. The signal path between the input 510 and the second output 530 forms the main transmission line (coaxial cable). The signal of the main transmission line flows along the second cable coming through the input 510 and along the third cable via the second output 530. The coupled signal (i.e. a portion of the signal of the main transmission line) flows along the first cable via the (single or double) galvanic isolated first output 520. The first cable may lead to a push-on filter 550 having outputs for e.g. TV 551, radio 552 and internet 553.

[0041] Fig. 5b shows an example of a coaxial cable extender implemented according to the block diagram of Fig. 5a. The coaxial cable extender according to an embodiment may comprise the first connector 560 comprising a first clamp 565 for the second cable and a second clamp 570 for the third cable. The directions of the signal (in and out) may be marked on top of the first clamp 565 and/or the second clamp 570 with arrows e.g. by moulding. The first clamp 565 in Fig. 5b corresponds to the input 510 in Fig. 5a. The second clamp 570 in Fig. 5b corresponds to the second output 530 in Fig. 5a. An output 580 in Fig. 5b corresponds to the first output 520 in Fig. 5a. A relevant connector, e.g. a male or a female connector may be coupled to the second end of the first cable 590.

[0042] Fig. 6 shows an example of a galvanic isolated Euro Style module 610 which may be coupled to the second end of the first cable 620. The galvanic isolation may be single or double isolation. The galvanic isolated module 610 may replace the male or the female connector, or some other relevant connector, at the end of the first cable. The module 610 may be mounted in a Euro Style face plate, which can then be fitted in to any Euro style back box.

[0043] It will be obvious for a person skilled in the art that with technological developments, the basic idea of the invention can be implemented in a variety of ways. Thus, the invention and its embodiments are not limited to the above-described examples but they may vary within the scope of the claims.

Claims

1. A coaxial cable extender comprising:

- a first connector;
- a first cable,

wherein the first connector is arranged to couple a first end of the first cable with an end of a second cable, the coaxial cable extender being mountable in an outlet box terminating the second cable; and the coaxial cable extender further comprising:

- a male connector or a female connector coupled to a second end of the first cable.

2. The coaxial cable extender according to claim 1, wherein the first cable is of length of 15 to 45 cm, preferably 20 to 40 cm.

3. The coaxial cable extender according to claims 1 or 2, the first connector comprising a first part and a second part being attached to each other with a hinge so that the first part and the second part are bendable in respect to each other.

4. The coaxial cable extender according to claim 3, wherein the hinge is a free-floating hinge enabling the first part to move in parallel with respect to the second part.

5. The coaxial cable extender according to claim 3 or 4, the first connector further comprising an opening for the end of the second cable when the first part and the second part are bent to a closed position, the opening being of adjustable diameter.

6. The coaxial cable extender according to any of claims 3 - 5, wherein the first part and the second part comprise a first projecting part and a second projecting part, respectively, for supporting the second cable and for forming a lining of the opening, wherein the first projecting part fits at least partially inside the second projecting part.

7. The coaxial cable extender according to claim 6, wherein the lining comprises one or more grooves, the one or more grooves being oriented in different direction than the longitudinal direction of the second cable.

8. The coaxial cable extender according to any preceding claim, further comprising:

- a baseplate, on which the male connector or the female connector is mounted.

9. The coaxial cable extender according to claim 8, the baseplate comprising:

- at least one aperture for the connector, the at least one aperture being formed to receive the connector.

10. The coaxial cable extender according to claim 8 or 9, the baseplate comprising a clip, wherein the clip is bendable by applying a pushing or a bending force to the clip.

11. The coaxial cable extender according to claim 10, wherein
when the clip is bent from its original state, the at least one aperture is arranged to receive the connector, and
when the connector has been inserted in the aperture, the clip is arranged to be bent back to its original state such that the clip locks the connector to the baseplate.

12. The coaxial cable extender according to any preceding claim, wherein the first connector comprises:

- input for the second cable;
- a first output for the first cable; and
- a second output for a third cable,

wherein the first output for the first cable is galvanic isolated from a signal path between the input and the second output.

13. The coaxial cable extender according to claim 12, wherein the first connector comprises a first clamp for the second cable and a second clamp for the third cable.

