



(51) International Patent Classification:

G01K 1/16 (2006.01) G01K 7/16 (2006.01)
G01K 1/14 (2006.01) H01M 10/48 (2006.01)

(21) International Application Number:

PCT/IB2017/054118

(22) International Filing Date:

07 July 2017 (07.07.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

201610539532.1 11 July 2016 (11.07.2016) CN

(71) Applicant: **TYCO ELECTRONICS (SHANGHAI) CO. LTD.** [CN/CN]; Sections F and G, Level 1, Building 15, No. 999 Yinglun Road, China (Shanghai) Pilot Free Trade Zone, Shanghai (CN).

(71) Applicant (for MG only): **TYCO ELECTRONICS UK LTD** [GB/GB]; Faraday Road, Dorcan, Swindon Wiltshire SN3 5HH (GB).

(72) Inventor: **SUN, Pengcheng**; c/o Tyco Electronics (Shanghai) Co. Ltd., Building 5, No.1528, Gumei Road, Shanghai (CN).

(74) Agent: **KEANE, David**; Murgitroyd & Company, Scotland House, 165-169 Scotland Street, Glasgow Strathclyde G5 8PL (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: TEMPERATURE MEASUREMENT ASSEMBLY, TEMPERATURE MEASUREMENT DEVICE AND ELECTRICAL DEVICE ASSEMBLY

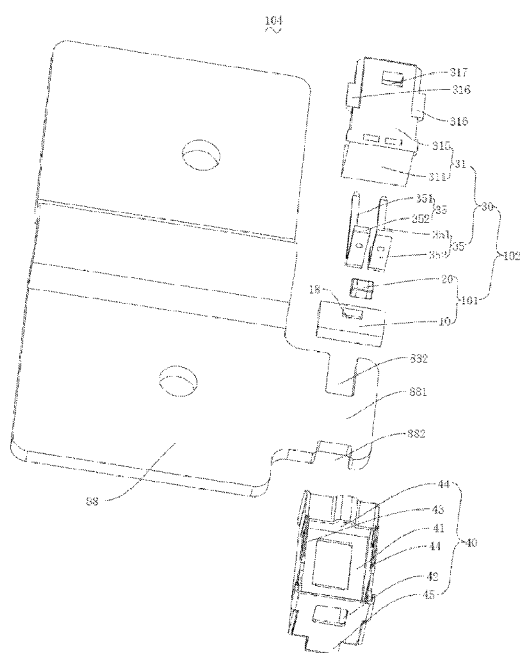


FIG. 12

(57) Abstract: The present invention discloses a temperature measurement assembly, a temperature measurement device and an electrical device assembly. The temperature measurement assembly includes a heat conductive pad and a temperature measurement element. The heat conductive pad is in heat conductive connection with an object to be measured. The temperature measurement element is configured to be in contact with the heat conductive pad and is spaced apart from the object to be measured, and the temperature measurement element is used for detecting the temperature of the object to be measured. The temperature measurement assembly of the present invention can avoid the problem of low efficiency resulting from excessively long adhesive filling time and difficulty in controlling the adhesive curing time by replacing a heat transfer structure manufactured by adhesive filling packaging technology with the heat conductive pad. Meanwhile, the heat conductive pad requires no cooperation of complex structures, and thereby has higher versatility.

Published:

— *with international search report (Art. 21(3))*

**TEMPERATURE MEASUREMENT ASSEMBLY, TEMPERATURE
MEASUREMENT DEVICE AND ELECTRICAL DEVICE ASSEMBLY**

TECHNICAL FIELD

[0001] The present invention relates generally to temperature measurement devices, and in particular to a temperature measurement assembly, temperature measurement device and electrical device assembly.

BACKGROUND

[0002] Due to the existence of resistors, electronic devices present a heat-generating phenomenon during work. Excessively high temperatures caused by the heat generation of the electronic devices not only affect the service lives of the electronic devices, but also endanger other components in connection and cooperation therewith. Especially when larger current passes through the electronic devices, the resulted excessively high temperatures may often cause the electronic devices and related equipment to abnormally work. Therefore, in application occasions where the electronic devices have higher requirements for temperature ranges and safety performance in the prior art, the temperatures of the electronic devices often need to be monitored. Correspondingly, temperature measurement devices are required to monitor the electronic devices in real time. In particular, with the promotion of electric vehicles, how to maintain the stable performance of battery packs serving as power sources of the electric vehicles appear to be extremely critical. The battery packs of the electric vehicles output extremely large current, and generate higher temperatures, which requires temperature measurement on related electronic devices in the battery packs.

SUMMARY OF THE INVENTION

[0003] One of the objectives of the present invention is to provide a temperature measurement assembly, temperature measurement device and electrical device assembly which are simple in structure and convenient to use to overcome the shortcomings of the prior art.

[0004] To achieve the above objective, the present invention is enabled by the following technical solutions.

[0005] The present invention provides a temperature measurement assembly. The temperature measurement assembly includes a heat conductive pad and a temperature measurement element. The heat conductive pad is in heat conductive connection with an object to be measured. The temperature measurement element is configured to be contacted with the heat conductive pad and spaced apart from the object to be measured, and the temperature measurement element is used for detecting the temperature of the object to be measured.

[0006] Preferably, the heat conductive pad is a silicone one-piece.

[0007] Preferably, the heat conductive pad is configured to deform under squeeze of the temperature measurement element to form a recess.

[0008] Preferably, an upper surface of the temperature measurement element and an upper surface of the heat conductive pad are arranged to be coplanar.

[0009] Preferably, the heat conductive pad is configured to be movable to contact with the object to be measured under squeeze.

[0010] Preferably, the heat conductive pad is provided with an accommodating cavity which is provided with an opening on the upper surface of the heat conductive pad. The temperature measurement element is accommodated in the accommodating cavity and is contacted with the bottom of the accommodating cavity.

[0011] Preferably, the temperature measurement element is configured to be contacted with a side wall of the accommodating cavity.

[0012] Preferably, the temperature measurement element is a thermistor.

[0013] Preferably, the temperature measurement element is a chip resistor.

[0014] Preferably, the temperature measurement element is a negative temperature coefficient thermistor.

[0015] Preferably, the temperature measurement assembly further includes a terminal connector. The terminal connector is configured to be in electrical contact with the temperature measurement element.

[0016] Preferably, the terminal connector includes a mounting base and a connection terminal. The mounting base is configured to propel the heat conductive pad to move to contact the object to be measured. The connection terminal is arranged on the mounting base, and both ends of the connection terminal are configured to respectively protrude relative to the mounting base. The connection terminal is electrically connected with the temperature measurement element.

[0017] Preferably, one end of the connection terminal is configured to protrude relative to the mounting base along a direction parallel to the upper surface of the temperature measurement element. The other end of the connection terminal is configured to extend perpendicularly to the one end of the connection terminal.

[0018] Preferably, the mounting base includes a base body and a protruding part. The base body is configured to extend along a direction perpendicular to the upper surface of the temperature measurement element, and a bottom end of the base body is in contact with the upper surface of the temperature measurement element. The protruding part is arranged at a top end of the base body and is configured to extend along a direction parallel to the upper surface of the temperature measurement element.

[0019] Preferably, the temperature measurement assembly further includes a mounting shell. The mounting shell is arranged on the object to be measured and carries the terminal connector.

[0020] Preferably, the bottom of the mounting shell is in contact with the object to be measured, and the mounting shell is provided with a through hole. The heat conductive pad is arranged to be directly opposite to the through hole to form a heat conductive connection with the object to be measured.

[0021] Preferably, the mounting shell is provided with a shell recess; and the bottom of the shell recess is configured to be in contact with the object to be measured. The through hole is disposed at the bottom of the shell recess. The heat conductive pad is accommodated in the shell recess.

[0022] Preferably, slots are respectively disposed on the side walls on both sides of the connection terminal of the mounting shell. Buckles are arranged on both sides of the protruding part. The buckles are in snap-fit with the slots of the mounting shell.

[0023] The present invention further provides a temperature measurement device. The temperature measurement device includes the temperature measurement assembly, terminal connector and mounting shell described in any one of the aforementioned items. The terminal connector is configured to be electrically contacted with the temperature measurement element. The mounting shell is arranged on the object to be measured and carries the terminal connector of the temperature measurement assembly.

[0024] Preferably, the bottom of the shell is configured to be in contact with an electronic device and provided with a through hole. The heat conductive pad is accommodated in the shell and is arranged to be directly opposite to the through hole to form a heat conductive connection with the object to be measured.

[0025] Preferably, the terminal connector includes a mounting base and a connection terminal. The mounting base is configured to propel the heat conductive pad to move to contact with the object to be measured. The connection terminal is arranged on the mounting base, and both ends of the connection terminal are configured to respectively protrude relative to the mounting base; the connection terminal is electrically connected with the temperature measurement element; and one end of the connection terminal is configured to connect with a mating connector.

[0026] Preferably, the mounting base includes a base body and a protruding part. The base body is configured to extend along a direction perpendicular to the upper surface of the temperature measurement element, and a bottom end of the base body is in contact with the upper surface of the temperature measurement element. The protruding part is arranged at a top end of the base body and is configured to extend along a direction parallel to the upper surface of the temperature measurement element.

[0027] Preferably, the terminal connector is detachably arranged on the mounting shell.

[0028] Preferably, slots are respectively disposed on the side walls of the connection terminal of the mounting shell. Buckles are arranged on both sides of the protruding part. The buckles are in snap-fit with the slots of the mounting shell.

[0029] Preferably, the mounting shell is provided with a welding part, and the welding part is configured to be joined with the electronic device by welding.

[0030] The present invention further provides an electrical device assembly. The electrical device assembly includes an object to be measured and the temperature measurement device described in any one of the aforementioned items. The mounting shell is arranged on the object to be measured; and the temperature measurement element is in heat conductive connection with the object to be measured.

[0031] Preferably, the mounting shell is provided with a welding part, and the welding part is joined with the object to be measured by welding.

[0032] Preferably, the object to be measured is a bus bar.

[0033] Preferably, the temperature measurement device further includes a mating connector. The mating connector is connected with one end of the connection terminal.

[0034] Preferably, the mating connector may include a mating connection shell. The upper surface of the mating connector may be provided with a protrusively arranged limiting stopper. A limiting hole may be disposed on the mounting base of the terminal connector. The limiting stopper is in block fitting with the limiting hole.

[0035] Preferably, the mating connector may be provided with a plug-in cavity. The mating connector may further include a mating connection terminal, and the mating connection terminal is accommodated in the plug-in cavity. One end of the connection terminal is electrically connected with the mating connection terminal.

[0036] Preferably, the mounting shell is provided with a plug-in through hole. The mating connector may extend into the plug-in through hole to be connected with the terminal connector.

[0037] Compared with the prior art, the temperature measurement assembly of the present invention can avoid the problem of low efficiency resulting from excessively long adhesive

filling time and difficulty in controlling the adhesive curing time by replacing a heat transfer structure manufactured by adhesive filling packaging technology with the heat conductive pad. Meanwhile, the heat conductive pad requires no cooperation of complex structures, and thereby has higher versatility. Therefore, the temperature measurement assembly is simple in structure, high in application efficiency and high in versatility.

[0038] Preferably, the temperature measurement element may be accommodated in the accommodating cavity in the heat conductive pad, thereby shortening the heat conductive distance from the electronic device, reducing the heat resistance and shortening the temperature measurement time, and enabling other equipments to respond quickly, for example, providing a possibility for vehicles to respond to fast operations. Correspondingly, the heat conductive pad made of silicone can achieve better insulation and heat conductive performances. Further, the hardness of the silicone satisfies the requirements of plastic deformation, that is, the heat conductive pad will form a recess under squeeze of the temperature measurement element, thereby reducing the heat resistance and improving the temperature measurement response speed. In addition, compared with wrapping the temperature measurement element by curing the heat conductive adhesive, the use of the detachable heat conductive pad, can achieve single replacement of the temperature measurement element and thereby avoid overall replacement and reduce the cost.

BRIEF DESCRIPTION OF DRAWINGS

[0039] Fig. 1 is a structural schematic diagram of a temperature measurement assembly provided by the present invention.

[0040] Fig. 2 is a perspective exploded view of the temperature measurement assembly shown in Fig. 1.

[0041] Fig. 3 is a structural schematic diagram of the heat conductive pad shown in Fig. 1 without any deformation.

[0042] Fig. 4 is a structural schematic diagram of an embodiment of a temperature measurement device provided by the present invention.

