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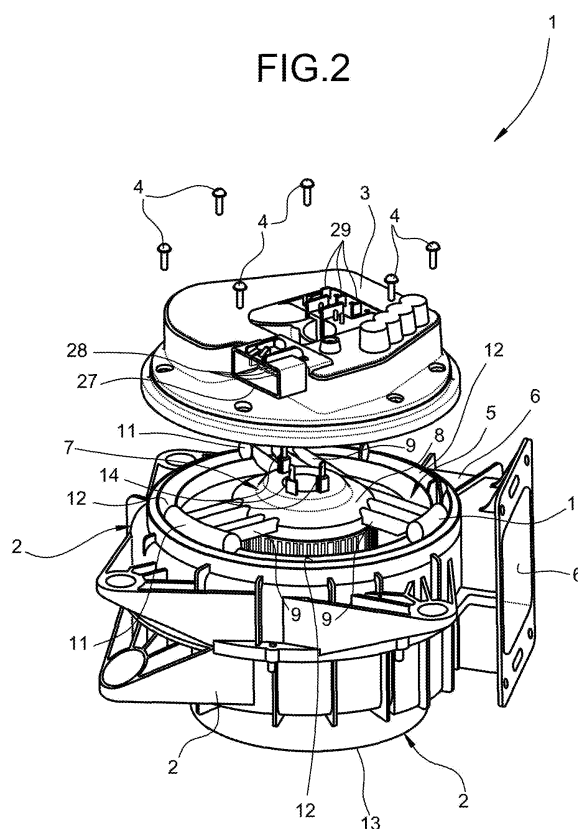
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(54) **Motorized electrical apparatus, in particular motorized electric fan**

(57) The apparatus (1) is in particular a motorized electric fan (1) and comprises a rigid support housing (2, 3) which defines internally a working chamber (5), an electric motor (7), in particular a brushless motor (7), arranged inside the housing (2, 3) and connected to the latter by vibration-damping means (11), for actuating an operating device which extends inside the working chamber (5), and power supply and control circuit means (17, 18) associated with and connected to the motor (7) and mounted, together with an associated heat dissipator (20), on at least one support card or board (16) which is fixed to the support housing (2, 3).

FIG.2



Description

[0001] The present invention relates in general to motorized electrical apparatus.

[0002] More specifically, the invention relates to a motorized electric apparatus, in particular a motorized electric fan, of the type comprising a rigid support housing defining internally a working chamber, and an electric motor, in particular a brushless motor, arranged inside the housing and connected thereto by vibration-damping means, for actuating an operating device such as a fan impeller extending inside the working chamber.

[0003] During operation the electric motor is activated by rotational actuation of the associated operating device. The combined rotation of the rotor part of the motor and the associated operating device results in the generation of vibrations, the transmission of which to the support housing (and to the structure to which the latter is fixed) is reduced by the damping means which are arranged between this motor and the support housing.

[0004] In these apparatus, power supply and control circuits mounted on (at least) one support card or board are typically associated with the electric motor. These circuits typically also comprise fairly voluminous and relatively heavy components, such as electrolytic capacitors. The same support card or board for the power supply and control circuits also typically has, connected thereto, means for dissipating the heat generated during operation of the circuit components.

[0005] According to the prior art the support card or board which houses the power supply and control circuits and the associated heat-dissipation means is fixed directly to the motor. Therefore, the weight of the power supply and control circuits as well as the weight of the associated heat-dissipation means and that of the support card or board is added to the overall weight of the motor, resulting in a substantial increase in the intensity of the vibrations produced during operation.

[0006] One object of the present invention is to propose a motorized electrical apparatus of the type initially mentioned, which is able to eliminate or at least substantially limit the aforementioned drawback of the solutions according to the prior art.

[0007] This object, together with others, is achieved according to the invention by means of a motorized electrical apparatus, the main characteristic features of which are defined in the accompanying Claim 1.

