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Amended claims in accordance with Rule 137(2) EPC.

(54) **ANTI-LOOSENING ELECTRICAL PLUG**

(57) The present invention provides an electrical plug having electrically conductive members assembled in an anti-loosening orientation, wherein the electrically conductive members are tilted towards each other because

of the cooperation between an orienting member and an orienting bulge. The assembly and orientation of the electrical conductive members are easy and simple, and has a high long-term structural stability.

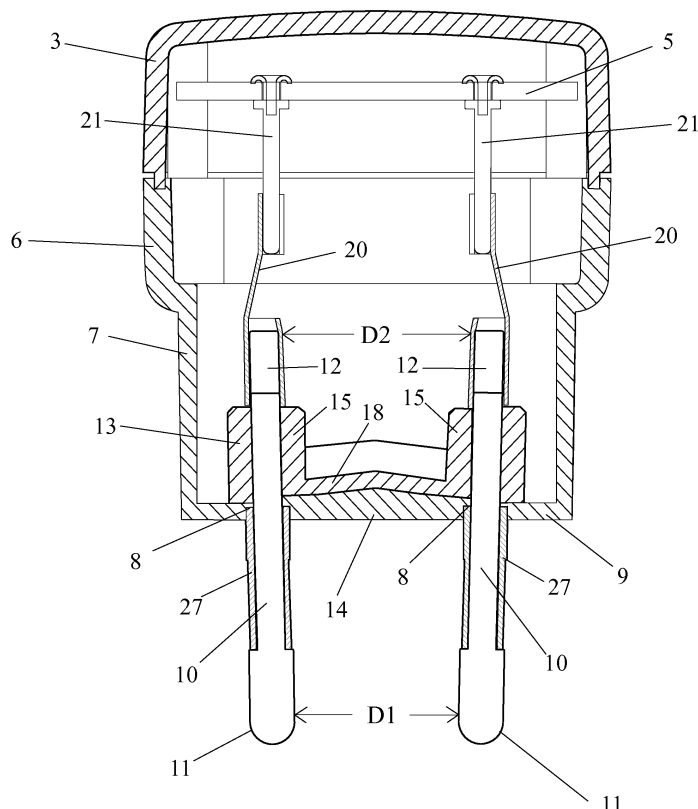


Fig. 4

Description

Technical Field of the Invention

[0001] This invention relates generally to an electrical plug, and in particular, to an anti-loosening electric plug capable of preventing inadvertent withdrawal from a socket.

Background of the Invention

[0002] Electrical plugs are commonly used in everyday life and in various industries. A typical electrical plug comprises two or three electrically conductive pins or blades that are inserted into corresponding holes on a socket in order to receive electricity therefrom. Inadvertent loosening or detachment of the electrical plug from the socket may result in poor electrical connection or even electrical disruption. To prevent this, a pair of the pins or blades of the electrical plug are usually oriented towards each other. In other words, the pins or blades are slightly tilted such that the distance between the outer ends of the pins or blades is smaller than the distance between the inner ends thereof. As a result, when inserted into the corresponding holes on the socket, the pair of pins or blades apply a gripping force onto the socket, thereby preventing inadvertent loosening or detachment of the electrical plug.

[0003] Currently, the pins or blades of an electrical plug are tilted towards each other during the manufacturing process thereof either manually or by a machine. This step is difficult to control, and adds to the complexity and costs of the manufacture of electrical plugs. In addition, after repeated insertion into and withdrawal from the socket, the tilted pins or blades tend to become parallel to each other, losing the gripping effect, that is, losing the anti-loosening function. Therefore, there is a need for an electrical plug with inwardly-tilted pins or blades that is easier, simpler and cheaper to manufacture, the tilted pins or blades being able to maintain the desired orientation even after a long time of use.

Summary of the Invention

[0004] The present invention has a principle object of providing an electrical plug having inwardly-tilted electrically conductive pins or blades, the manufacture and assembly of which are easier, simpler and cheaper compared with prior art. In addition, the present invention further aims to provide an electrical plug having inwardly-tilted electrically conductive pins or blades which are able to maintain the desired inwardly-tilted orientation ever after repeated insertion into and withdrawal from a socket.

[0005] The above and other goals are achieved by an electrical plug, comprising:

a plug body having a orienting bulge and a pair of

through holes formed on a bottom thereof, a printed circuit board accommodated inside the plug body, a pair of electrically conductive members extending through the pair of through holes, respectively, a pair of electrically conductive connectors connecting the pair of electrically conductive members, respectively, to the printed circuit board, and an orienting member cooperating with the orienting bulge on the bottom of the plug body to orient the pair of electrically conductive members in an anti-loosening orientation, in which a distance between outer ends of the electrically conductive members is smaller than a distance between inner ends of the electrically conductive members.

[0006] In an embodiment of the present invention, the orienting member comprises:

a pair of cylinders, the pair of electrically conductive members extending through the pair of cylinders, respectively, and a connecting portion connecting the pair of cylinders, the connecting portion cooperating with the orienting bulge on the bottom of the plug body to orient the pair of electrically conductive members in the anti-loosening orientation.

[0007] In an embodiment of the present invention, the connecting portion of the orienting member comprises a deformable bottom plate, wherein the deformable bottom plate is pressed against the orienting bulge on the bottom of the plug body, and is deformed to have a shape corresponding to the shape of the orienting bulge, such that the pair of cylinders are tilted away from each other, thereby orienting the pair of electrically conductive members in the anti-loosening orientation.

[0008] In an embodiment of the present invention, the orienting bulge has a triangular cross section, and the deformable bottom plate is deformed to have an inverted V-shaped cross section.

[0009] In an embodiment of the present invention, the connecting portion of the orienting member further comprises a pair of flexible side plates.

[0010] In an embodiment of the present invention, each of the electrically conductive connectors comprises:

a first end portion fixedly connected with the inner end of the corresponding electrically conductive member, a flexible middle portion, and a second end portion fixedly connected with a corresponding pin on the printed circuit board.

[0011] In an embodiment of the present invention, the flexible middle portion has a strip shape.

[0012] In an embodiment of the present invention, the first end portion and/or the second end portion have/has

a C-shaped cross section.