[0043] Fig. 5 is a top view of the temperature measurement device shown in Fig. 4.

[0044] Fig. 6 is a cross-sectional view of the temperature measurement device shown in Fig. 5 along C-C line.

[0045] Fig. 7 is a cross-sectional view of the temperature measurement device shown in Fig. 5 along D-D line.

[0046] Fig. 8 is a structural schematic diagram of another embodiment of a temperature measurement device provided by the present invention.

[0047] Fig. 9 is a perspective exploded view of the temperature measurement device shown in Fig. 8.

[0048] Fig. 10 is a structural schematic diagram of the mounting shell shown in Fig. 9.

[0049] Fig. 11 is a structural schematic diagram of an embodiment of an electrical device assembly provided by the present invention.

[0050] Fig. 12 is a perspective exploded view of the electrical device assembly shown in Fig. 11.

[0051] Fig. 13 is a structural schematic diagram of another embodiment of an electrical device assembly provided by the present invention.

[0052] Fig. 14 is a perspective exploded view of the electrical device assembly shown in Fig. 13.

[0053] Fig. 15 is a cross-sectional view of the electrical device assembly shown in Fig. 13 along G-G line.

[0054] Fig. 16 is a structural schematic diagram of the mating connector shown in Fig. 13.

[0055] Fig. 17 is a schematic assembly diagram of the mating connector and the temperature measurement device shown in Fig. 16.

[0056] Fig. 18 is a top view of the assembled mating connector and the temperature measurement device shown in Fig. 17.

[0057] Fig. 19 is a cross-sectional view of the assembled mating connector and the temperature measurement device shown in Fig. 18 along E-E line.

[0058] Fig. 20 is a cross-sectional view of the assembled mating connector and the temperature measurement device shown in Fig. 18 along F-F line.

DETAILED DESCRIPTION OF EMBODIMENTS

[0059] The present invention will be described below in detail with reference to the drawings.

Embodiment 1:

[0060] With reference to Fig. 1 and Fig. 2, the present invention provides a temperature measurement assembly 101. The temperature measurement assembly 101 includes a heat conductive pad 10 and a temperature measurement element 20. The temperature measurement element 20 is configured to be contacted with the heat conductive pad 10. The heat conductive pad 10 is configured to be in heat conductive connection with an object 88 to be measured described below. It is conceivable that the heat conductive pad 10 can be made of any heat conductive material. To comprehensively consider good elastic deformability, insulation performance and heat conductivity, in the present embodiment, the heat conductive pad 10 is a silicone one-piece. Of course, some specifically required heat conductive materials, such as ceramic powder, can be doped into the silicone one-piece.

[0061] With reference to Fig. 3 together, it is a structural schematic diagram of the heat conductive pad 10 without any deformation, namely in a shape of a flat plate. In the present embodiment, the hardness of the silicone of the heat conductive pad 10 satisfies the requirements of plastic deformation. The term of “plastic deformation” refers to changes in the relative positions between points due to an external force applied to a solid, despite the removal of the external force with the shape of the solid retaining more or less deformation yet irrecoverable completely, which is the synonym for “plasticity deformation”. Elastic deformation is opposite to the plastic deformation. Specifically, upon being completely assembled, the heat conductive pad 10 undergoes plastic deformation under the squeeze of the temperature measurement element 20 to form a recess 18. At this time, the recess 18 wraps the bottom and the periphery of the temperature measurement element 20. To achieve better-insulated conduction performance and save the mounting space, in the present embodiment, upon being completely assembled, the heat conductive pad 10 is accommodated

in the recess 18, and an upper surface of the heat conductive pad 10 and the upper surface of the temperature measurement element 20 are coplanar.

[0062] Continuously with reference to Figs.1 and 2, the temperature measurement element 20 is used for measuring the temperature of the object 88 to be measured. It is conceivable to measure temperature by measuring the changes of the physical properties because the physical properties of the temperature measurement element 20 will correspondingly change according to the temperature change. The temperature measurement element 20 can convert the temperature change into an electrical signal, wherein the temperature measurement element 20 may be a thermistor. To further facilitate the mounting, the temperature measurement element 20 may be a chip resistor. In the present embodiment, to improve the precision of the temperature measurement, the temperature measurement element 20 is a negative temperature coefficient (NTC) thermistor.

[0063] The temperature measurement element 20 is in contact with the heat conductive pad 10. In order to further shorten the heat conductive distance, the temperature measurement element 20 and the object 88 to be measured are respectively located on both sides of the heat conductive pad 10. In the present embodiment, the temperature measurement element 20 is accommodated in an accommodating cavity 11 of the heat conductive pad 10. The temperature measurement element 20 is approximately rectangular solid. The temperature measurement element 20 is respectively in contact with an inner side wall and a bottom wall of the accommodating cavity 11 to improve the heat conductive efficiency and precision. To achieve a better contact effect, the upper surface of the temperature measurement element 20 and the upper surface of the heat conductive pad 10 are coplanar.

Embodiment 2:

[0064] With reference to Figs.4 to 7, the present invention further provides a temperature measurement device 102. The temperature measurement device 102 includes a terminal connector 30 and the foregoing temperature measurement assembly 101. The terminal connector 30 is configured to be in contact with the temperature measurement element 20.

[0065] The terminal connector 30 includes a mounting base 31 and a connection terminal 35. During mounting, the mounting base 31 propels the temperature measurement element 20

to move to contact with the object 88 to be measured. Meanwhile, the mounting base 31 is used for carrying the connection terminal 35. In the present embodiment, in order to facilitate fitting with a mating connector 60 and a mounting shell 40 described below, the mounting base 31 includes a base body 311 and a protruding part 315.

[0066] The base body 311 is used for carrying the connection terminal 35 and the protruding part 315. In the present embodiment, the base body 311 is approximately rectangular solid. A bottom surface of the base body 311 is a plane so that the connection terminal 35 is in contact with the temperature measurement element 20. In order to conveniently carry the connection terminal 35, the base body 311 may be provided with a mounting cavity. Of course, the connection terminal 35 can be embedded in a mold in advance, and then the base body 311 is manufactured by the mold. In the present embodiment, a notch is disposed on the bottom surface of the base body 311 to accommodate the connection terminal 35, so that the connection terminal 35 forms a surface-surface contact with the temperature measurement element 20.

[0067] The protruding part 315 is arranged at a top end of the base body 311 and extends along a direction parallel to the upper surface of the temperature measurement element 20. The protruding part 315 is approximately rectangular solid. To be stably arranged on the mounting shell 40 described below, buckles 316 are respectively arranged on both sides of the protruding part 315. The cross-sections of the buckles 316 located on the both sides of the protruding part 315 can be hypotenuses of an isosceles inverted triangle to be conveniently pressed and snapped in the mounting shell 40. The buckles 316 are in snap-fit with slots 43 of the mounting shell 40 described below to achieve a detachable connection and thus to conveniently replace the terminal connector 30. To conveniently detach a mating connecting shell 66 described below, the upper surface of the protruding part 315 may be provided with a limiting hole 317, as long as the shape and the size of the limiting hole 317 can match with those of a limiting stopper 665 on the upper surface of the mating connecting shell 66. In the present embodiment, the limiting hole 317 is a rectangular through hole.

[0068] The connection terminal 35 is arranged on the mounting base 31. The connection terminal 35 is arranged to be in contact with the temperature measurement element 20 to

receive a corresponding temperature change signal generated by the temperature measurement element 20. Both ends of the connection terminal 35 respectively protrude relative to the mounting base 31. In the present embodiment, the connection terminal 35 is configured to be in contact with the upper surface of the temperature measurement element 20. To conveniently realize the connection with other signal conversion, transmission or display devices, the connection terminal 35 has two ends 351, 352, and the two ends 351, 352 protrude relative to the mounting base 31. Particularly, one end 351 of the connection terminal 35 protrudes relative to the mounting base 31 along a direction parallel to the upper surface of the temperature measurement element 20. The other end 352 of the connection terminal 35 extends perpendicular to one end 351 of the connection terminal 35, that is, along a direction perpendicular to the upper surface of the temperature measurement element 20. One end 351 of the connection terminal 35 extends to be inserted into a plug-in cavity 661 of the mating connecting shell 66 described below. In the present embodiment, the connection terminal 35 is an approximately L-shaped one-piece made of a metal conductor. Two connection terminals 35 are provided and are respectively in contact with the temperature measurement element 20.

Embodiment 3:

[0069] As another implementation of Embodiment 2, please refer to Fig. 8 and Fig. 9, which are structural schematic diagrams of a temperature measurement device 103 provided by the present invention. Different from embodiment 2, the temperature measurement device 103 further includes a mounting shell 40. The mounting shell 40 is arranged on the object 88 to be measured. The temperature measurement assembly 101 is arranged on the mounting shell 40.

[0070] With reference to Fig. 10 together, the mounting shell 40 is used for carrying the temperature measurement assembly 101. In the present embodiment, for stable carrying, the mounting shell 40 is provided with a shell recess 41. The shell recess 41 sinks from the upper surface to the lower surface of the mounting shell 40. The bottom of the shell recess 41 is in contact with the object 88 to be measured. The bottom of the shell recess 41 is provided with a connecting through hole 42, as long as the shell recess 41 satisfies the requirements for accommodating corresponding components. In the present embodiment, the shell recess 41 is

an approximately rectangular solid. The connecting through hole 42 is an approximately rectangular solid.

[0071] To conveniently detach and mount the terminal connector 30 by snap fitting, the shell recess 41 is provided with slots 43 in two side walls along the extending direction of the protruding part 315. In the present embodiment, the slots 43 are rectangular through grooves, that is, rectangular through holes.

[0072] To facilitate the insertion assembly with the mating connecting shell 66, a plug-in through hole 44 is disposed in the side wall at a front end of the shell recess 41. The plug-in through hole 44 communicates with the shell recess 41. The plug-in through hole 44 enables the mating connecting shell 66 to extend along a direction opposite to the extending direction of the protruding part 315 to be connected with one end 351 of the connection terminal 35.

[0073] To be stably arranged on the object 88 to be measured, the mounting shell 40 is provided with a welding part 45. The welding part 45 is in welding connection with the object 88 to be measured.

Embodiment 4:

[0074] Please refer to Figs. 11 and 12, which show an electrical device assembly 104 provided by the present invention. The electrical device assembly 104 includes an object 88 to be measured and the temperature measurement device 103 recorded in Embodiment 3. The mounting shell 40 is arranged on the object 88 to be measured. The temperature measurement element 20 is in heat conductive connection with the object 88 to be measured.

[0075] The object 88 to be measured can be any device requiring temperature measurement. In the present embodiment, the object 88 to be measured is a bus bar (called in English name). The object 88 to be measured is provided with a protrudingly arranged mounting part 881. Mounting notches 882 are disposed on both sides of the mounting part 881. The two welding parts 45 of the mounting shell 41 are bent to contact the lower surface of the mounting part 881 and then are connected by welding, and enable the bottom of the shell recess 41 to be in contact with the upper surface of the mounting part 881. The mounting notches 882 are used for respectively accommodating the welding parts 45 so as to realize a stable connection.

Embodiment 5:

[0076] As another implementation of Embodiment 4, please refer to Figs.13 to 15, which show another electrical device assembly 105 provided by the present invention. With reference to Fig. 16 together, different from Embodiment 4, the temperature measurement device 102 further includes a mating connector 60. The mating connector 60 includes a mating connecting shell 66 and a mating connecting terminal (not shown in the figures).

[0077] With reference to Figs.17 to 20 together, the mating connecting shell 66 is connected with the terminal connector 30. The mating connecting shell 66 is used for transmitting a temperature change signal transmitted by the terminal connector 30 to a corresponding display device. To realize the stable connection, in the present embodiment, a plug-in cavity 661 is disposed in the mating connecting shell 66. The mating connecting terminal is accommodated in the plug-in cavity 661. The mating connecting terminal is electrically connected with one end 351 of the connection terminal 35.

[0078] To conveniently realize the stable connection and rapid disconnection with the terminal connector 30, a limiting stopper 665 is disposed on the upper surface of the mating connecting shell 66. The limiting stopper 665 may be a convex column, a boss and the like. In the present embodiment, the limiting stopper 665 has a trapezoidal cross-section, so that the limiting stopper 665 can be conveniently mounted in the limiting hole 317 of the terminal connector 30 along a direction opposite to the extending direction of the protruding part 315, and retreat from the limiting hole 317 along the extending direction of the protruding part 315.