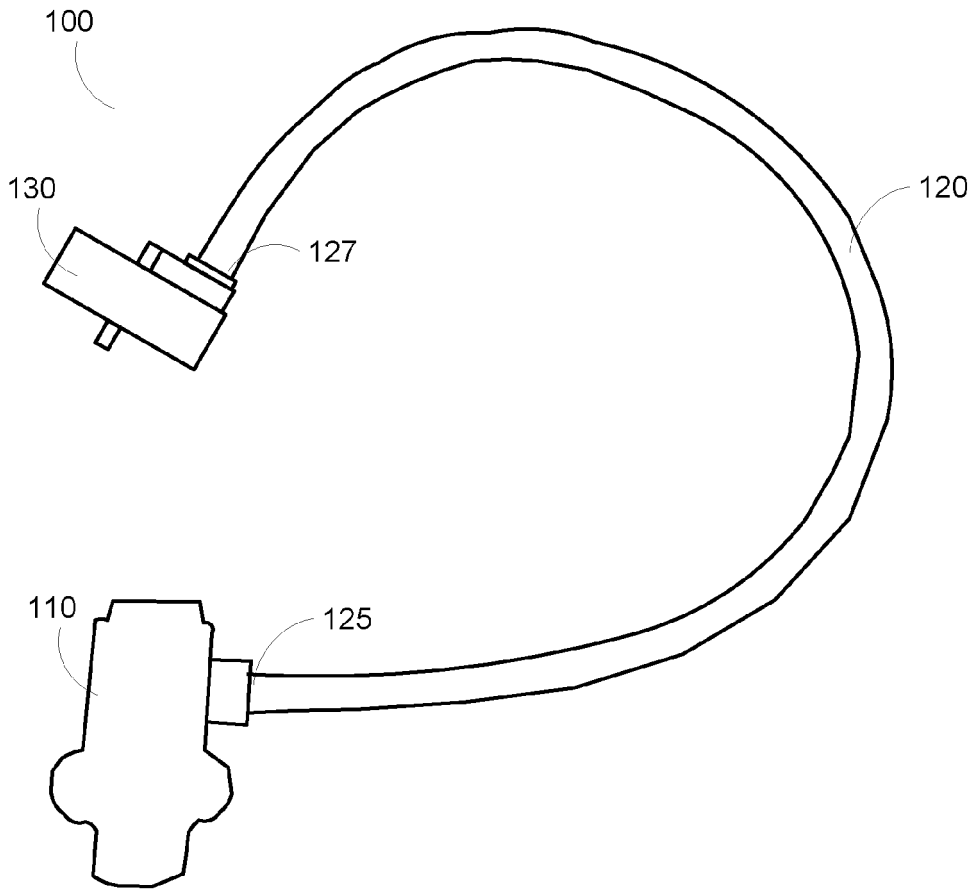


Fig. 1a

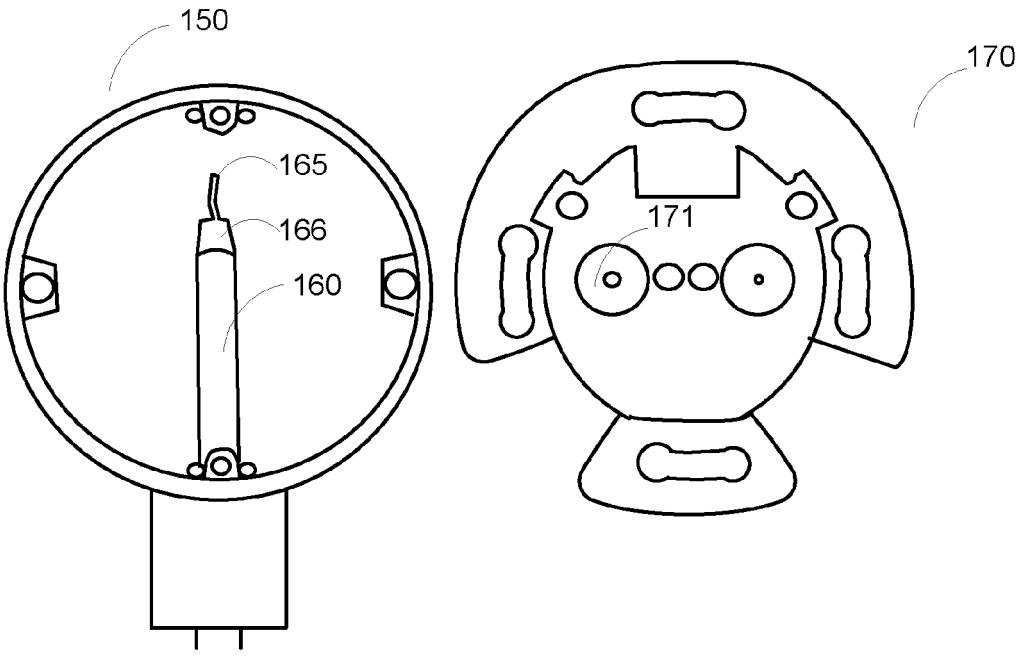


Fig. 1b

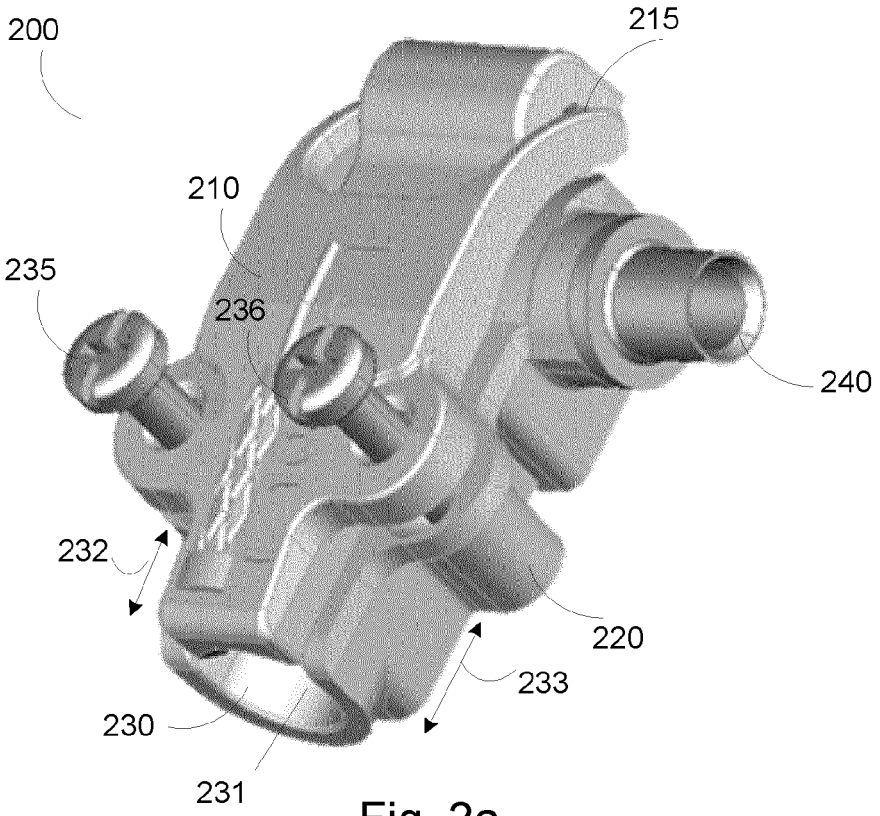


Fig. 2a