[0008] In a motorized electrical apparatus according to the invention the abovementioned at least one support card or board for the power supply and control circuit means, together with the associated heat-dissipation means, is fixed directly to the support housing. In this way their weight is not added to that of the motor or to that of the source of the vibrations, but is instead added to the weight of the operationally stationary structure of the apparatus.

[0009] This thereby results in a substantial reduction in the intensity of the vibrations induced during operation.

[0010] According to a further characteristic feature, the support housing of the apparatus comprises a hollow body defining internally the abovementioned working chamber, and a cover which is fixed to this body, and the support card or board for the power supply and control circuit means is preferably fixed to this cover.

[0011] Further characteristic features and advantages of the invention will become clear from the following detailed description provided purely by way of a non-limiting example, with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a motorized electric fan according to the present invention;

Figure 2 is another, partially exploded, perspective view of the motorized fan according to Figure 1;

Figure 4 is a view on a larger scale of part of Figure 3;

Figure 5 and Figure 6 are two exploded perspective views of a cover forming part of the support housing of the motorized fan according to the preceding figures;

Figure 7 is a partial perspective view, from above, of the cover according to Figures 5 and 6;

Figure 8 is a plan view, from below, of the cover according to the preceding figures;

Figure 9 is a partial perspective view of a variation of embodiment of the cover for an apparatus according to the invention;

Figure 10 is a perspective view of an electrically conductive connecting member used in the variation of embodiment according to Figure 9;

Figure 11 is a partial perspective view, from below, of the cover according to Figure 9; and

Figure 12 is a perspective view of an electrical connecting element which can be used with the cover according to Figures 9 and 11.

[0012] In the drawings 1 denotes overall a motorized electrical apparatus, in particular a motorized electric fan, according to the invention.

[0013] The motorized fan 1 comprises a rigid support housing which, in the embodiment shown, comprises a hollow body 2 which is, for example, made of moulded plastic and to the top of which a cover 3, which is also conveniently made of moulded plastic, is fixed.

[0014] Fixing of the cover 3 to the body 2 is performed for example using screw means 4 (Figures 1 and 2).

[0015] With reference to Figure 2, the body 2 is open at the top and defines internally a chamber 5 (see also Figure 3) communicating with a tangential outlet duct 6 formed integrally with this body. Essentially, in the example of embodiment shown, the body 2 forms substantially a tangential outlet spiral or volute of a fan.

[0016] The chamber 5 houses an electric motor denoted overall by 7 in Figure 2. This motor is, for example, a direct-current brushless motor and has an operationally stationary stator part 8. As can be seen in Figures 2 and 4, the stator part 8 of the electric motor 7 has a plurality

of radial-arm assemblies 9 which extend in a practically radial direction outwards.

[0017] The outer ends of the radial arms of each assembly are interconnected by a connecting element 10 (Figure 4, right-hand side) having a progression in the form of a circle arc. Respective sheaths 11 of a vibration-damping material, such as elastomer material (Figures 2 to 4), for example in the form of essentially cylindrical sleeves, are mounted on these connecting elements 10.

[0018] With reference to Figures 2 and 3, the electric motor is positioned inside the container 2, with the ends 10 of the radial arms and the associated damping elements 11 which rest on a channel 12 provided in the top edge of the body 2. The cover 3, complete with the associated devices which will be described below, is then fixed to the body 2 so that the connecting elements 10 and the associated vibration-damping elements 11 are firmly gripped between this cover 3 and said body 2.

[0019] In a manner known per se and not shown in the drawings, the electric motor 7 comprises a rotor to which an operating device extending inside the bottom of the working chamber 5 is connected. Such an operating device is, for example, a vaned fan impeller.