[0013] In an embodiment of the present invention, the first end portion and/or the second end portion have/has an O-shaped cross section.

[0014] In an embodiment of the present invention, the plug body comprises a top casing and a bottom casing, wherein the top casing comprises a plurality of posts snugly inserted into a plurality of corresponding pits formed in the bottom casing, thereby attaching the top casing to the bottom casing.

[0015] In an embodiment of the present invention, the bottom casing comprises a main portion and a hollow extension portion extending downwardly from a bottom of the main portion, wherein the orienting bulge is formed on a bottom of the extension portion, and the orienting member is accommodated inside the extension portion.

Brief Description of the Drawings

[0016]

Fig. 1 is a perspective view of an electrical plug according to an embodiment of the present invention.

Fig. 2 is an exploded view of the electrical plug shown in Fig. 1.

Fig. 3 is a top perspective view of the bottom casing of the electrical plug shown in Fig. 1.

Fig. 4 is a cross-sectional view of the electrical plug shown in Fig. 1 cut along the line A-A.

Fig. 5 is a top perspective view of the orienting member of the electrical plug shown in Fig. 1 before assembly.

Fig. 6 is a perspective view of the connector of the electrical plug shown in Fig. 1 before assembly.

Fig. 7 is a cross-sectional view of the electrical plug shown in Fig. 1 cut along the line B-B.

Detailed Description of the Invention

[0017] Referring to Figs. 1 and 2, the electrical plug 1 according to an embodiment of the present invention comprises a plug body 2, which is consisted of a top casing 3 and a bottom casing 4. The top casing 3 is fixedly attached to the bottom casing 4, and together they define a chamber for accommodating various components of the electrical plug 1, especially a printed circuit board (PCB) 5.

[0018] The bottom casing 4 comprises a main portion 6, which is substantially of a hollow cubic shape with an open top, or in other words, of the shape of a bucket having a rectangular cross section. In addition, the bottom casing 4 further comprises a hollow extension portion

7 which extends downwardly from a bottom of the main portion 6. As can be seen in Fig. 3, the hollow extension portion 7 also has an open top. In other words, the inside of the hollow extension portion 7 is in communication with the chamber defined by the top casing 3 and the bottom casing 4.

[0019] As can be seen in Figs. 3 and 4, a pair of through holes 8 are formed on a bottom 9 of the extension portion 7. A pair of electrically conductive members 10 extend through the pair of through holes 8, respectively. In the present embodiment, the electrically conductive members 10 are formed in the shape of rounded pins, and correspondingly, the through holes 8 are formed to have a round shape. Those skilled in the art will understand that the electrically conductive members 10 may also be formed in other shapes (for example, blades), and the through holes 8 may be formed in other corresponding shapes (for example, slits).

[0020] As can be seen in Fig. 4, the pair of electrically conductive members 10 are not parallel to each other. Rather, they are oriented such that their outer ends 11 are tilted towards each other. In other words, the distance D1 between the outer ends 11 of the electrically conductive members 10 is smaller than the distance D2 between the inner ends 12 of the electrically conductive members 10. Such an orientation of the electrically conductive members 10 provides an anti-loosening effect when the electrical plug 1 is inserted into a socket because the inwardly-tilted outer ends 11 apply a gripping force onto the socket.

[0021] The anti-loosening orientation of the electrically conductive members 10 is achieved mainly by an orienting member 13 in cooperation with an orienting bulge 14 formed on the bottom 9 of the extension portion 7. As can be seen in Fig. 5, the orienting member 13 comprises a pair of cylinders 15 and a connecting portion 16 connecting the pair of cylinders 15. An aperture 17 is formed through each of the cylinders 15 for each of the electrically conductive members 10 to pass through, respectively. The connecting portion 16 of the orienting member 13 comprises a bottom plate 18 made of a deformable material (such as Nylon), and a pair of side plates 19 made of a flexible material (such as Nylon).

[0022] As can be seen in Fig. 4, the orienting bulge 14 is formed between the pair of through holes 8, and has a triangular cross section. In other words, the thickness of the bottom 9 of the extension portion 7 increases from the through holes 8 to a middle point between the through holes 8. Therefore, when the orienting member 13 is pressed against the orienting bulge 14 during the assembly of the electrical plug 1, the bottom plate 18 of the orienting member 13 is forced to be deformed to have an inverted V-shaped cross section, corresponding to the shape of the orienting bulge 14. As a result of the deformation of the bottom plate 18, the pair of cylinders 15 are tilted away from each other, thereby orienting the pair of electrically conductive members 10 in the anti-loosening orientation, that is, the outer ends 11 are tilted

towards each other, while the inner ends 12 are tilted away from each other.

[0023] Thus, the orienting member 13 in cooperation with the orienting bulge 14 provides an easy method for the anti-loosening orientation of the electrically conductive members 10 by simply pressing the orienting member 13 against the orienting bulge 14. As those skilled in the art will understand, the tilting angle of the electrically conductive members 10 is determined by the shape (for example, the height) of the orienting bulge 14. Therefore, no control of the tilting angle of the electrically conductive members 10 needs to be provided in the assembly of the electrical plug 9, thus reducing the complexity of the manufacture process.

[0024] Those skilled in the art will understand that the cross section of the orienting bulge 14 may also be formed to have a different shape, for example, a semi-circular shape, as long as it causes the pair of cylinders 15 to be tilted away from each other when the orienting member 13 is pressed against the orienting bulge 14.

[0025] As shown in Figs. 2 and 4, the electrical plug 1 further comprises a pair of electrically conductive connectors 20 for connecting the pair of electrically conductive members 10 to the printed circuit board 5, in particular, to a pair of pins 21, respectively, on the printed circuit board 5. As better seen in Fig. 6, each of the connectors 20 comprises a first end portion 22 fixedly connected with the inner end 12 of the corresponding electrically conductive member 10, a second end portion 23 fixedly connected with the corresponding pin 21 on the printed circuit board 5, and a middle portion 24 connecting the first end portion 22 and the second end portion 23.