[0079] The assembly manner of the electrical device assembly 104 will be specifically illustrated below:

[0080] Firstly, the mounting shell 40 is welded on the object 88 to be measured. The welding part 45 in an initial state arranged at the bottom of the shell recess 41 and extending along the depth direction of the shell recess 41 is inserted in the mounting notch 882 of the object 88 to be measured, and then the welding part 45 is bent to contact the lower surface of the mounting part 881. The connection between the welding part 45 and the mounting part 881 is realized by welding.

[0081] Then, a device for receiving and converting a temperature signal is arranged on the mounting shell 40. The heat conductive pad 10 is arranged in the shell recess 41 and directly opposite to the connecting through hole 42. The temperature measurement element 20 is arranged in the accommodating cavity 11 of the heat conductive pad 10. The terminal connector 30 is arranged in the shell recess 41 so that both of the connection terminal 35 and the base body 311 of the mounting base 31 are in contact with the upper surface of the temperature measurement element 20. The buckles 316 on the protruding part 315 are pressed to be snapped into the slots 43 of the mounting shell 40. In a process of pressing the buckles 316 to realize the snap fit, the base body 311 enables the heat conductive pad 10 to generate elastic deformation so as to drive the heat conductive pad 10 to move to contact with the upper surface of the mounting part 881 of the object 88 to be measured.

[0082] Finally, the mating connecting shell 66 is arranged to and connected with the terminal connector 30. The end of the mating connecting shell 66 provided with the plug-in cavity 661 is inserted in the shell recess 41 from the plug-in through hole 44 of the mounting shell 40. The plug-in cavity 661 is aligned with one end 351 of the connection terminal 35 to realize the insertion fit between the connection terminal 35 and the plug-in cavity 661. Meanwhile, the limiting stopper 665 on the upper surface of the mating connecting shell 66 is pushed into the limiting hole 316 on the protruding part 315.

[0083] The foregoing descriptions are merely preferred embodiments of the present invention and are not intended to limit the protection scope of the present invention. Therefore, any modifications, equivalents or improvements or the like made within the spirit of the present invention are all encompassed within the scope of the claims of the present invention.

CLAIMS

1. A temperature measurement assembly, comprising:
a heat conductive pad for heat conductively connecting with an object to be measured;
and
a temperature measurement element configured to be in contact with the heat conductive pad and spaced apart from the object to be measured,
wherein the temperature measurement element is used for detecting the temperature of the object to be measured.
2. The temperature measurement assembly of claim 1, wherein the heat conductive pad is a one-piece silicone member.
3. The temperature measurement assembly of claim 1, wherein the heat conductive pad is configured to be deformed under squeeze of the temperature measurement element to form a recess.
4. The temperature measurement assembly of claim 1, wherein the heat conductive pad is provided with an accommodating cavity; the accommodating cavity is provided with an opening on the upper surface of the heat conductive pad; and the temperature measurement element is accommodated in the accommodating cavity and is in contact with the bottom of the accommodating cavity.
5. The temperature measurement assembly of claim 1, wherein the temperature measurement element is a chip resistor.
6. The temperature measurement assembly of claim 1, further comprising a terminal connector, wherein the terminal connector is configured to be in electrical contact with the temperature measurement element.

7. The temperature measurement assembly of claim 6, wherein the terminal connector comprises a mounting base and a connection terminal;

the mounting base is configured to propel the heat conductive pad to move to contact with the object to be measured;

the connection terminal is arranged on the mounting base, and both ends of the connection terminal are configured to respectively protrude relative to the mounting base; and

the connection terminal is electrically connected with the temperature measurement element.

8. The temperature measurement assembly of claim 7, wherein one end of the connection terminal is configured to protrude relative to the mounting base along a direction parallel to the upper surface of the temperature measurement element; and the other end of the connection terminal is configured to extend perpendicularly to the one end of the connection terminal.

9. The temperature measurement assembly of claim 7, wherein the mounting base comprises a base body and a protruding part;

the base body is configured to extend along a direction perpendicular to the upper surface of the temperature measurement element, and a bottom end of the base body is in contact with the upper surface of the temperature measurement element; and

the protruding part is arranged at a top end of the base body and is configured to extend along a direction parallel to the upper surface of the temperature measurement element.

10. The temperature measurement assembly of claim 9, wherein the temperature measurement assembly further comprises a mounting shell; and

the mounting shell is arranged on the object to be measured and carries the terminal connector.

11. The temperature measurement assembly of claim 10, wherein

the bottom of the mounting shell is in contact with the object to be measured, and the mounting shell is provided with a through hole; and the heat conductive pad is arranged to be

directly opposite to the through hole so as to form a heat conductive connection with the object to be measured.

12. The temperature measurement assembly of claim 11, wherein
the mounting shell is provided with a shell recess; the bottom of the shell recess is configured to be in contact with the object to be measured;
the through hole is disposed at the bottom of the shell recess; and
the heat conductive pad is accommodated in the shell recess.

13. The temperature measurement assembly of claim 12, wherein
slots are respectively disposed on side walls on both sides of the connection terminal of the mounting shell;
buckles are arranged on both sides of the protruding part; and
the buckles are in snap-fit with the slots of the mounting shell.

14. A temperature measurement device, comprising:
the temperature measurement assembly of any one of claims 1-5;
a terminal connector configured to be electrically contacted with the temperature measurement element; and
a mounting shell arranged on the object to be measured and carrying the terminal connector of the temperature measurement assembly.

15. The temperature measurement device of claim 14, wherein
the bottom of the shell is configured to be in contact with an electronic device, and provided with a through hole; and
the heat conductive pad is accommodated in the shell and is arranged to be directly opposite to the through hole so as to form a heat conductive connection with the object to be measured.

16. The temperature measurement device of claim 14, wherein the terminal connector comprises a mounting base and a connection terminal;

the mounting base is configured to propel the heat conductive pad to move to contact with the object to be measured;

the connection terminal is arranged on the mounting base, and both ends of the connection terminal are configured to respectively protrude relative to the mounting base; the connection terminal is electrically connected with the temperature measurement element; and one end of the connection terminal is used for connecting with a mating connector.

17. The temperature measurement device of claim 16, wherein the mounting base comprises a base body and a protruding part;

the base body is configured to extend along a direction perpendicular to the upper surface of the temperature measurement element, and a bottom end of the base body is in contact with the upper surface of the temperature measurement element; and

the protruding part is arranged at a top end of the base body and is configured to extend along a direction parallel to the upper surface of the temperature measurement element.

18. The temperature measurement device of claim 17, wherein slots are respectively disposed on the side walls of the connection terminal of the mounting shell;

buckles are arranged on both sides of the protruding part; and

the buckles are in snap-fit with the slots of the mounting shell.

19. An electrical device assembly, comprising an object to be measured and the temperature measurement device of any one of claims 14-18, wherein

the mounting shell is arranged on the object to be measured; and

the temperature measurement element is in heat conductive connection with the object to be measured.