[0020] With reference to Figure 3, in the embodiment shown, the body 2 of the support housing of the motorized fan 1 has at the bottom an axial intake opening 13 which is essentially concentric with the axis of rotation of the motor 7. During operation, activation of the electric motor 7 causes the intake of an airflow into the chamber 5 through the opening 13 and the conveying of an airflow inside the tangential outlet duct 6 integrally formed in the body 2.

[0021] With reference to Figures 2 and 4, the stator 8 of the electric motor 7 has a plurality of electrical connection terminals 14 projecting upwards in the direction of the cover 3. These terminals are connected to the windings or phases of the motor 7.

[0022] With reference to Figures 5 to 8, the cover 3 is formed by an element made of moulded plastic and having an opening 15 in its central portion.

[0023] In Figures 5 and 6, 16 denotes a printed circuit board or card which houses a plurality of electrical/electronic components which form power supply and control circuits of the electric motor 7.

[0024] Figures 5 and 6 show only some components of these circuits, such as electrolytic capacitors 17 and electronic solid-state switches (MOSFET transistors) 18.

[0025] The board or card 16 also has a central opening, denoted by 19, with a shape essentially corresponding to that of the opening 15 in the cover 3.

[0026] The bottom side of the board or card 16 has, fixed thereto, a heat-dissipation element 20 made of metallic material, with the arrangement, in between, of a thin sheet 21 of material which is electrically conductive, but has at least a reasonable thermal conductivity.

[0027] The board or card 16 and the associated dissipator 20 are fixed to the bottom side of the cover 3 by means of a plurality of screws denoted by 22 in Figures

5 and 6.

[0028] With reference to Figures 5, 6 and 8, the bottom side of the cover 3 also has, fixed thereto, a covering element 23 which is, for example, made of plastic and covers the bottom side of the card or board 16. This covering element 23 has an opening 24, through which the heat dissipator 20 extends, and a further central opening 25 which has a shape essentially corresponding to that of the opening 19 of the card or board 16 and to the opening 15 of the cover 3.

[0029] In Figures 1, 3 and 4 to 6, 26 denotes a small top cover piece which is, for example, made of moulded plastic and closes at the top the opening 15 of the main cover 3. The top cover piece 26 and the main cover 3 may be joined together for example by means of snap-engagement.

[0030] The main cover 3 has, integrally formed therein, a multi-pole connector 27 including a plurality of electrical terminals 28 (Figure 2) for example in the form of flat pins connected, inside the cover 3, to the circuits mounted on the card 16.

[0031] The terminals 14 of the phases of the electric motor 7 are each connected in order to a corresponding terminal 29 incorporated in the cover 3 during moulding thereof (Figure 7), for example by means of flexible electrically conductive braids. These braids may be provided at one end with a connector, designed to be connected to a respective phase terminal 14, and at the other end may be provided with a similar terminal designed to be connected to a terminal 29, or they may be soldered directly to this terminal 29.

[0032] In any case, the connectors connecting together the phase terminals 14 and the terminals 29 of the main cover are confined within the region situated between the main cover 3 and the associated top cover piece 26 which not only covers and closes the opening 15 but also extends so as to cover and close also the portion of the main cover 3 from which the terminals 29 protrude.

[0033] Figures 9 to 12 show a variation of embodiment of the main cover 3. In these figures, parts and elements already described have again been assigned the same reference numbers.

[0034] With reference to Figure 9, according to said variant, the main cover 3 incorporates, during moulding thereof, three terminals 129 essentially in the form of a turret, one of which can be seen in detail in Figure 10. Each of these terminals has a top end 129a, with an opening 129b for engaging a screw or the like, and a bottom end 129c from which four stems 129d protrude downwards, said stems being intended to be soldered to corresponding conductors mounted on the circuit card or board 16.