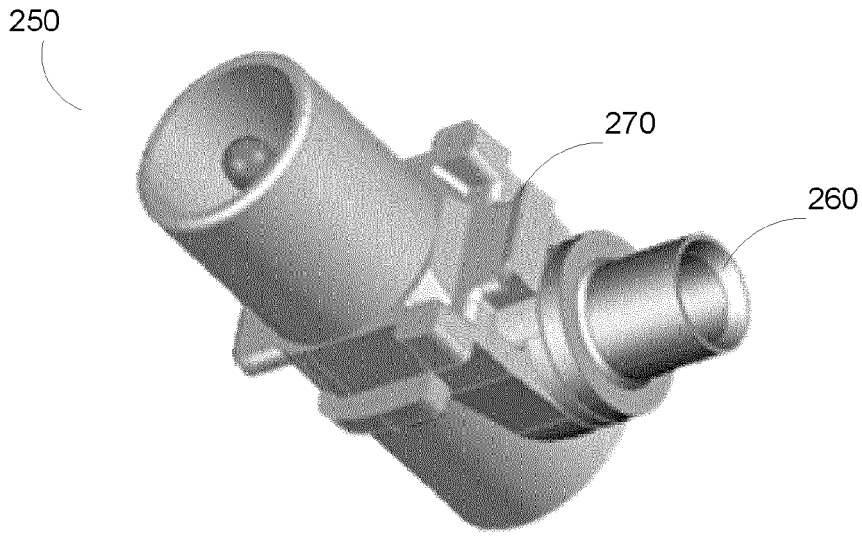


Fig. 2b

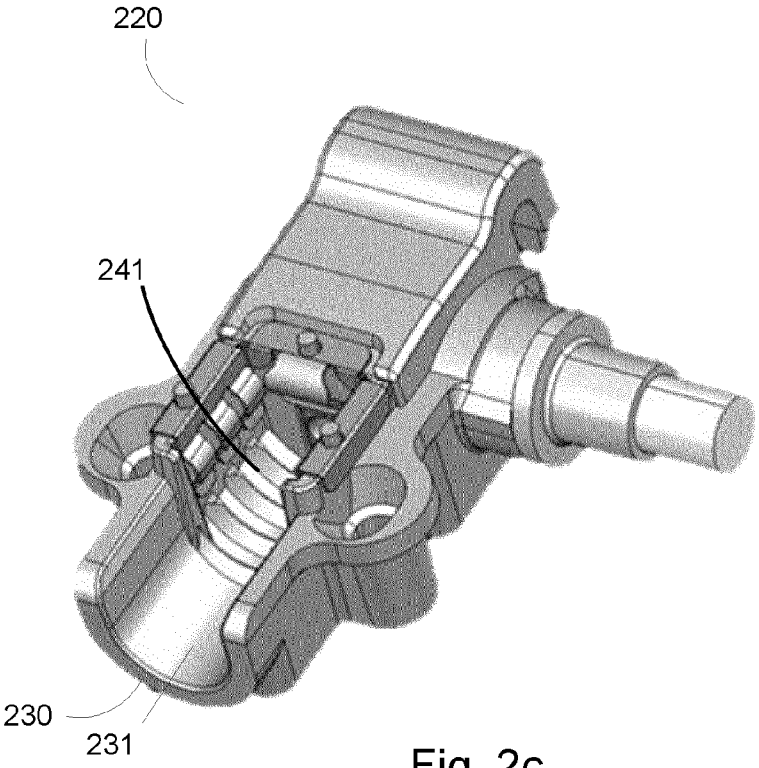


Fig. 2c

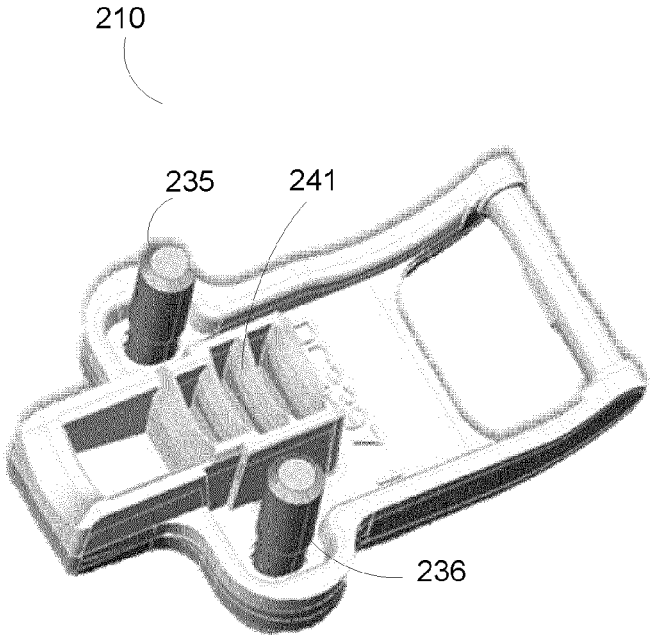


Fig. 2d

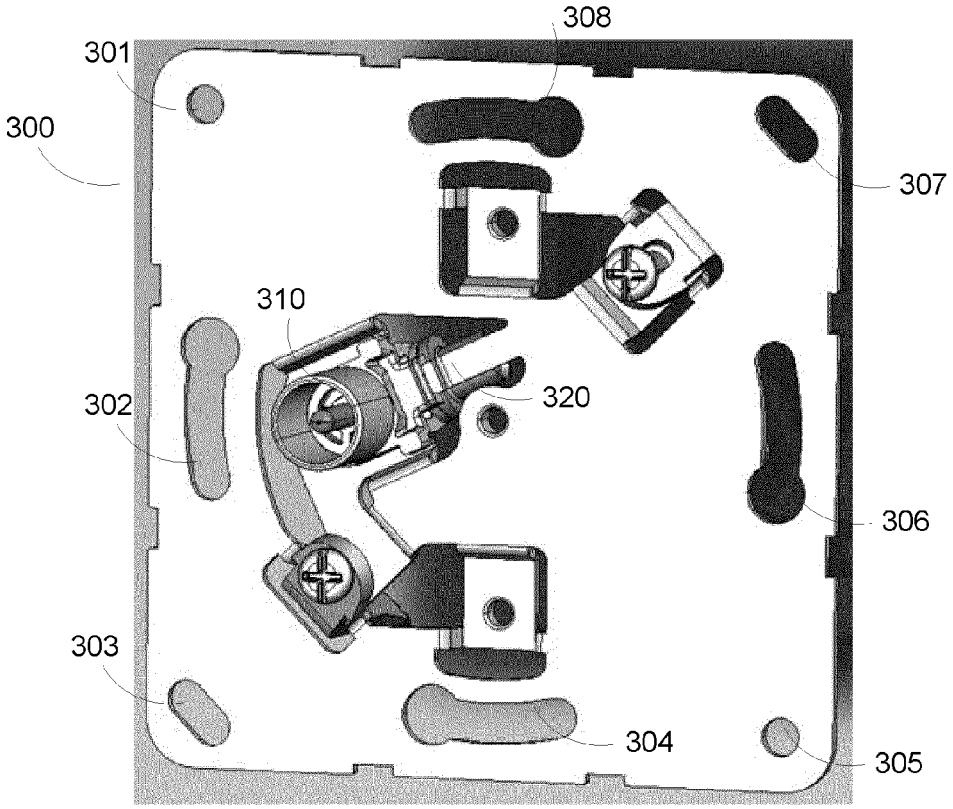