20. The electrical device assembly of claim 19, wherein the object to be measured is a bus bar.

1/18

101

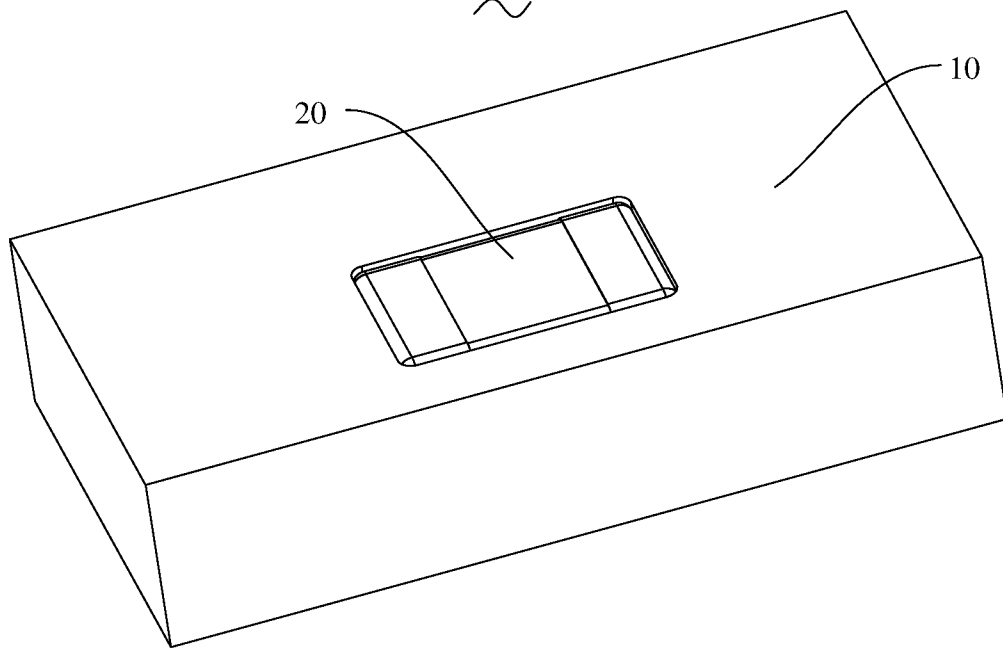


FIG. 1

101

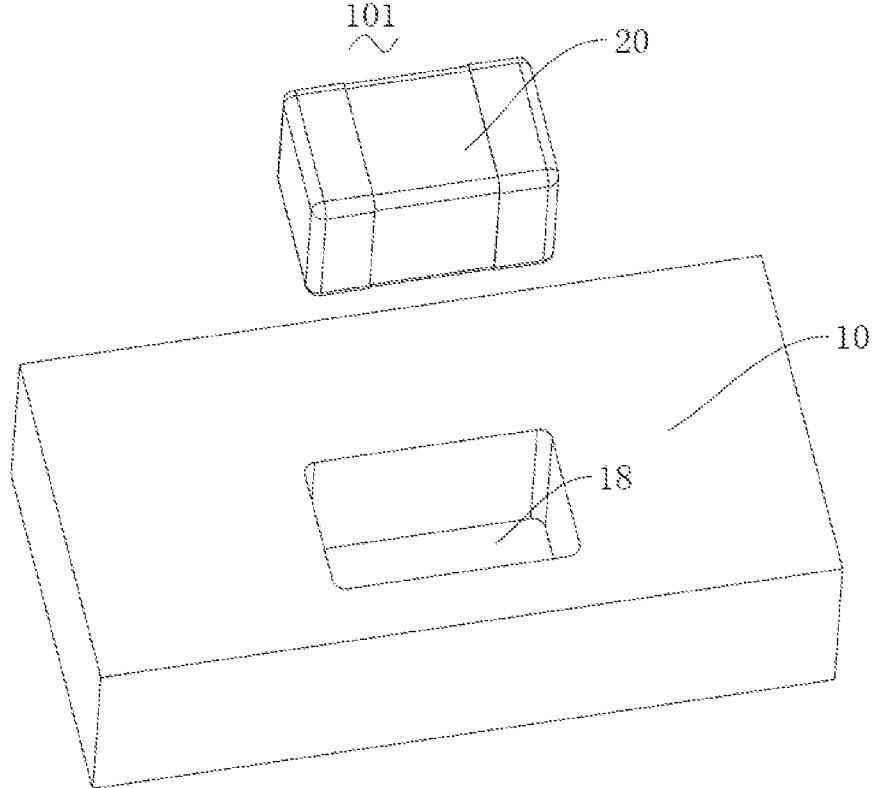


FIG. 2

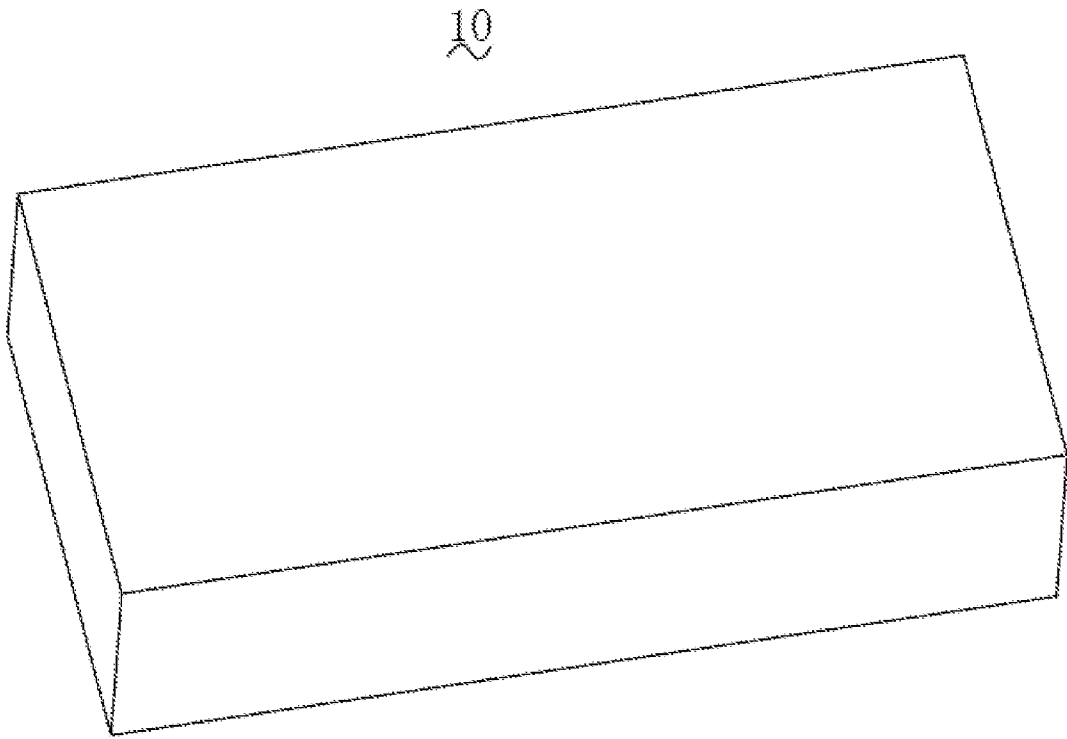


FIG. 3

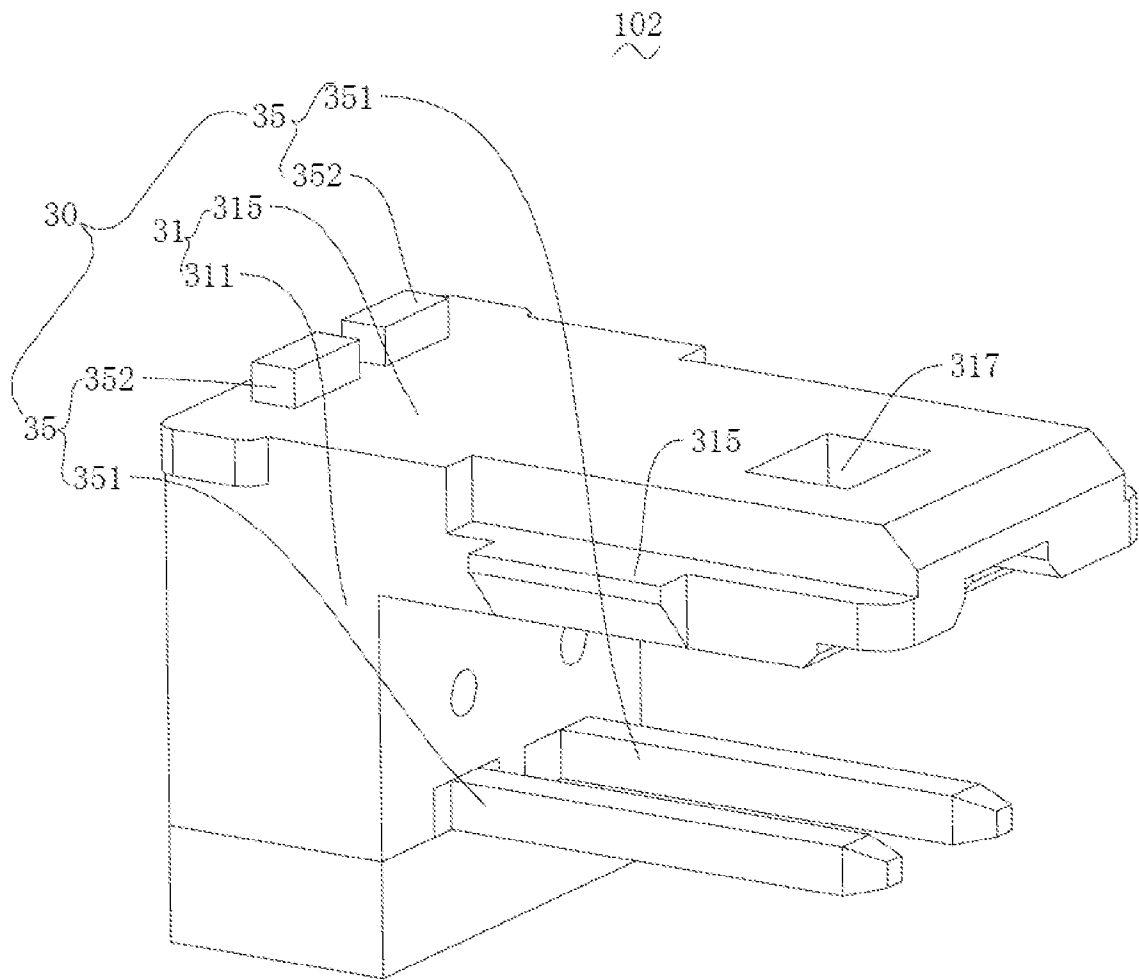


FIG. 4

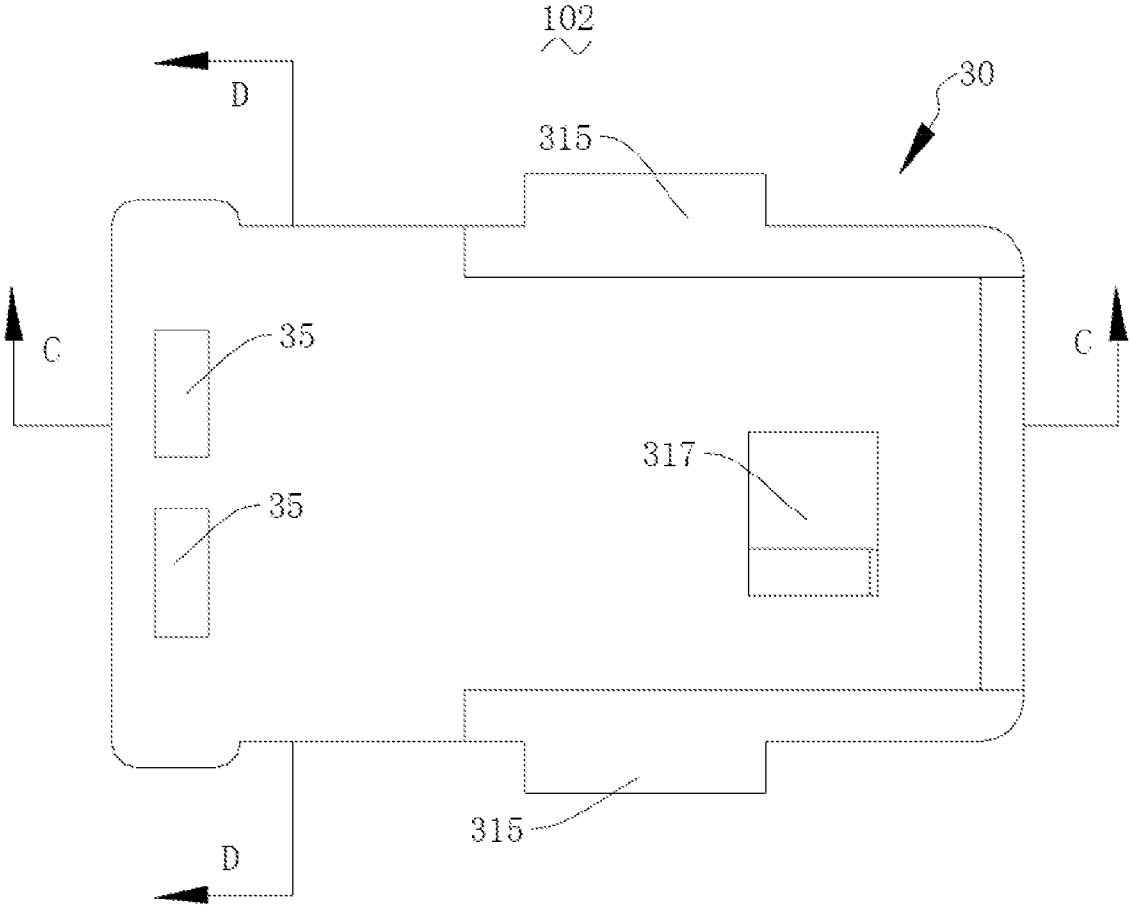


FIG. 5

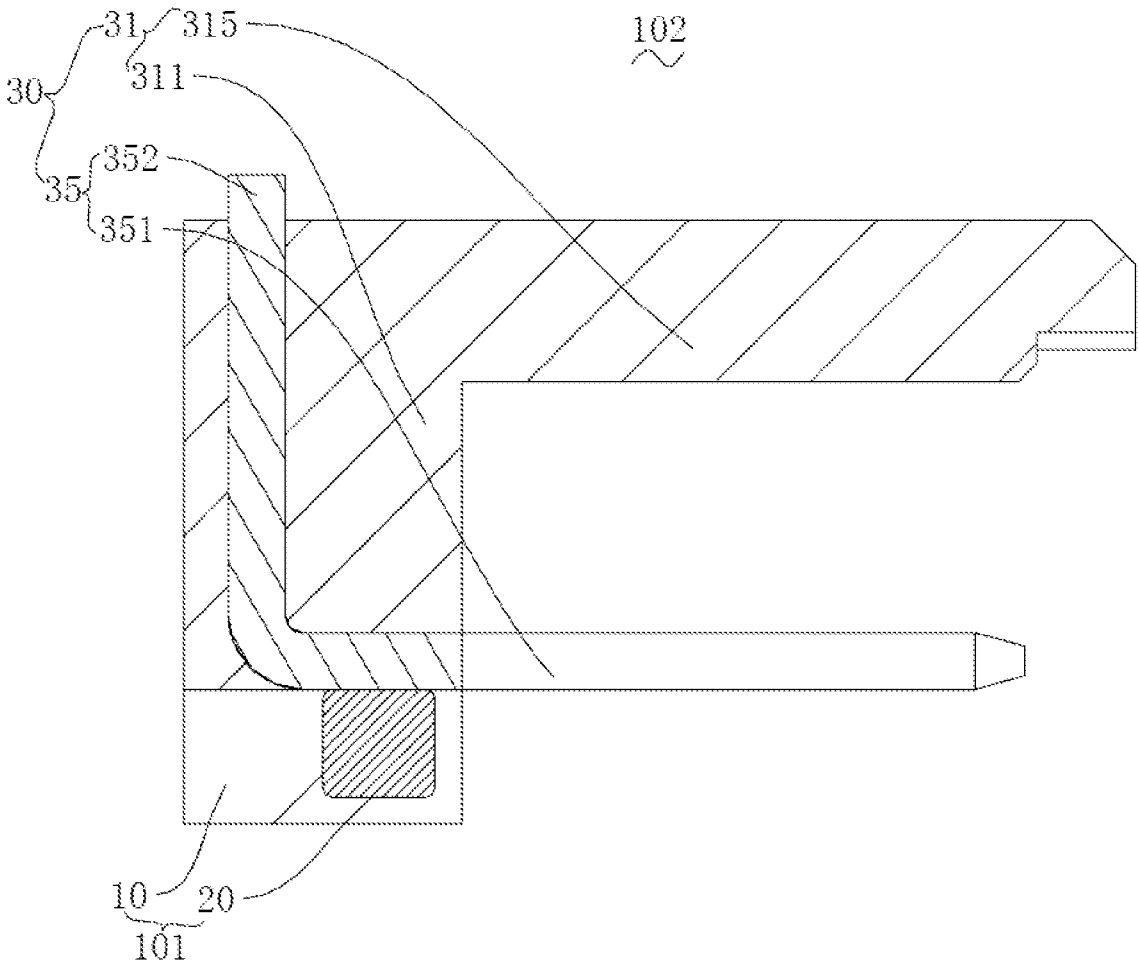
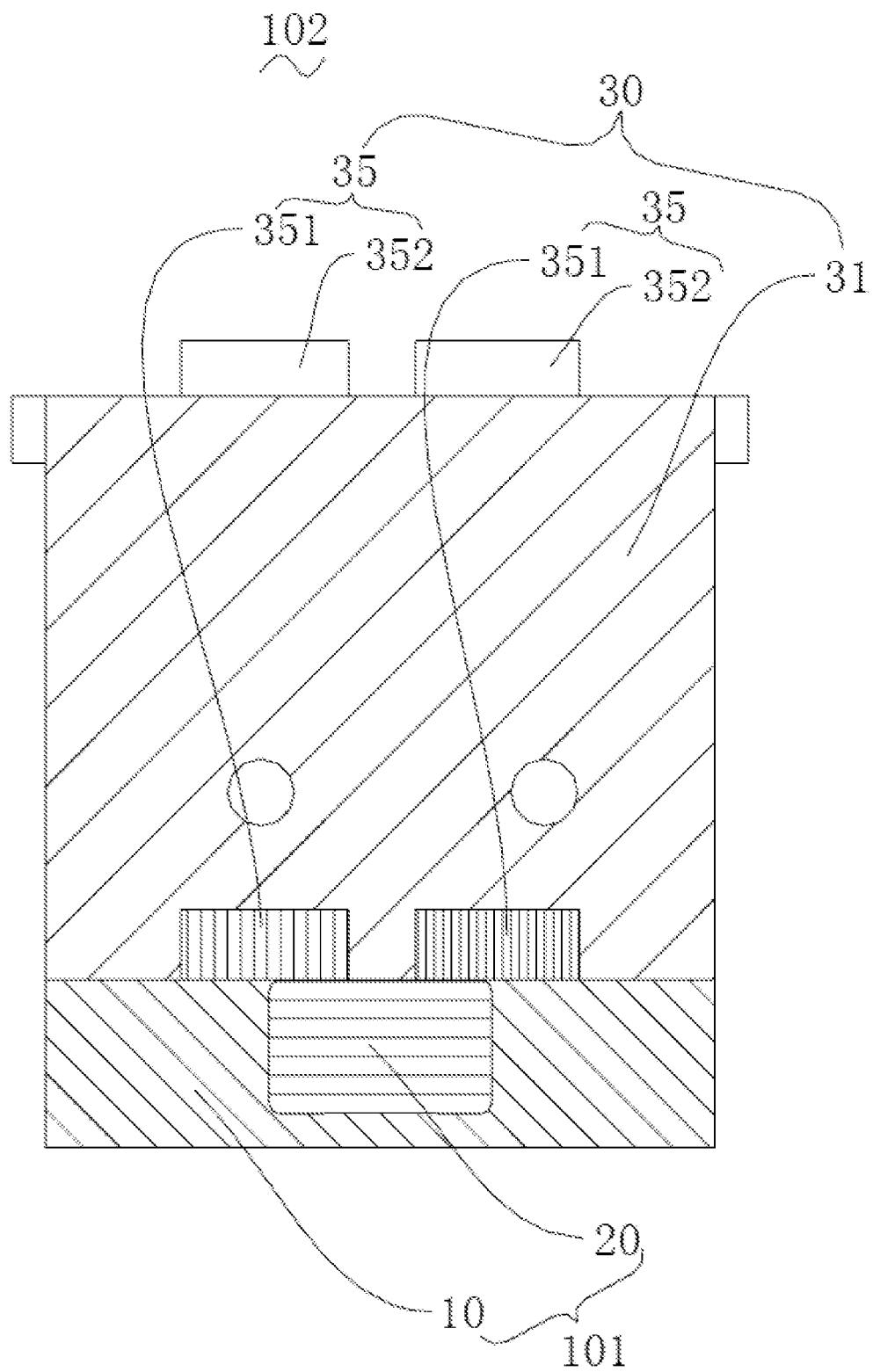