[0035] In the variant according to Figures 9 to 12, the connection between the phase terminals 14 of the windings of the electric motor 7 and the terminals 129 of the main cover 3, and therefore the power supply and control circuits mounted on the card or board 16, may be per-

formed, for example, using connecting conductors such as that shown by way of example and denoted by 30 in Figure 12. This conductor essentially comprises a conductive braid 31 which has fixed, at one end thereof, a terminal 32 in the form of an eyelet intended to be fitted onto the top portion 129a of a corresponding terminal 129 and to be fixed to the latter by means of a screw and has fixed, at the other end, a terminal 33, for example of the so-called "fast-on" type, which can be connected to a corresponding phase terminal 14 of the electric motor 7.

[0036] The solutions according to the present invention as described above offer numerous advantages.

[0037] Firstly, as already mentioned in the introduction of the present description, the circuit card or board, with the power supply and control circuit components, as well as the associated heat dissipator, is fixed to the operationally stationary structure of the motorized electrical apparatus and not to the electric motor as was the case in the apparatus according to the prior art. As a result, it is possible to achieve a substantial reduction in the vibrations.

[0038] A further advantage of the solution according to the invention consists in the fact that the main cover 3 which helps form the support housing of the apparatus ensures at the same time effective protection of the circuits mounted on the card or board 16, without the need for specific measures, such as resin-coating of said circuits, the use of seals, etc.

[0039] Obviously, without affecting the principle of the invention, the embodiments and the constructional details may be greatly varied with respect to those described and illustrated purely by way of a non-limiting example, without thereby departing from the scope of the invention as defined in the accompanying claims.

Claims

1. Motorized electrical apparatus (1), in particular motorized electric fan (1), comprising
 - a rigid support housing (2, 3) which defines internally a working chamber (5),
 - an electric motor (7), in particular a brushless motor (7), arranged inside the housing (2, 3) and connected to the latter by vibration-damping means (11), for actuating an operating device which extends inside the working chamber (5), and
 - power supply and control circuit means (17, 18) associated with and connected to the motor (7) and mounted, together with associated heat-dissipation means (20), on at least one support card or board (16) which is fixed to the support housing (2, 3).
2. Apparatus according to Claim 1, in which the support housing comprises a hollow body (2), defining internally said working chamber (5), and a main cover (3) fixed to said body (2); said at least one card or board (14) supporting the circuit means (17, 18) being fixed to said main cover (3).
3. Apparatus according to Claim 2, in which the motor (7) has an operationally stationary part (8) having, extending therefrom, a plurality of radial arms (9), the ends (10) of which are gripped between the body (2) and the main cover (3) with the arrangement, in between, of vibration-damping means (11).
4. Apparatus according to Claim 2 or 3, in which the motor (7) has a plurality of terminals (14) which extend facing an opening (15) of said main cover (3) and which are connected to electrical interconnecting terminals (29; 129) mounted on the main cover (3) via flexible connecting conductors (30); said interconnecting terminals (29; 129) of the main cover (3) being connected to the power supply and control circuit means (17, 18) mounted on said support card or board (16).
5. Apparatus according to Claim 4, in which said interconnecting terminals (29; 129) protrude at the top from the main cover (3) for connection to the terminals (14) of the electric motor (7) and at the bottom from this main cover (3) for connection to said power supply and control circuit means (16-18).
6. Apparatus according to Claim 5, in which said interconnecting terminals (29) are in the form of flat pins.
7. Apparatus according to Claim 5, in which said interconnecting terminals (129) are essentially in the form of turrets, with the top end designed to be connected via screw member or similar means to a terminal eyelet (32) of a flexible conductor (30) for connection to a corresponding terminal (14) of the electric motor (7).
8. Apparatus according to any one of Claims 4 to 7, in which the main cover (3) has, associated therewith, a top cover piece (26) designed to cover and close the abovementioned central opening (15) as well as the abovementioned interconnecting terminals (29; 129) and the conductors which connect the latter to the terminals (14) of the electric motor (7).