Fig. 3a

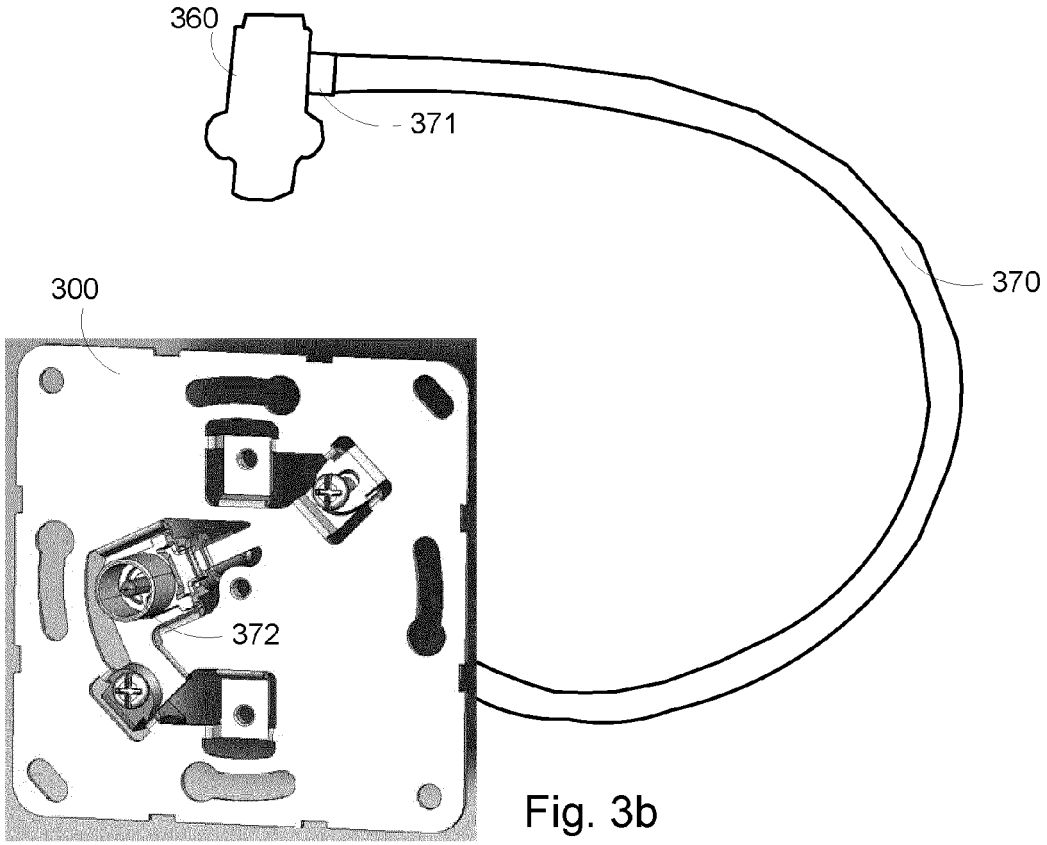


Fig. 3b

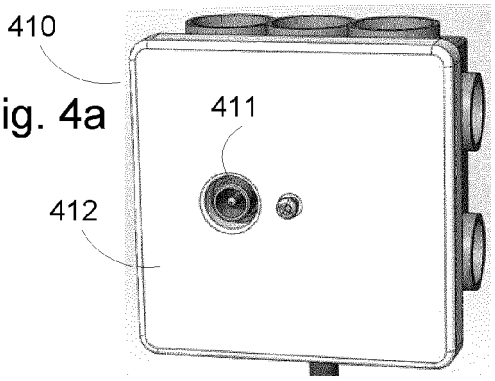


Fig. 4a

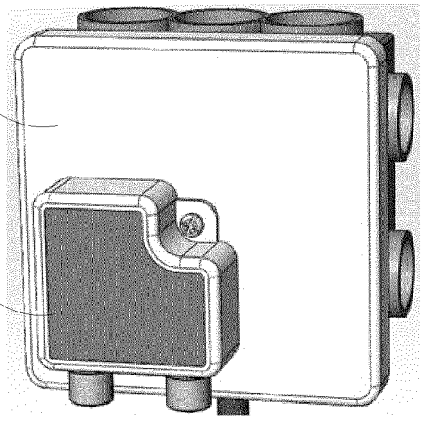


Fig. 4b