[0026] In order to establish a stable connection with the inner end 12 of the corresponding electrically conductive member 10, the first end portion 22 is formed to have a C-shaped cross section, such that the inner end 12 of the corresponding electrically conductive member 10 is surrounded by the first end portion 22, resulting in a large contact area. Those skilled in the art will understand that the first end portion 22 may also be formed to have an O-shaped cross section. Similarly, the second end portion 23 is also formed to have a C-shaped cross section, but may as well be formed to have an O-shaped cross section alternatively.

[0027] Unlike the first end portion 22 and the second end portion 23 which are formed to have a tube-like shape, the middle portion 24 is formed to have a strip shape, in order for it to have a high flexibility. As can be seen in Fig. 4, during the assembly of the electrical plug 1, particularly when the orienting member 13 is pressed against the orienting bulge 14, as the inner ends 12 of the electrically conductive members 10 are tilted away from each other, the distance between the first end portions 22 is increased, while the distance between the second end portions 23 remains unchanged (as the pins 21 are fixedly mounted on the printed circuit board 5). Therefore, a certain degree of flexibility of the middle portion 24 is necessary and/or beneficial for the anti-loos-

ening orientation of the electrically conductive members 10.

[0028] Those skilled in the art will understand that, other than the strip shape, the middle portion 24 may also be formed in other shapes, as long as it provides the flexibility needed for the anti-loosening orientation of the electrically conductive members 10.

[0029] As can be seen in Figs. 2 and 7, according to the present embodiment, the top casing 3 is attached to the bottom casing 4 by snugly inserting a plurality of posts 25 formed on the top casing 3 into a plurality of corresponding pits 26 formed on the bottom casing 4. To be specific, as shown in Fig. 2, the top casing 3 comprises 4 posts 25 extending downwardly from 4 corners of the top casing 3. Correspondingly, the bottom casing 4 comprises 4 pits 26 formed in 4 corners of the main portion 6 of the bottom casing 4 (see Fig. 3). The size and shape of the pits 26 are formed corresponding to those of the posts 25 to form a snug fit therebetween, such that when the posts 25 are inserted into the pits 26, respectively, the top casing 3 is firmly attached to the bottom casing 4.

[0030] In order to provide higher safety, a pair of protective sheaths 27 (see Figs. 2 and 4) made of an insulating material are provided around the electrically conductive members 10 between the outer ends 11 thereof and the corresponding through holes 8, respectively.

[0031] Thus, the present invention provides an electrical plug having electrically conductive members assembled in an anti-loosening orientation. As a result of the cooperation between the orienting member and the orienting bulge, and process of orienting the electrically conductive members into the anti-loosening orientation is easy and simple, not requiring any meticulous techniques or complex equipments. In addition, the anti-loosening orientation of the electrically conductive members has high long-term structural stability because of the cooperation between the orienting member and the orienting bulge.

Reference numerals

[0032]

- 1 electrical plug
- 2 plug body
- 3 top casing
- 4 bottom casing
- 5 printed circuit board
- 6 main portion
- 7 extension portion
- 8 through hole
- 9 bottom
- 10 electrically conductive member
- 11 outer end
- 12 inner end
- 13 orienting member
- 14 orienting bulge
- 15 cylinder

16 connecting portion
 17 aperture
 18 bottom plate
 19 side plate
 20 connector
 21 pin
 22 first end portion
 23 second end portion
 24 middle portion
 25 post
 26 pit
 27 protective sheath

Claims

1. An electrical plug (1), comprising:

a plug body (2) having a orienting bulge (14) and a pair of through holes (8) formed on a bottom (9) thereof,
 a printed circuit board (5) accommodated inside the plug body (2),
 a pair of electrically conductive members (10) extending through the pair of through holes (8), respectively,
 a pair of electrically conductive connectors (20) connecting the pair of electrically conductive members (10), respectively, to the printed circuit board (5),
 an orienting member (13) cooperating with the orienting bulge (14) on the bottom (9) of the plug body (2) to orient the pair of electrically conductive members (10) in an anti-loosening orientation, in which a distance (D1) between outer ends (11) of the electrically conductive members (10) is smaller than a distance (D2) between inner ends (12) of the electrically conductive members (10).

2. The electrical plug (1) of claim 1, wherein the orienting member (13) comprises:

a pair of cylinders (15), the pair of electrically conductive members (10) extending through the pair of cylinders (15), respectively,
 and a connecting portion (16) connecting the pair of cylinders (15), the connecting portion (16) cooperating with the orienting bulge (14) on the bottom (9) of the plug body (2) to orient the pair of electrically conductive members (10) in the anti-loosening orientation.

3. The electrical plug (1) of claim 2, wherein the connecting portion (16) of the orienting member (13) comprises a deformable bottom plate (18), wherein the deformable bottom plate (18) is pressed against the orienting bulge (14) on the bottom (9) of the plug

body (2), and is deformed to have a shape corresponding to the shape of the orienting bulge (14), such that the pair of cylinders (15) are tilted away from each other, thereby orienting the pair of electrically conductive members (10) in the anti-loosening orientation.

4. The electrical plug (1) of claim 3, wherein the orienting bulge (14) has a triangular cross section, and the deformable bottom plate (18) is deformed to have an inverted V-shaped cross section.

5. The electrical plug (1) of claim 3, wherein the connecting portion (16) of the orienting member (13) further comprises a pair of flexible side plates (19).

6. The electrical plug (1) of claim 1, wherein each of the electrically conductive connectors (20) comprises:

a first end portion (22) fixedly connected with the inner end (12) of the corresponding electrically conductive member (10),
 a flexible middle portion (24), and
 a second end portion (23) fixedly connected with a corresponding pin (21) on the printed circuit board (5).

7. The electrical plug (1) of claim 6, wherein the flexible middle portion (24) has a strip shape.

8. The electrical plug (1) of claim 6, wherein the first end portion (22) and/or the second end portion (23) have/has a C-shaped cross section.

9. The electrical plug (1) of claim 6, wherein the first end portion (22) and/or the second end portion (23) have/has an O-shaped cross section.