FIG. 1

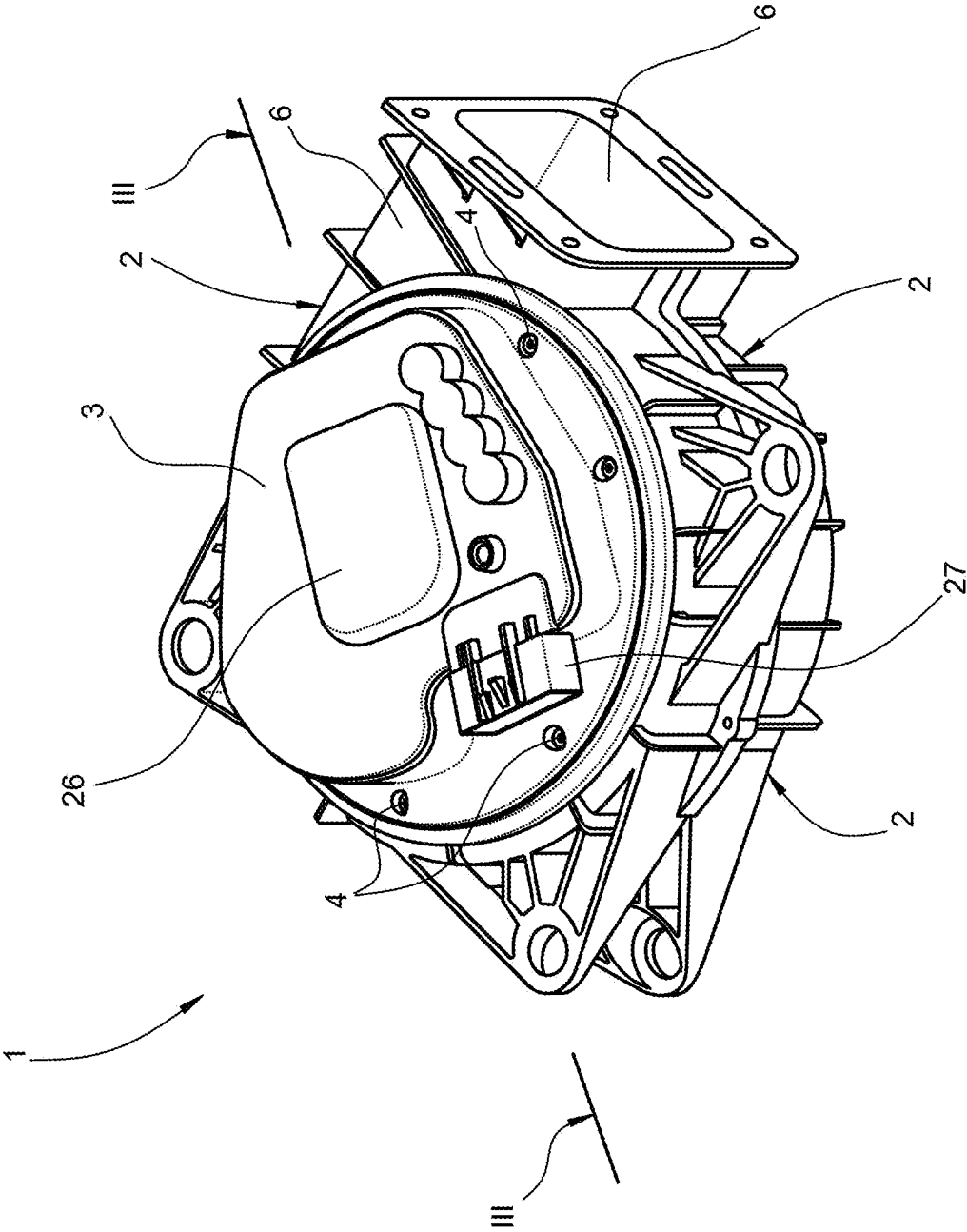