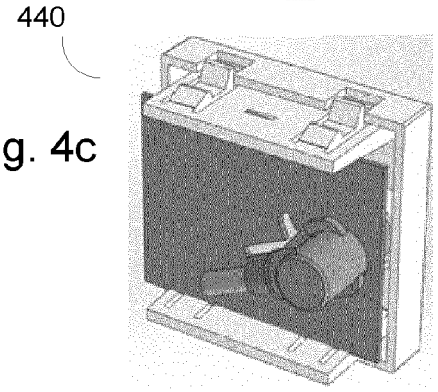


Fig. 4c

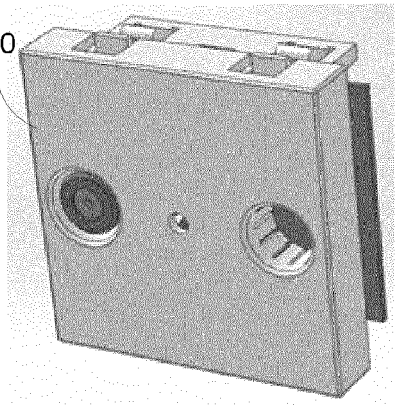


Fig. 4d

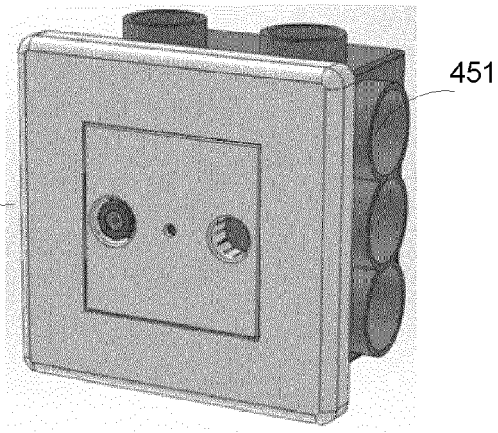


Fig. 4e

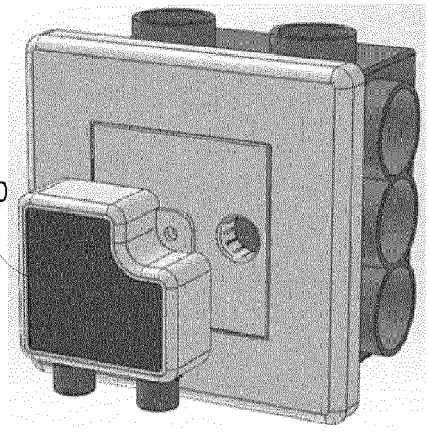