FIG. 6

**FIG. 7**

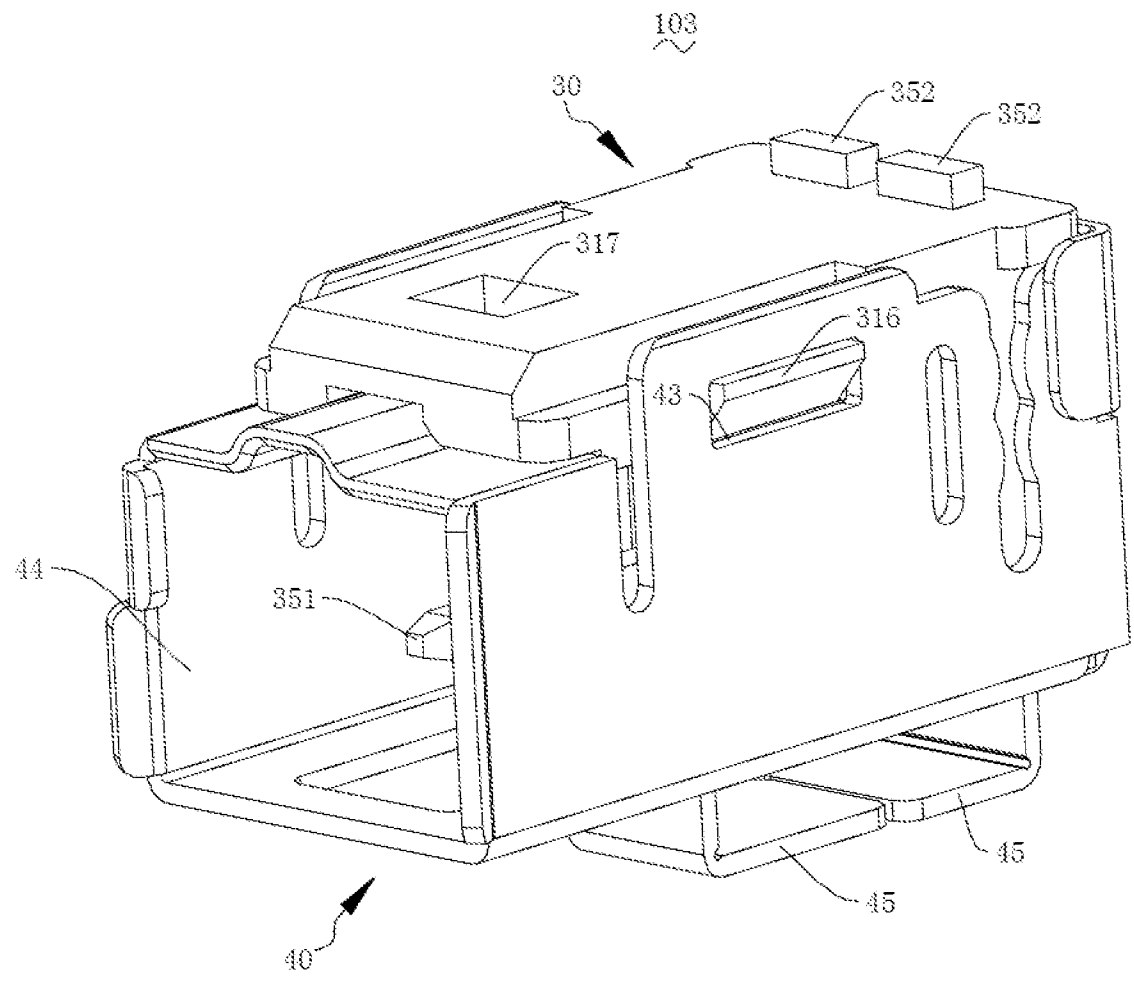
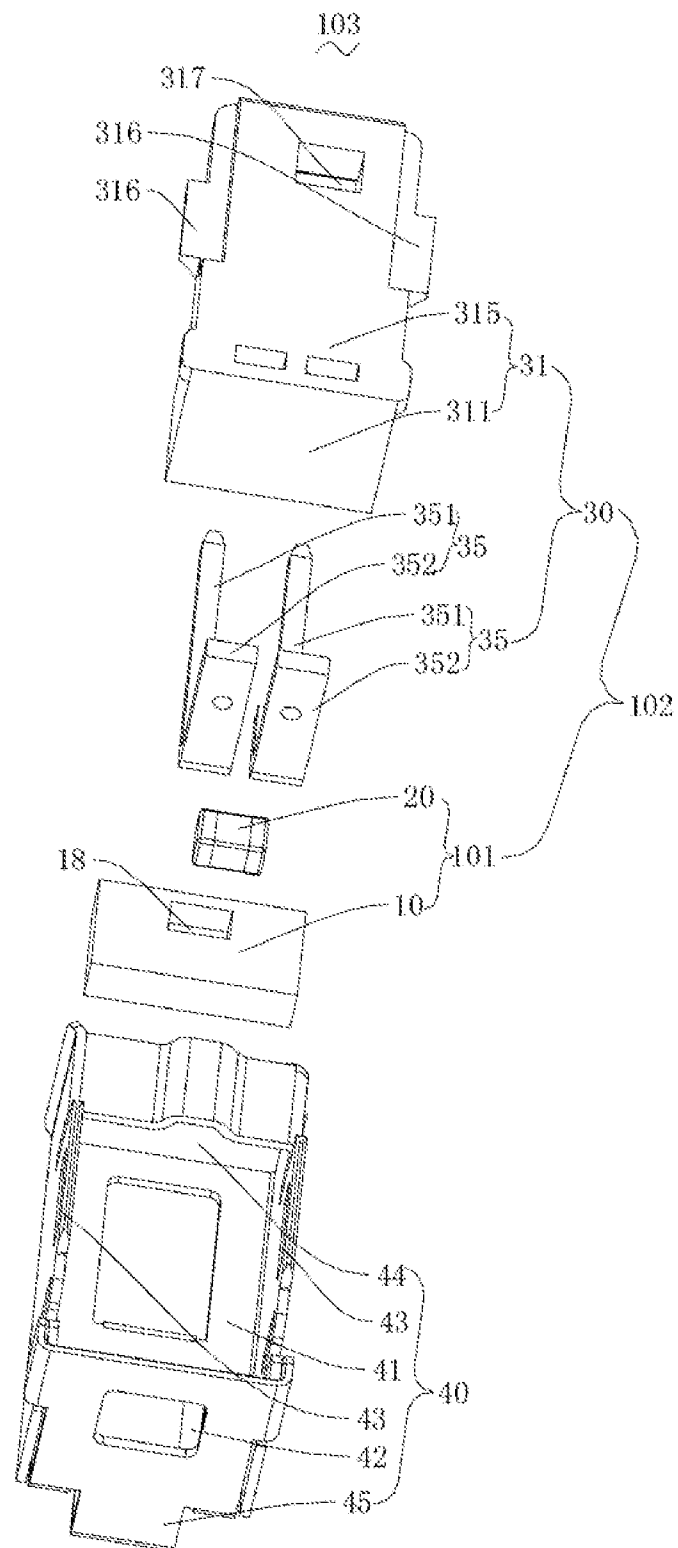