10. The electrical plug (1) of claim 1, wherein the plug body (2) comprises a top casing (3) and a bottom casing (4), wherein the top casing (3) comprises a plurality of posts (25) snugly inserted into a plurality of corresponding pits (26) formed in the bottom casing (4), thereby attaching the top casing (3) to the bottom casing (4).

11. The electrical plug (1) of claim 10, wherein the bottom casing (4) comprises a main portion (6) and a hollow extension portion (7) extending downwardly from a bottom of the main portion (6), wherein the orienting bulge (14) is formed on a bottom (9) of the extension portion (7), and the orienting member (13) is accommodated inside the extension portion (7).

Amended claims in accordance with Rule 137(2) EPC.

1. An electrical plug (1), comprising:

a plug body (2) having a pair of through holes (8) formed on a bottom (9) thereof,
 a printed circuit board (5) accommodated inside the plug body (2),
 a pair of electrically conductive members (10) extending through the pair of through holes (8), respectively,
 a pair of electrically conductive connectors (20) connecting the pair of electrically conductive members (10), respectively, to the printed circuit board (5),
characterized in that the plug body (2) further has an orienting bulge (14), and the electrical plug (1) further comprises an orienting member (13) cooperating with the orienting bulge (14) on the bottom (9) of the plug body (2) to orient the pair of electrically conductive members (10) in an anti-loosening orientation, in which a distance (D1) between outer ends (11) of the electrically conductive members (10) is smaller than a distance (D2) between inner ends (12) of the electrically conductive members (10),

wherein the orienting member (13) comprises:

a pair of cylinders (15), the pair of electrically conductive members (10) extending through the pair of cylinders (15), respectively,
 and a connecting portion (16) connecting the pair of cylinders (15), the connecting portion (16) cooperating with the orienting bulge (14) on the bottom (9) of the plug body (2) to orient the pair of electrically conductive members (10); and

wherein the connecting portion (16) of the orienting member (13) comprises a deformable bottom plate (18), wherein the deformable bottom plate (18) is pressed against the orienting bulge (14) on the bottom (9) of the plug body (2), and is deformed to have a shape corresponding to the shape of the orienting bulge (14), such that the pair of cylinders (15) are tilted away from each other, thereby orienting the pair of electrically conductive members (10) in the anti-loosening orientation.

2. The electrical plug (1) of claim 1, wherein the orienting bulge (14) has a triangular cross section, and the deformable bottom plate (18) is deformed to have an inverted V-shaped cross section.

3. The electrical plug (1) of claim 1, wherein the connecting portion (16) of the orienting member (13) further comprises a pair of flexible side plates (19).

4. The electrical plug (1) of claim 1, wherein each of the electrically conductive connectors (20) comprises:

a first end portion (22) fixedly connected with the inner end (12) of the corresponding electrically conductive member (10),
 a flexible middle portion (24), and
 a second end portion (23) fixedly connected with a corresponding pin (21) on the printed circuit board (5).

5. The electrical plug (1) of claim 4, wherein the flexible middle portion (24) has a strip shape.

6. The electrical plug (1) of claim 4, wherein the first end portion (22) and/or the second end portion (23) have/has a C-shaped cross section.

7. The electrical plug (1) of claim 4, wherein the first end portion (22) and/or the second end portion (23) have/has an O-shaped cross section.

8. The electrical plug (1) of claim 1, wherein the plug body (2) comprises a top casing (3) and a bottom casing (4), wherein the top casing (3) comprises a plurality of posts (25) snugly inserted into a plurality of corresponding pits (26) formed in the bottom casing (4), thereby attaching the top casing (3) to the bottom casing (4).

9. The electrical plug (1) of claim 8, wherein the bottom casing (4) comprises a main portion (6) and a hollow extension portion (7) extending downwardly from a bottom of the main portion (6), wherein the orienting bulge (14) is formed on a bottom (9) of the extension portion (7), and the orienting member (13) is accommodated inside the extension portion (7).