Fig. 4f

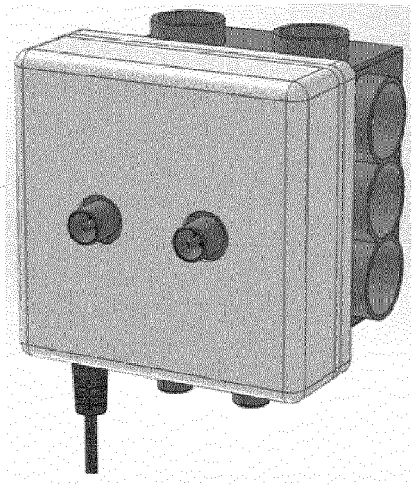


Fig. 4g

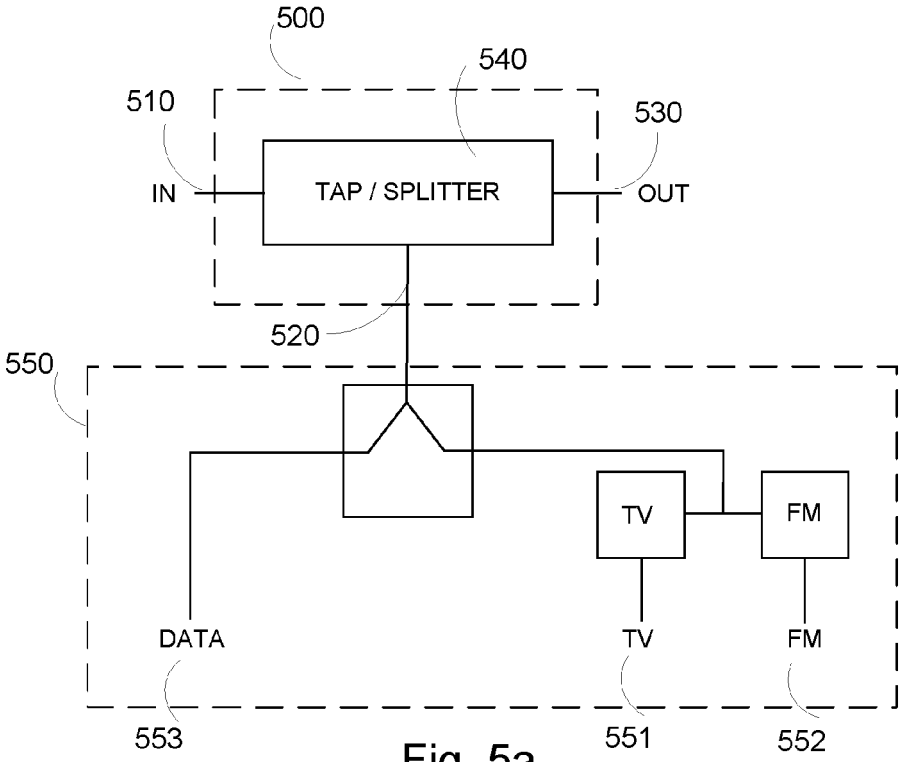

500
540
510
530
IN
TAP / SPLITTER
OUT
520
550
TV
FM