FIG. 8

**FIG. 9**

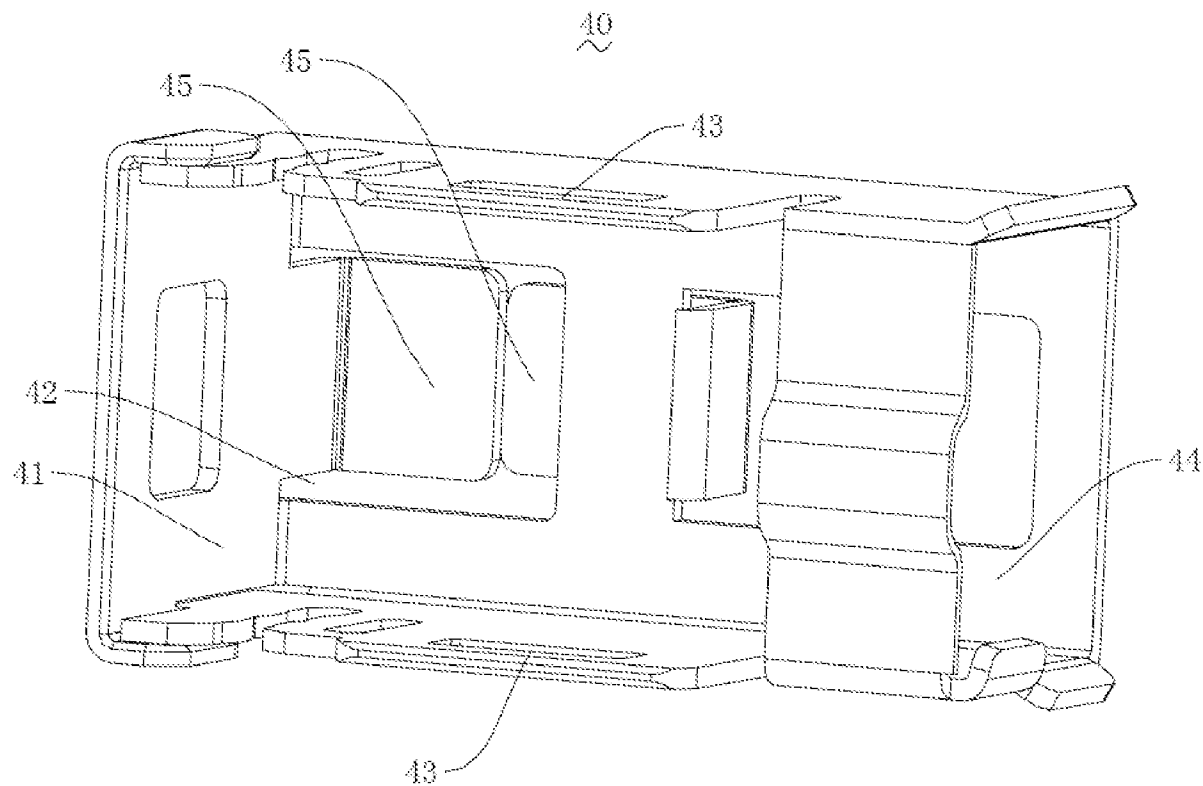


FIG. 10

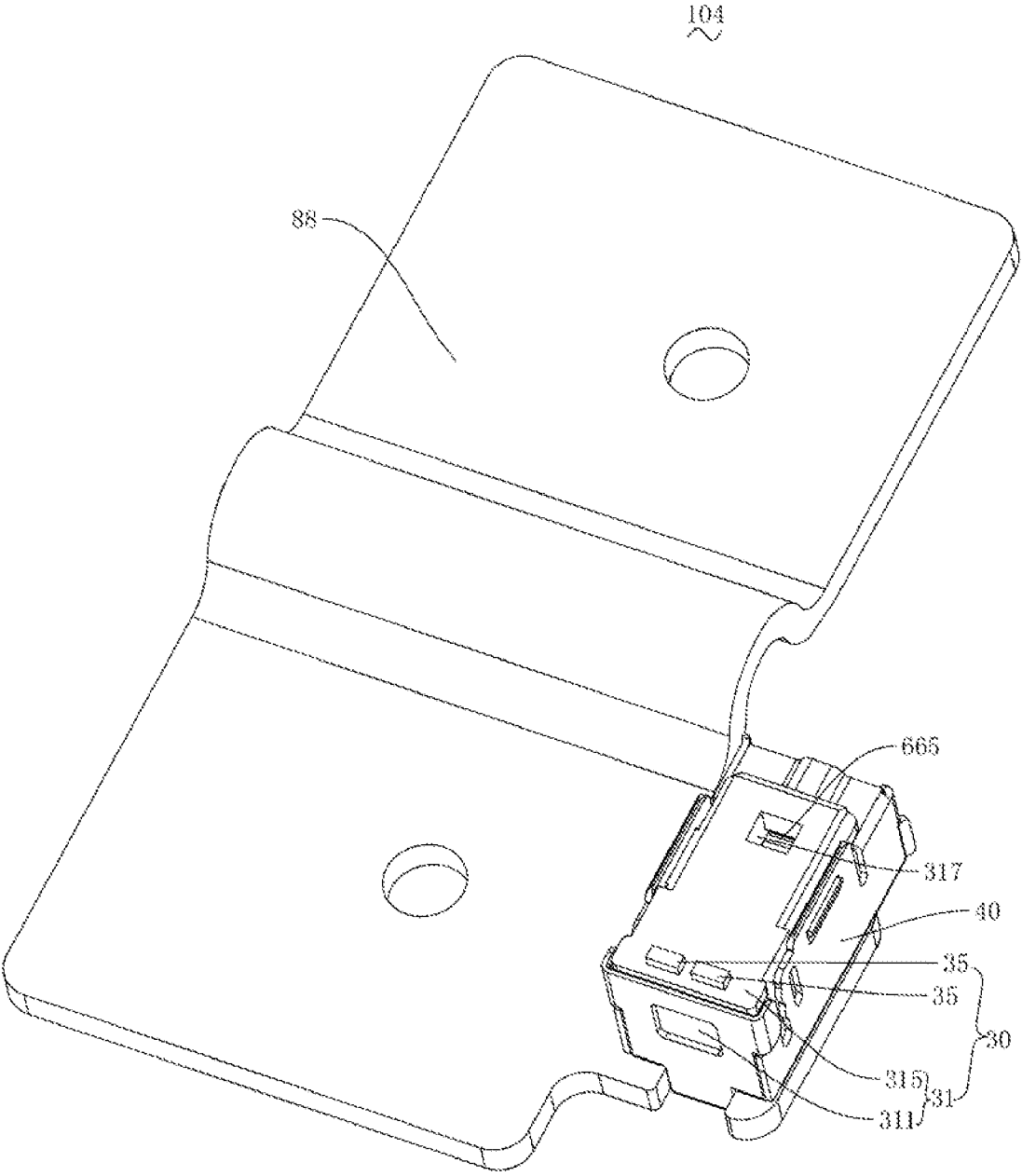


FIG. 11

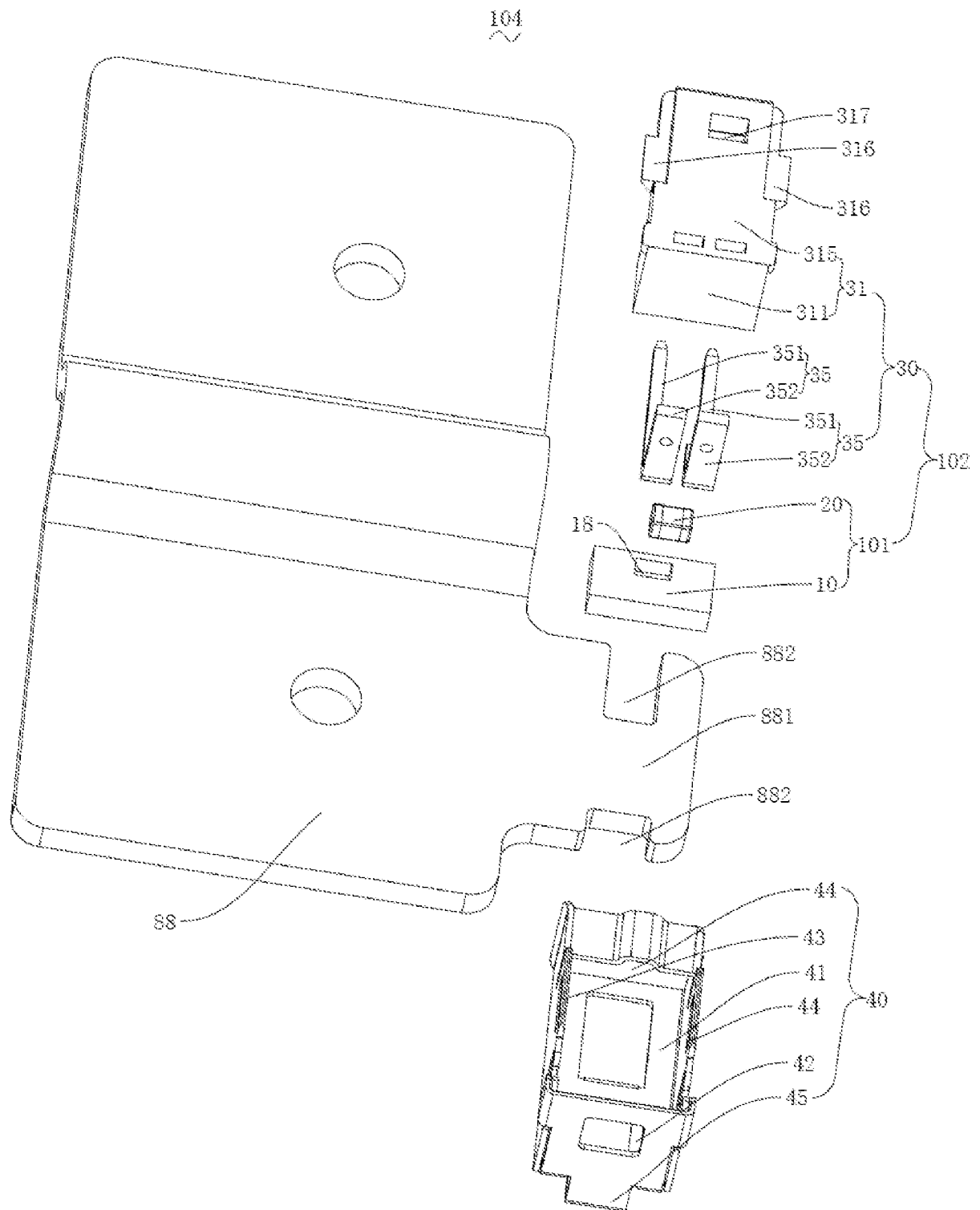


FIG. 12