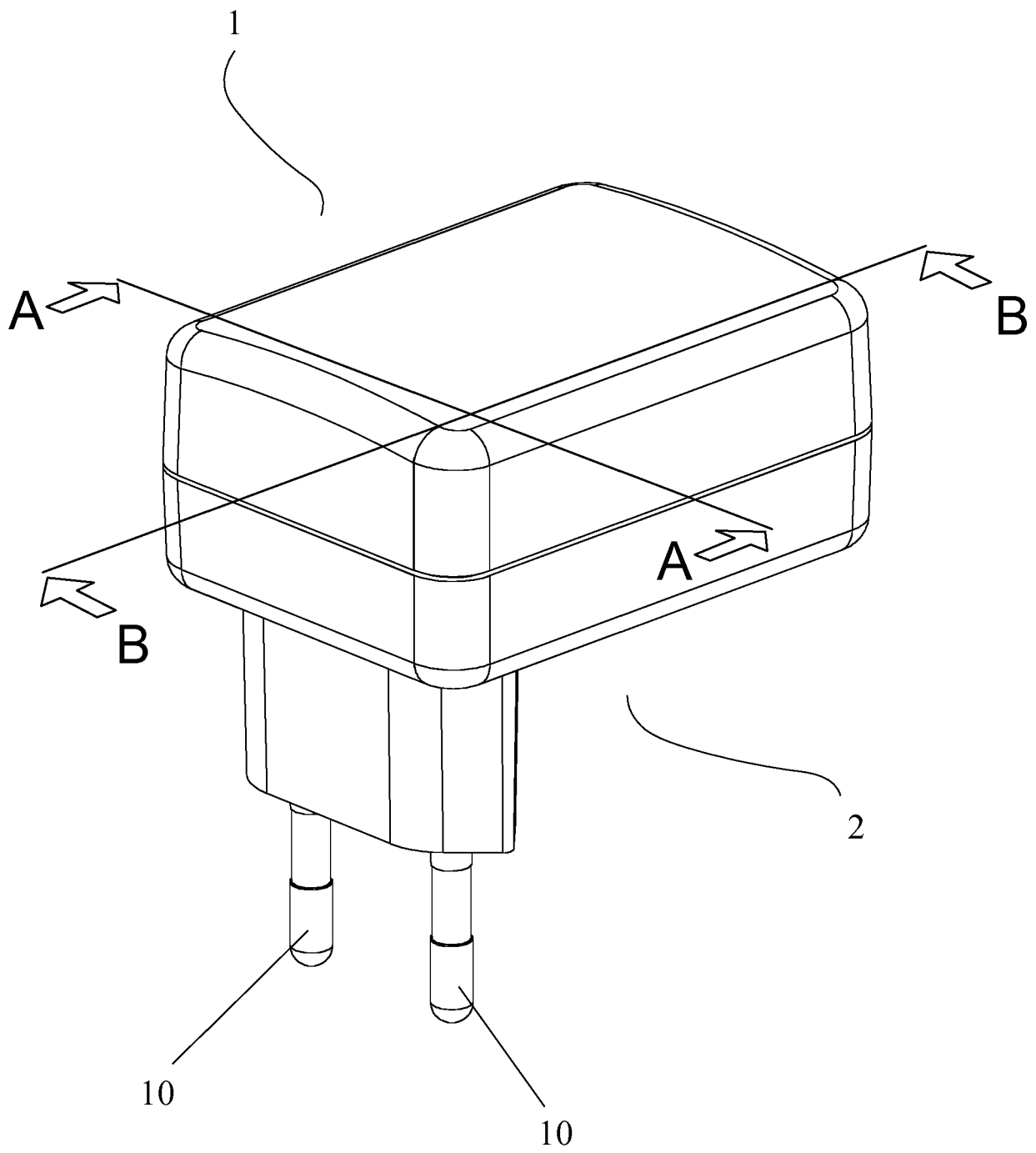


Fig. 1

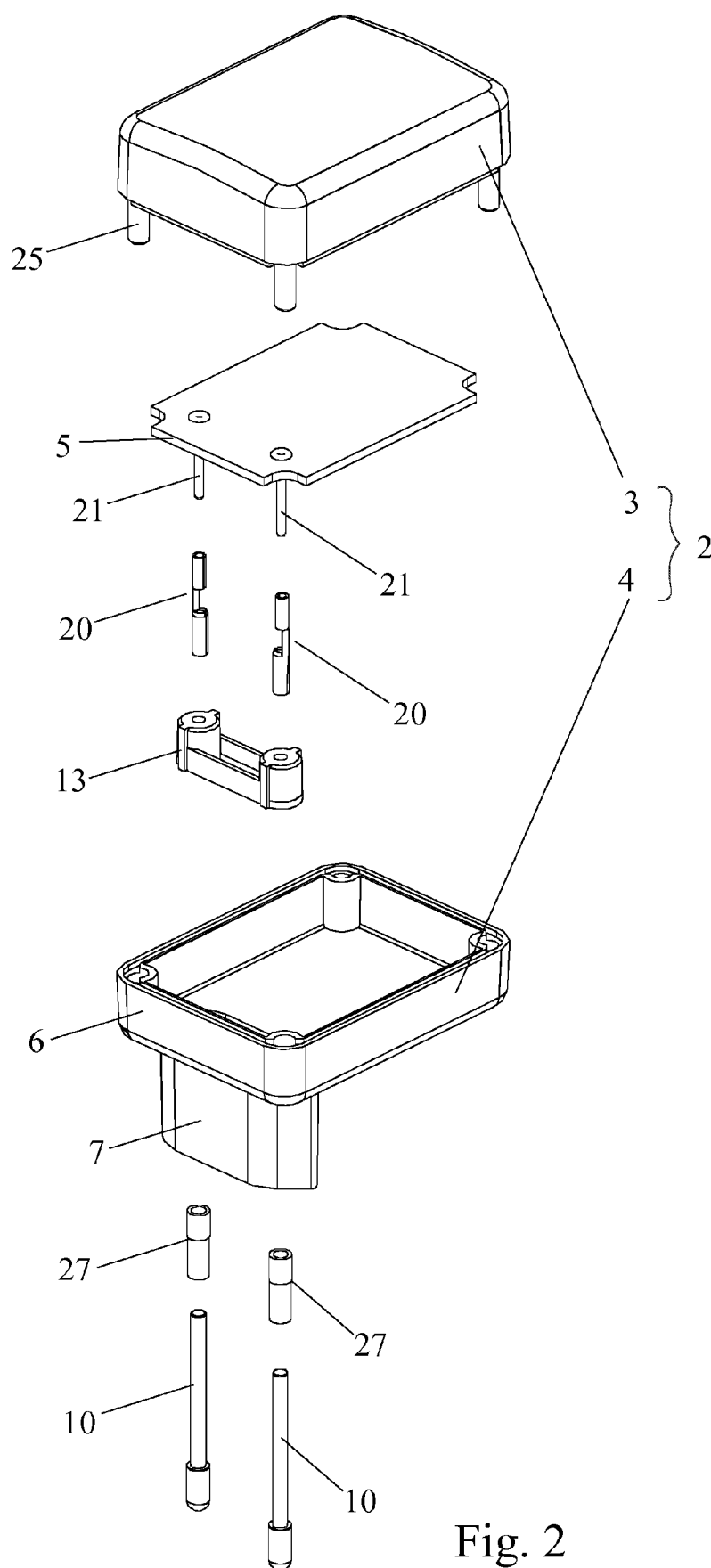


Fig. 2