DATA
TV
FM
553
551
552

Fig. 5a

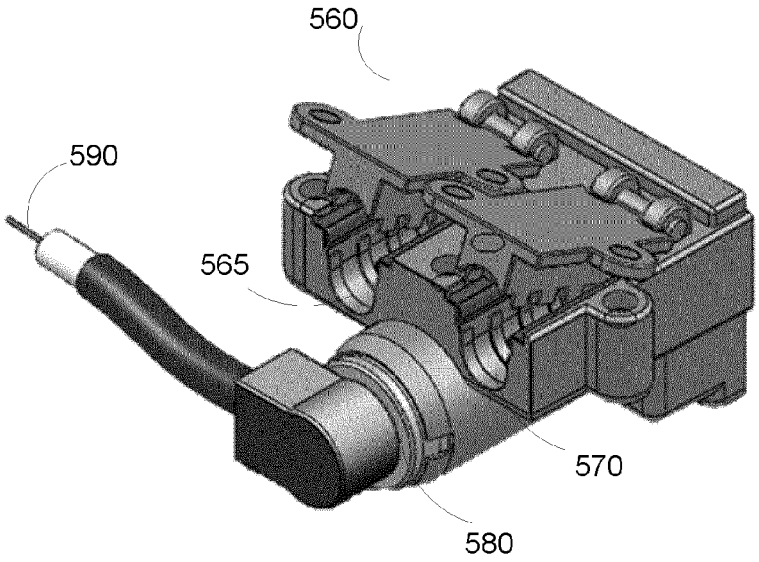

560
590
565
570
580

Fig. 5b

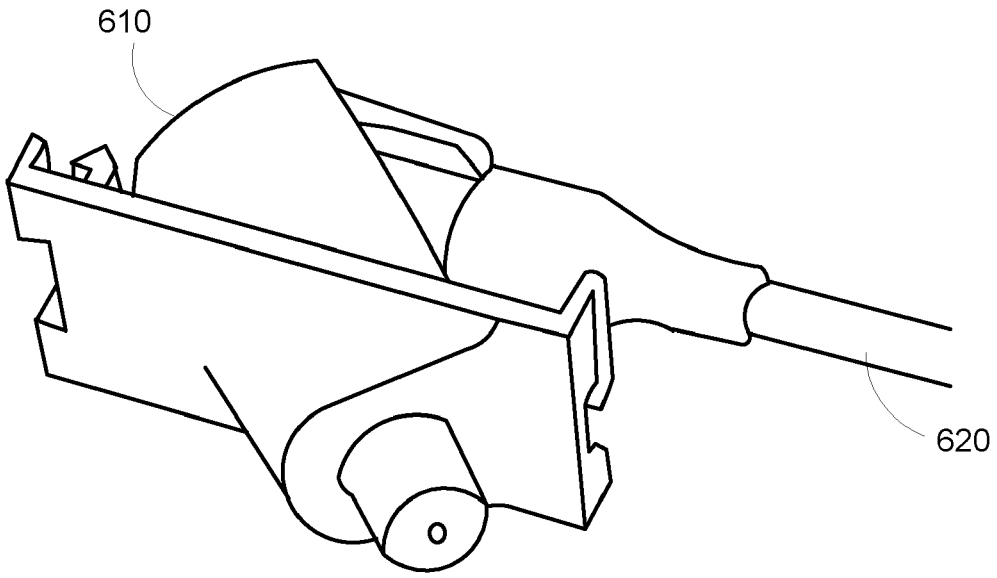


Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 15 39 7539

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 May 2016	Hugueny, Bertrand

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