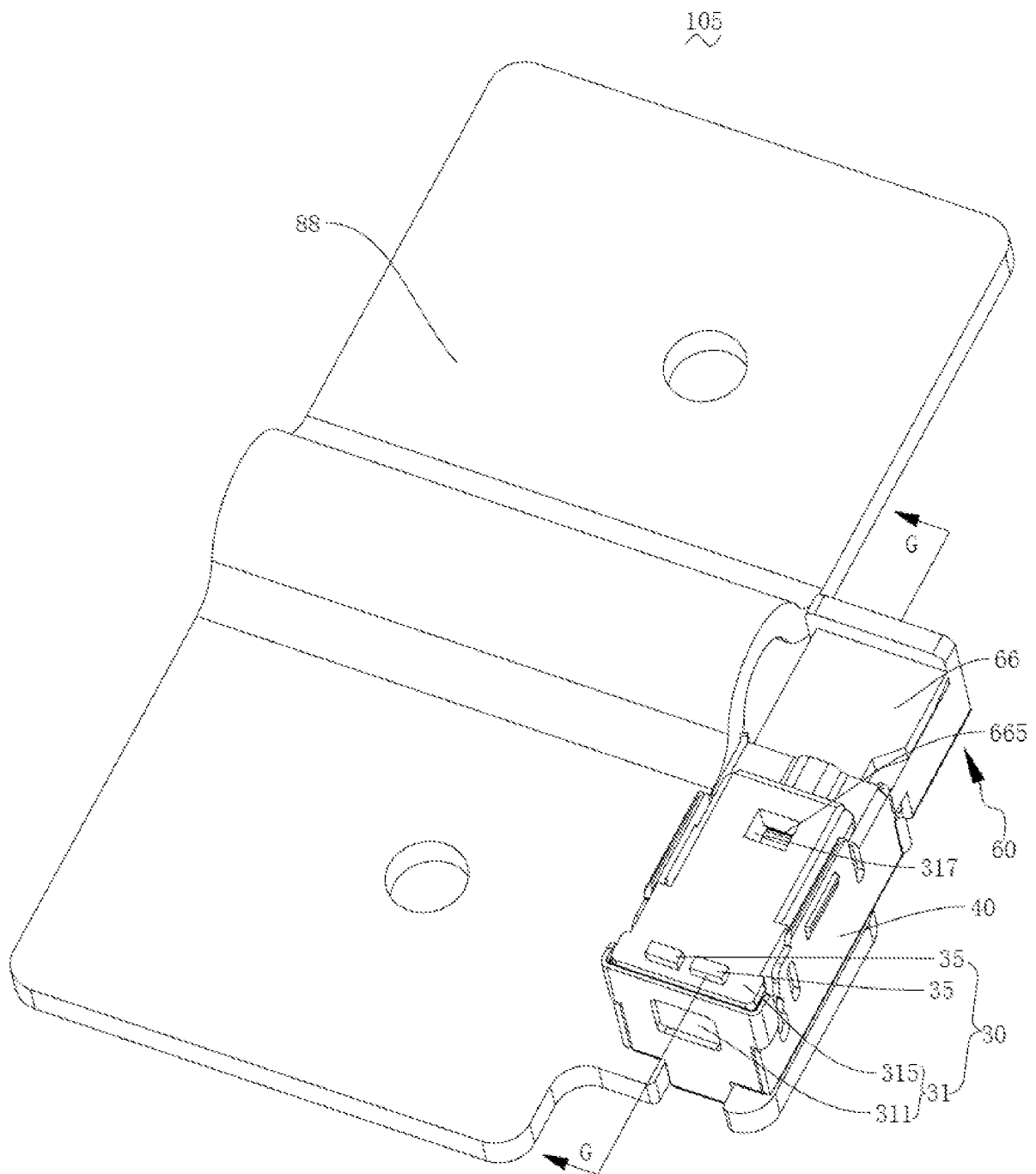


FIG. 13

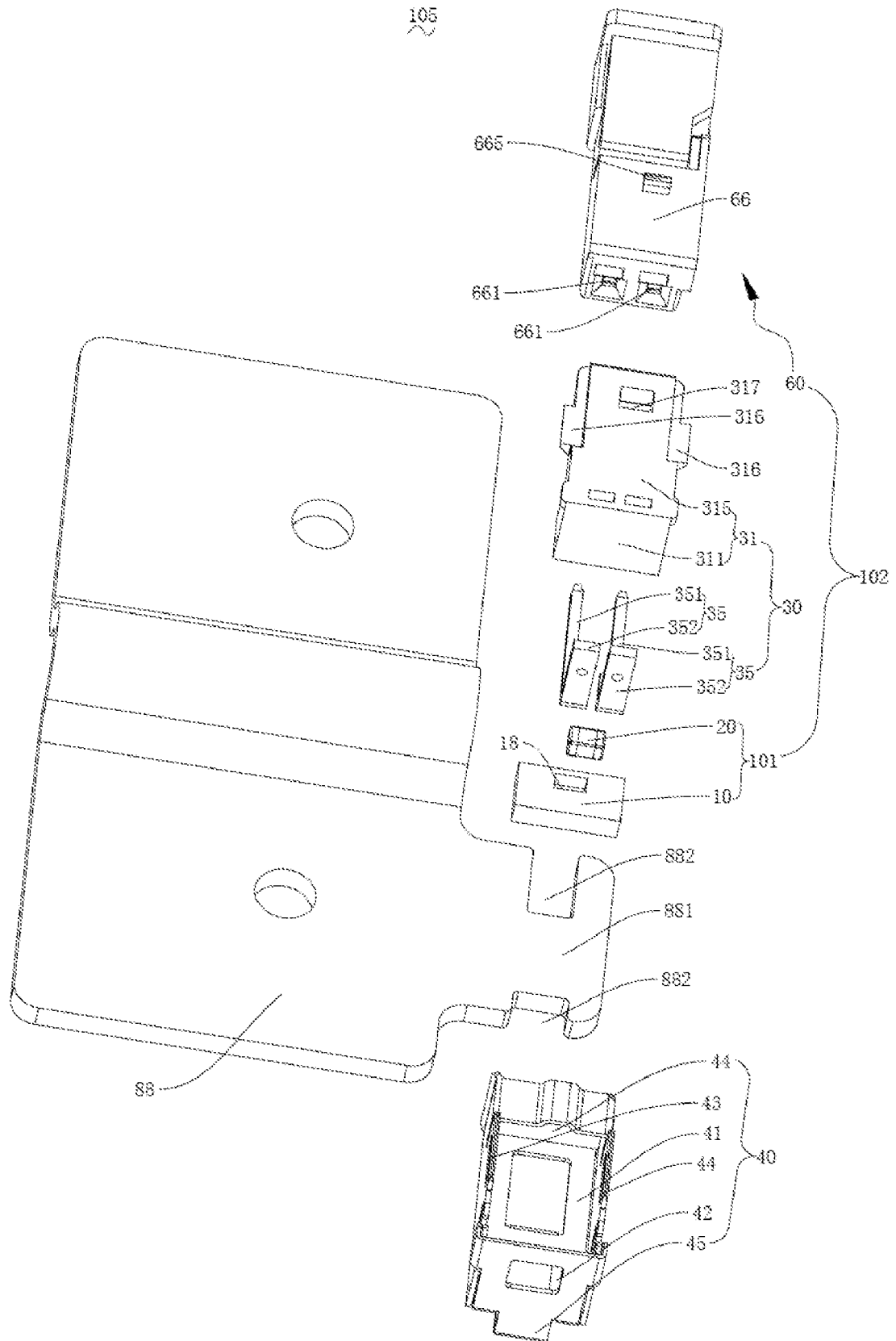


FIG. 14

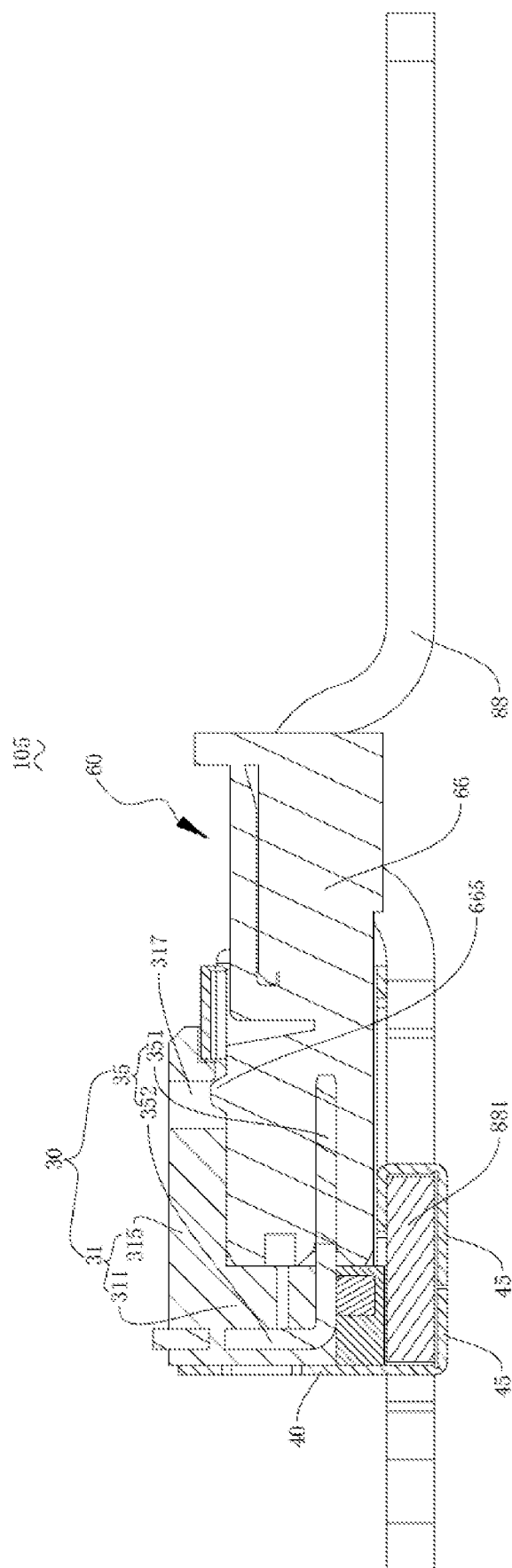
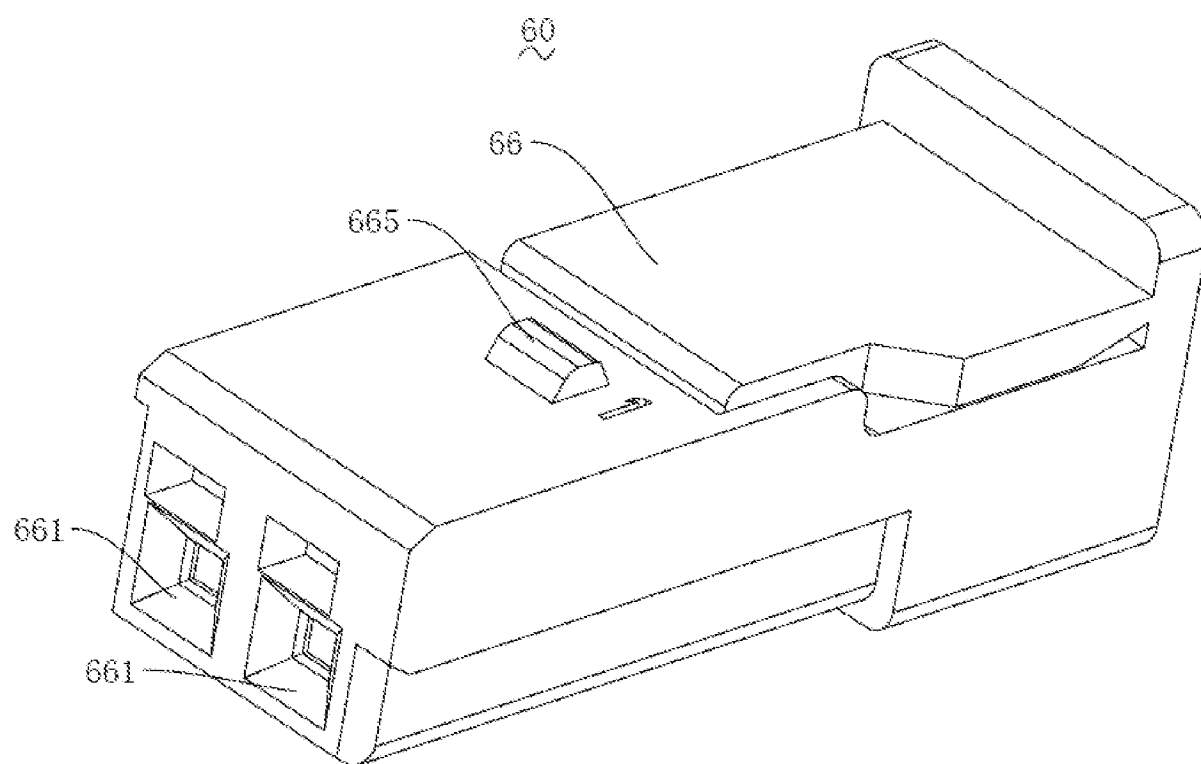