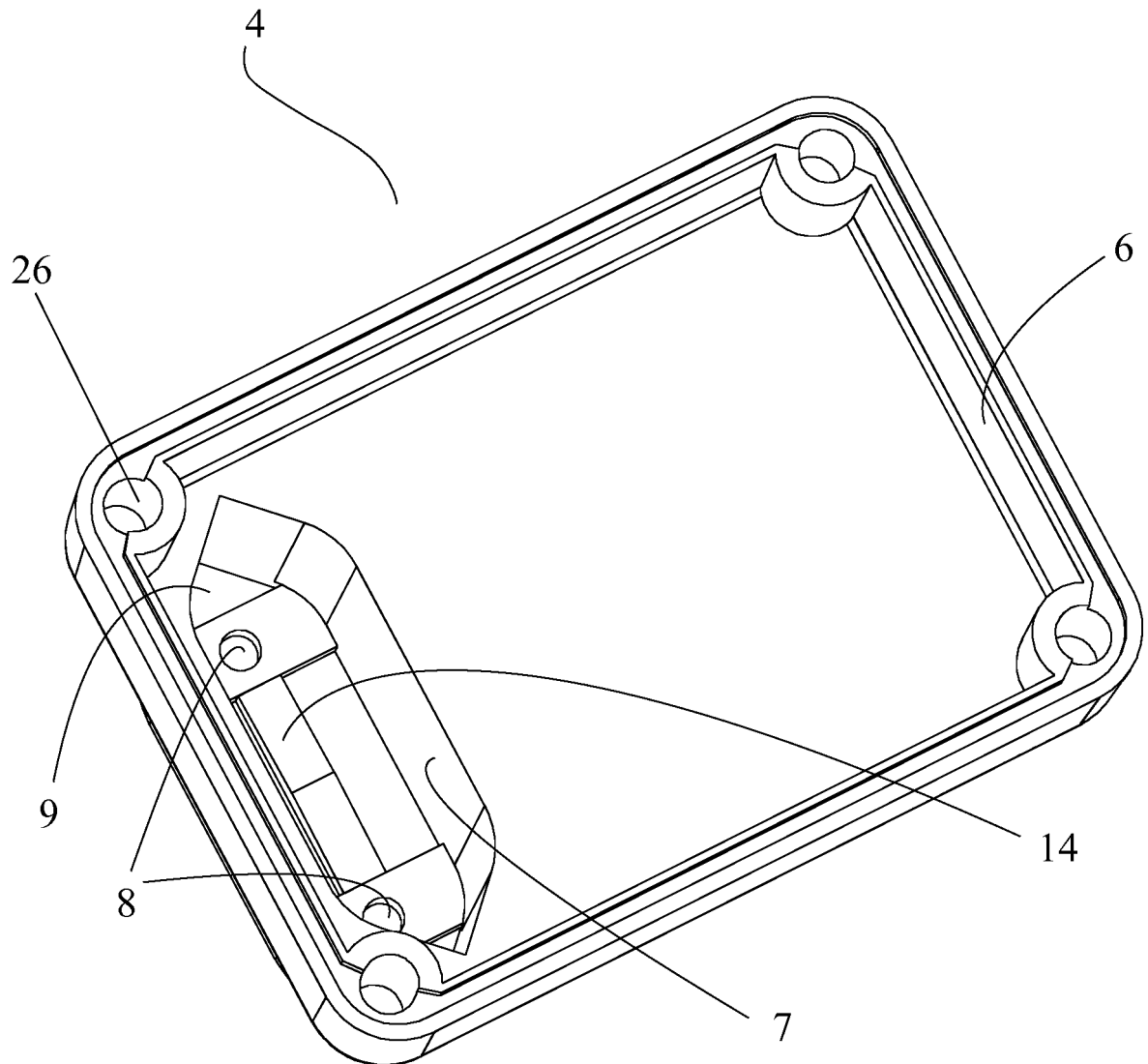


Fig. 3

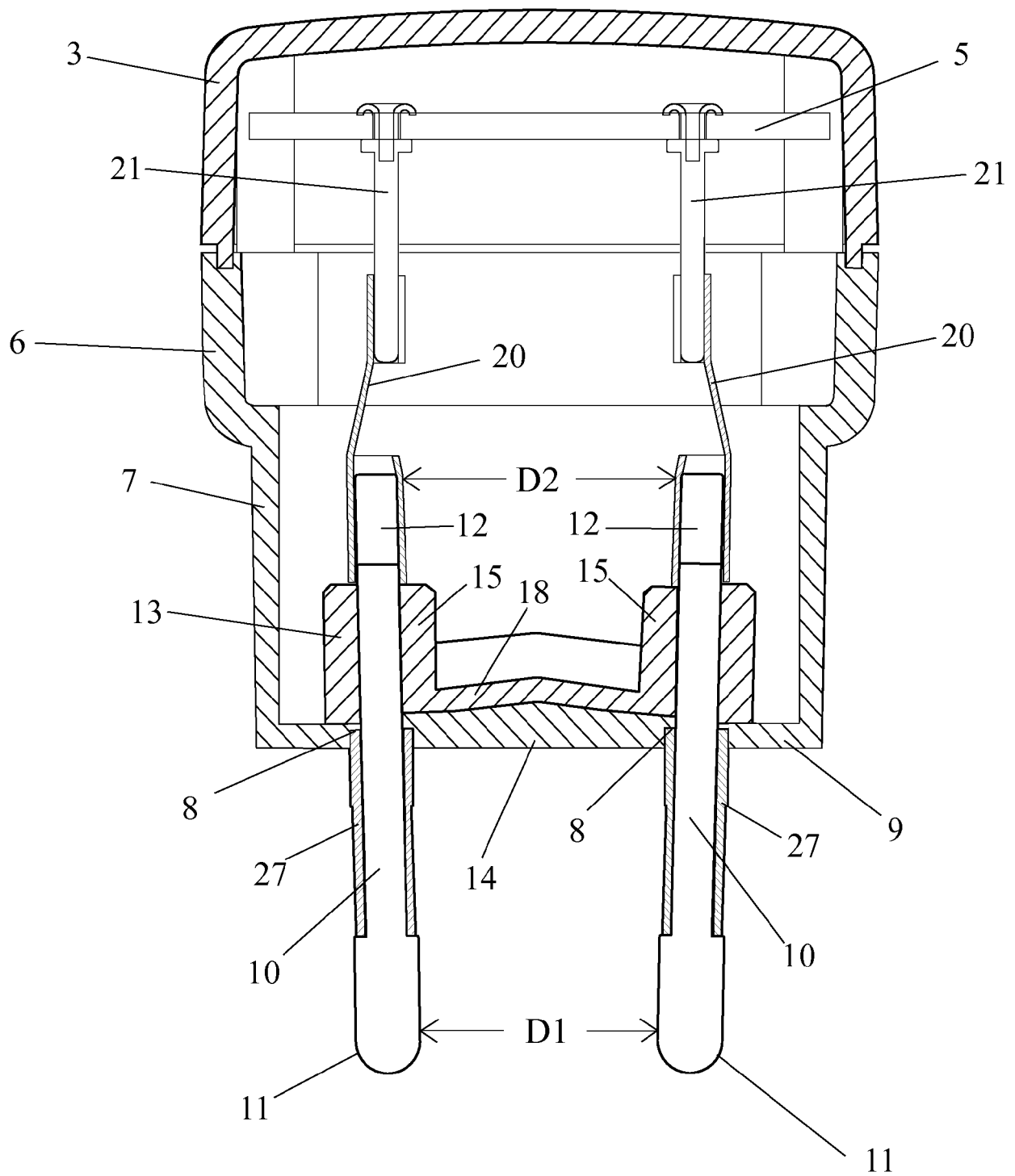


Fig. 4

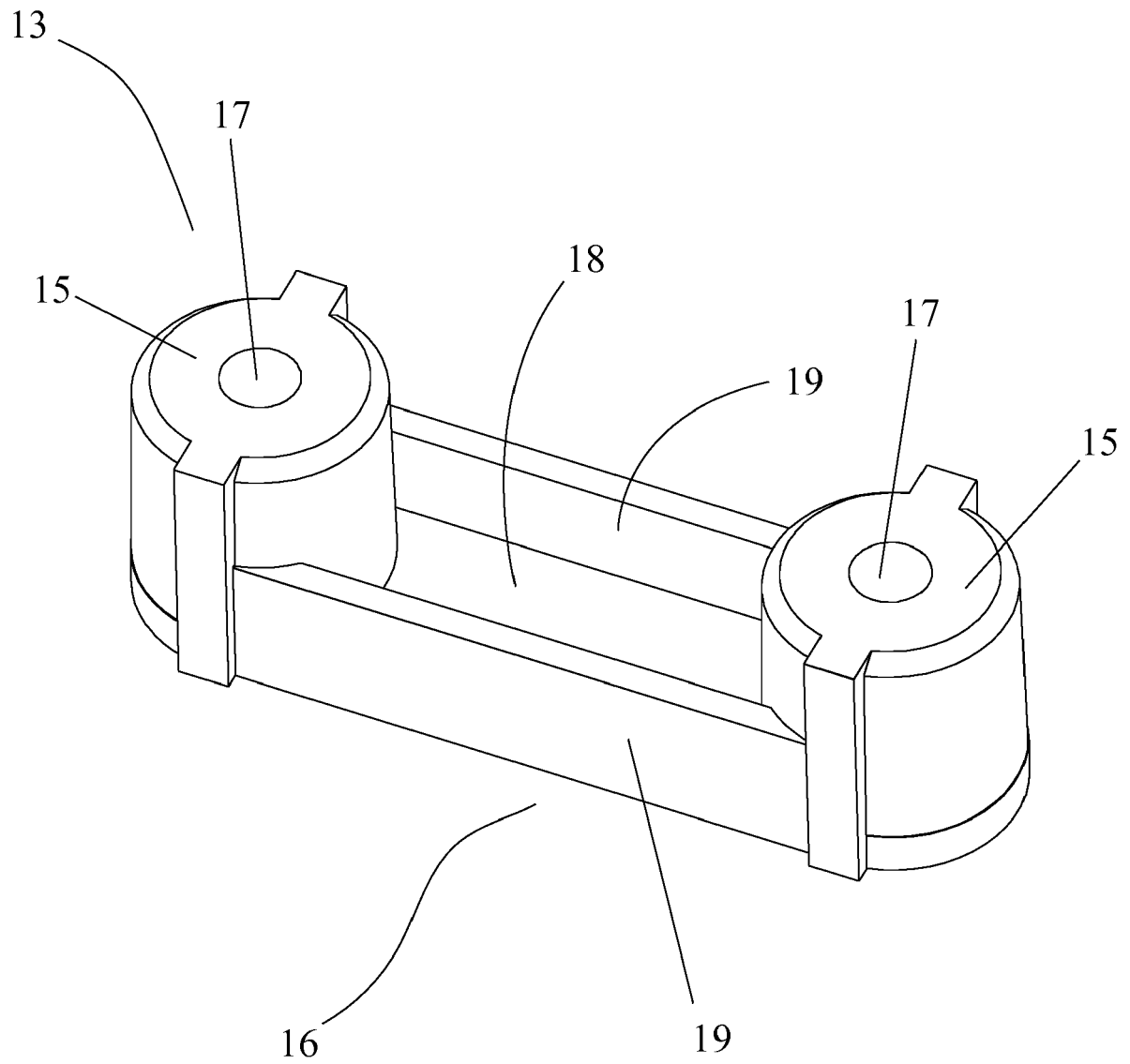


Fig. 5

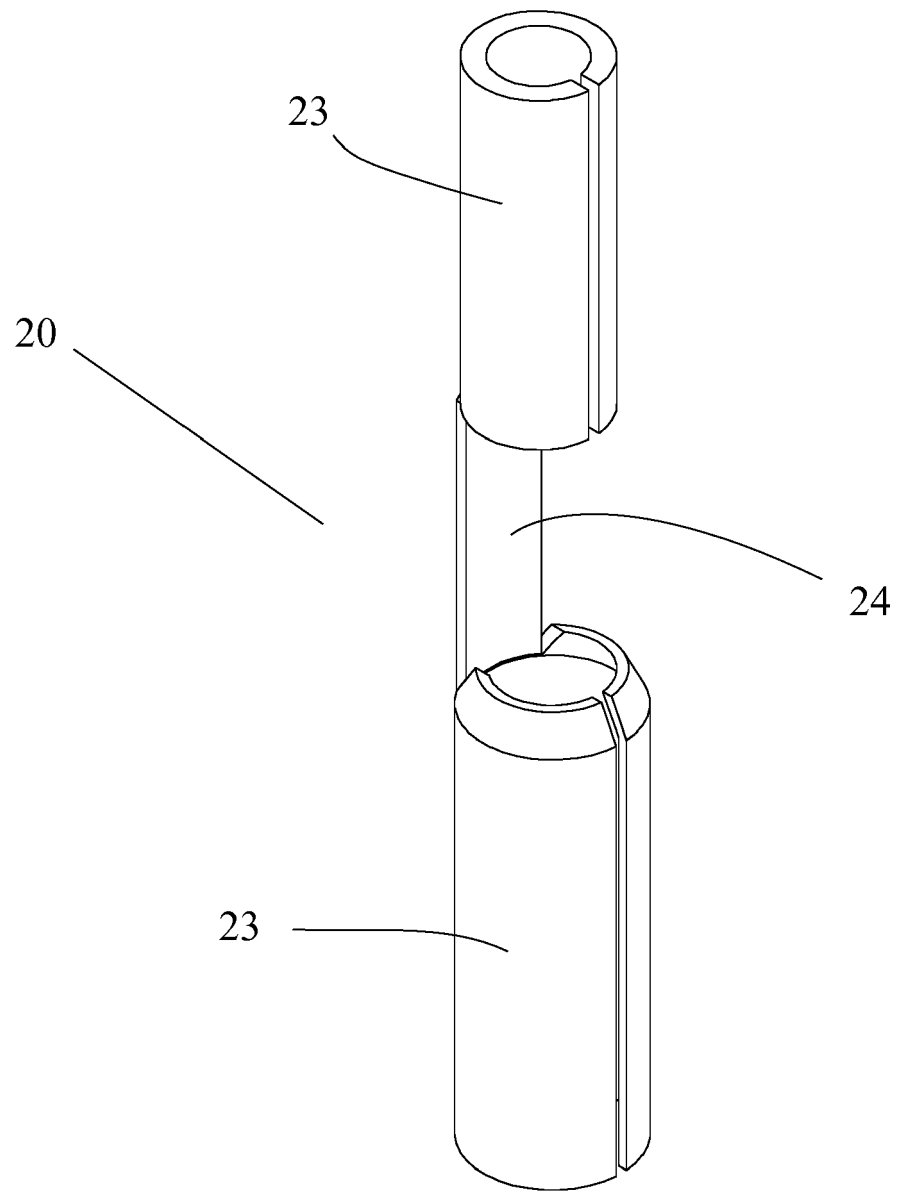


Fig. 6

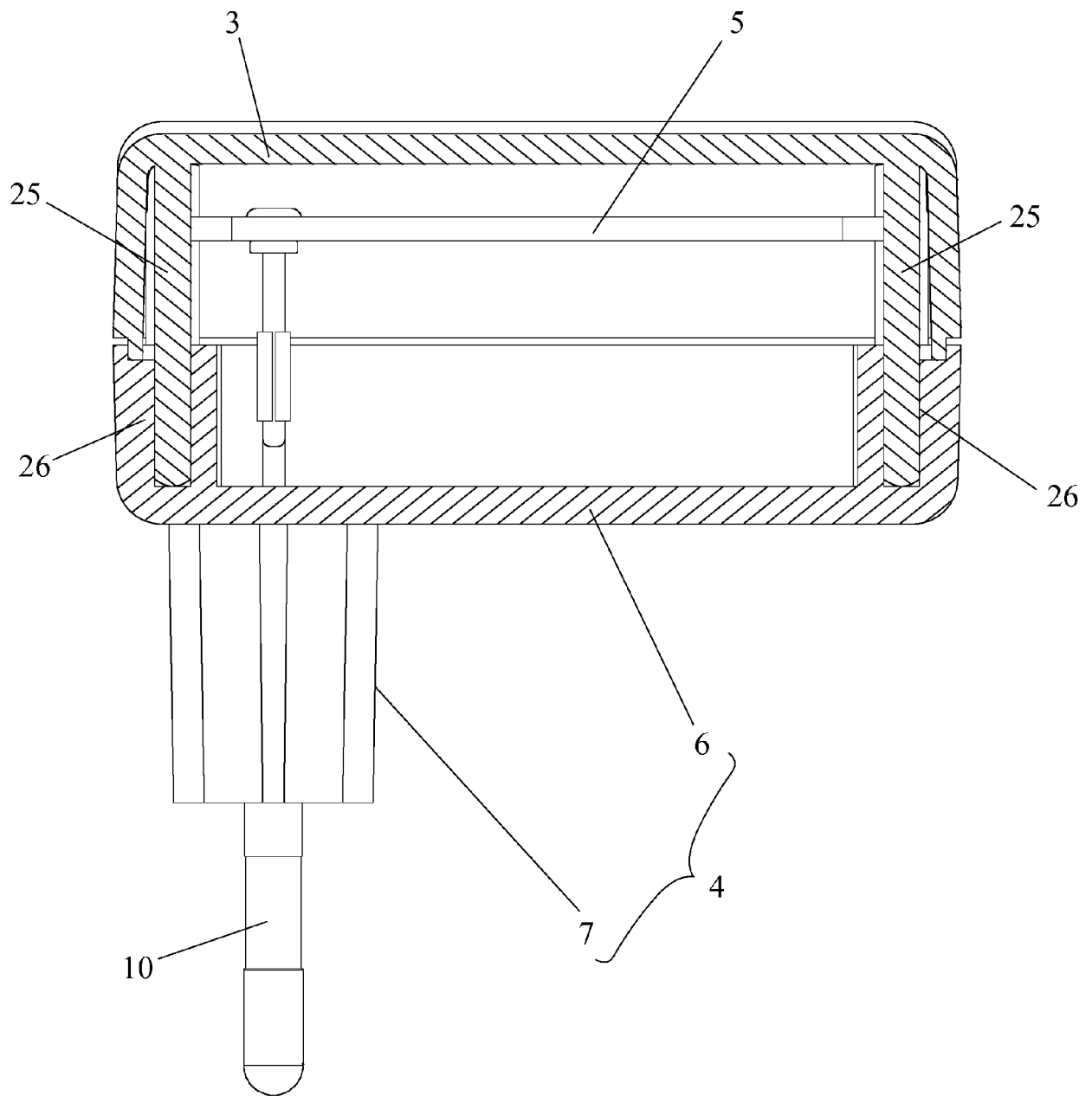


Fig. 7



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Application Number
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