FIG. 15

**FIG. 16**

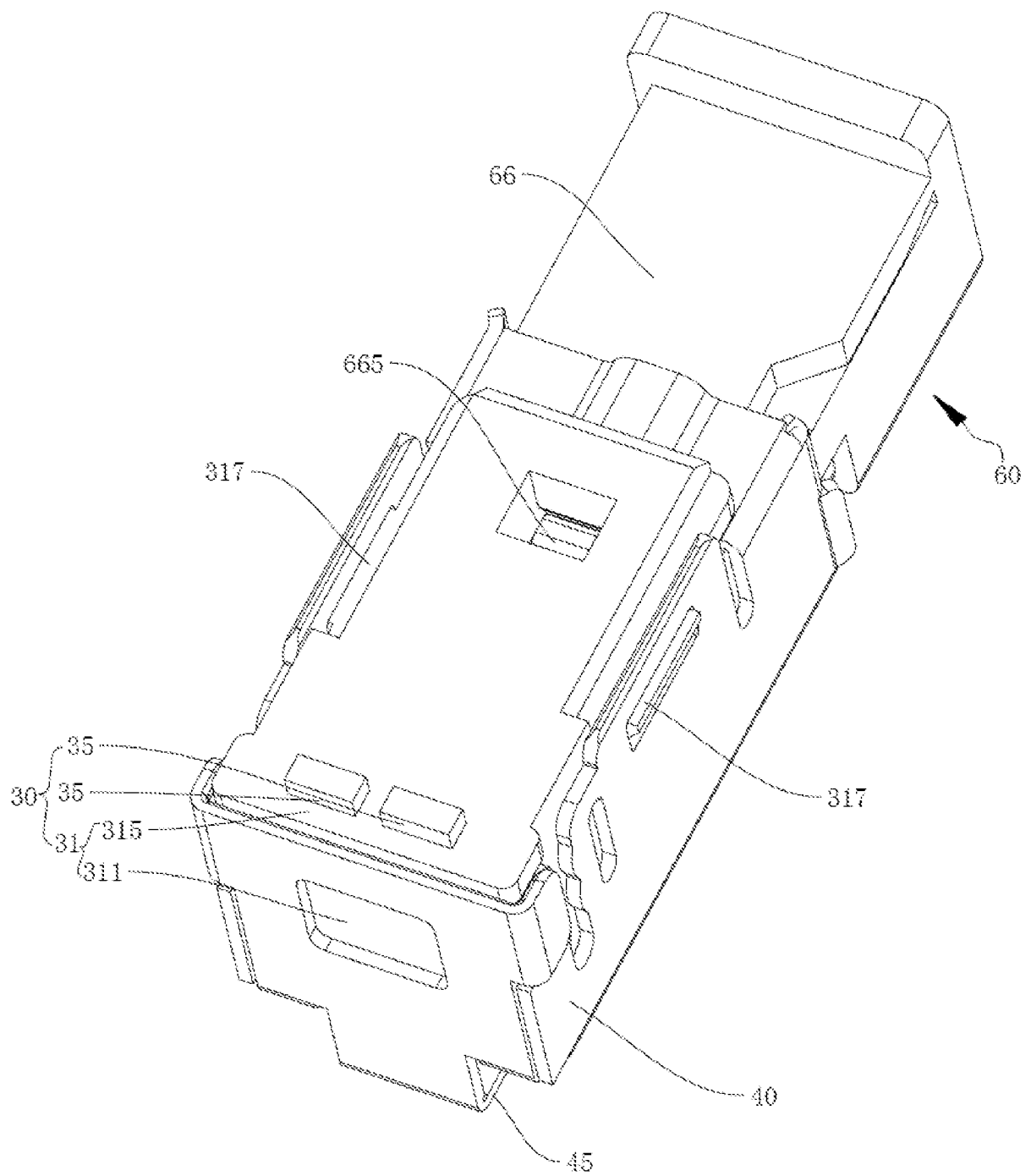


FIG. 17

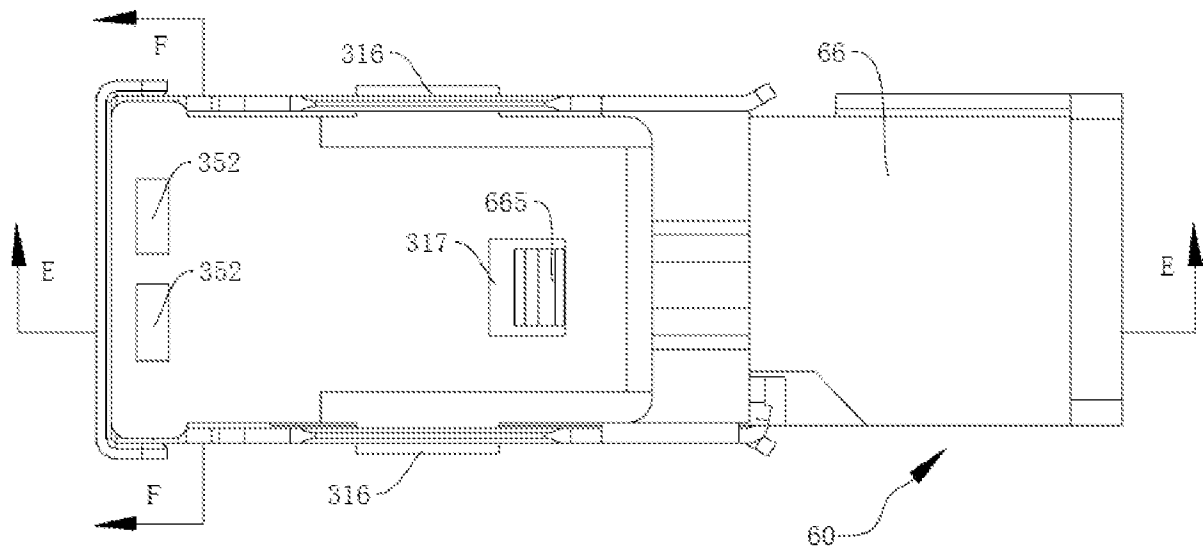


FIG. 18

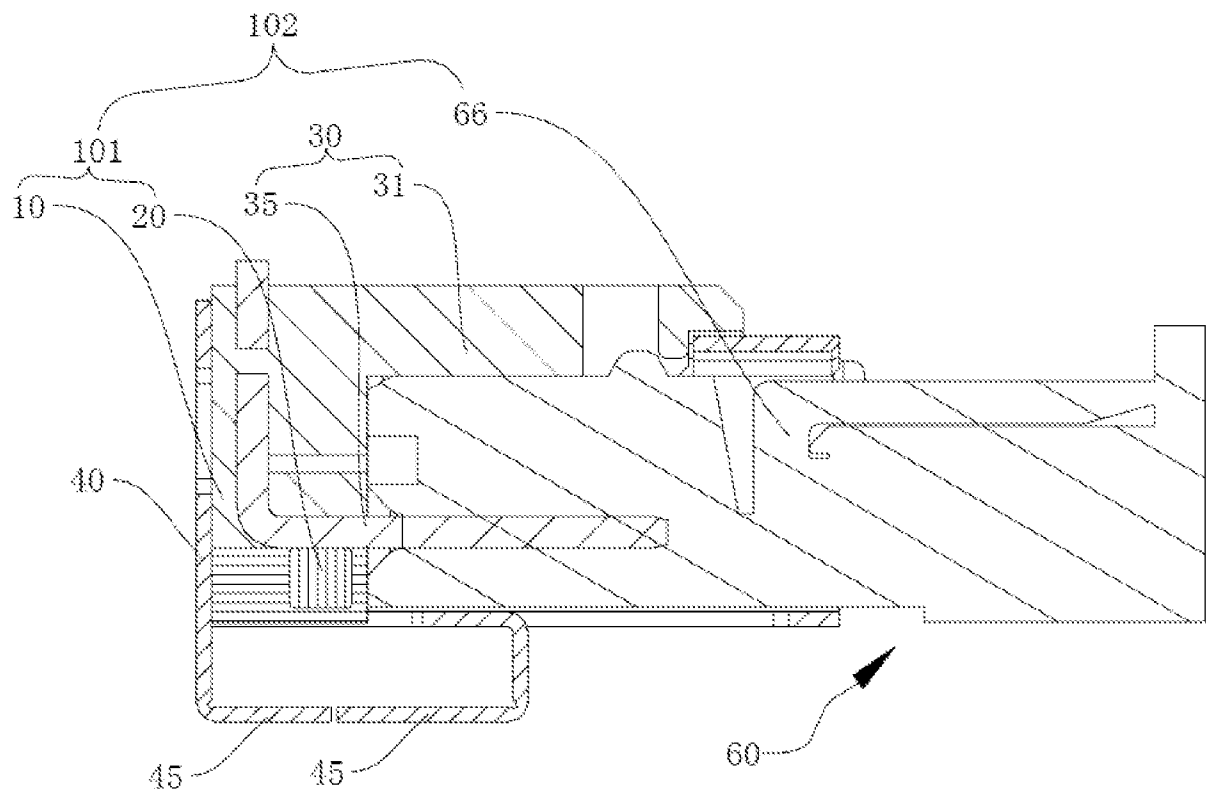
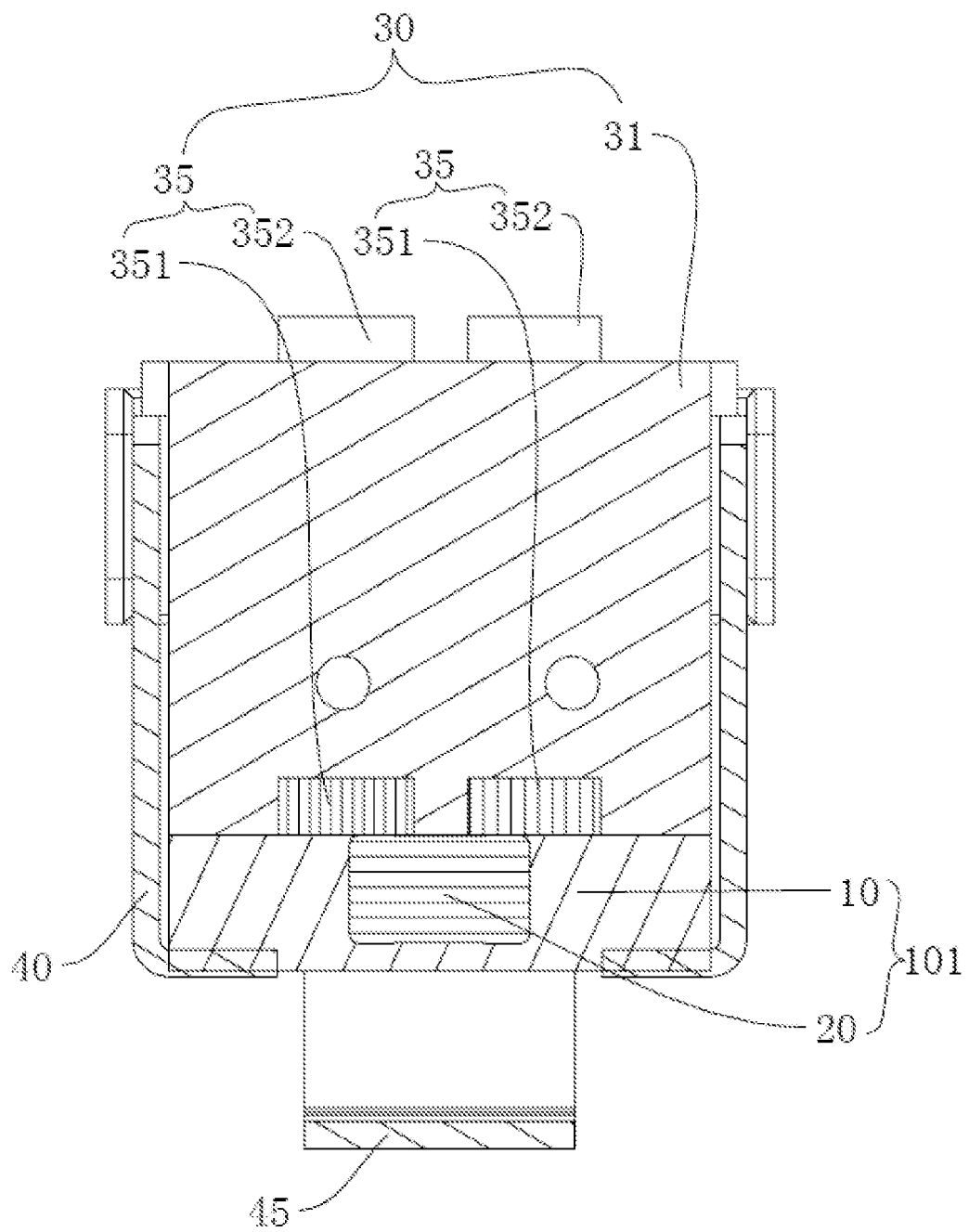


FIG. 19

**FIG. 20**

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/054118

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01K1/16 G01K1/14 G01K7/16 H01M10/48
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G01K H01R H01M

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP S60 198441 A (ISHIZUKA DENSHI KK) 7 October 1985 (1985-10-07) abstract; figures 1-3 -----	1,2,4,5
X	JP H09 218102 A (FUJI XEROX CO LTD) 19 August 1997 (1997-08-19) abstract; figures 4-5 -----	1,2,4,5
X	JP 5 326826 B2 (MITSUBISHI MATERIALS CORP) 30 October 2013 (2013-10-30) abstract; figure 1 -----	1,2,5
X	GB 2 387 232 A (BOSCH GMBH ROBERT [DE]) 8 October 2003 (2003-10-08) abstract; figure 2 ----- -/-	1,2,4,5

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 September 2017

Date of mailing of the international search report

09/10/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Rosello Garcia, M

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/054118

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 684 057 A1 (EATON CORP [US]) 26 July 2006 (2006-07-26) abstract; figure 5 -----	1,5
A	JP 2015 078851 A (TDK CORP) 23 April 2015 (2015-04-23) abstract; figure 1 -----	1-20
A	EP 2 849 252 A1 (SAMSUNG SDI CO LTD [KR]) 18 March 2015 (2015-03-18) abstract; figures 1-6 -----	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2017/054118

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP S60198441	A	07-10-1985	NONE
JP H09218102	A	19-08-1997	JP 3374640 B2 10-02-2003 JP H09218102 A 19-08-1997
JP 5326826	B2	30-10-2013	CN 101907497 A 08-12-2010 JP 5326826 B2 30-10-2013 JP 2010281593 A 16-12-2010 KR 20100130147 A 10-12-2010 TW 201109638 A 16-03-2011
GB 2387232	A	08-10-2003	CN 1449071 A 15-10-2003 DE 10214368 A1 16-10-2003 GB 2387232 A 08-10-2003 JP 2003307457 A 31-10-2003 US 2003223474 A1 04-12-2003
EP 1684057	A1	26-07-2006	CA 2533376 A1 21-07-2006 EP 1684057 A1 26-07-2006 US 2006165153 A1 27-07-2006
JP 2015078851	A	23-04-2015	NONE
EP 2849252	A1	18-03-2015	CN 104466067 A 25-03-2015 EP 2849252 A1 18-03-2015 JP 2015056400 A 23-03-2015 KR 20150031094 A 23-03-2015 US 2015079437 A1 19-03-2015