FIG.2

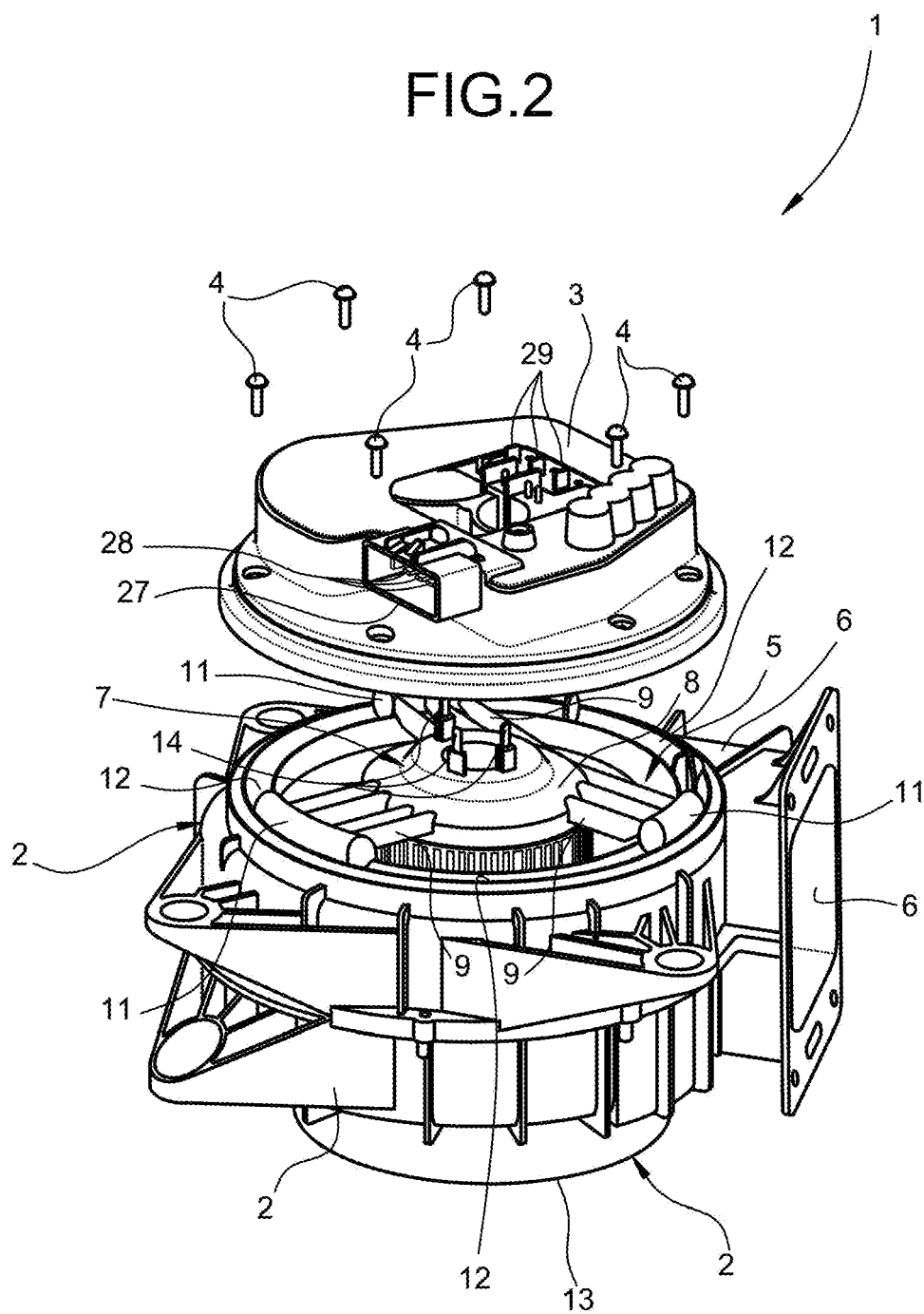


FIG. 3

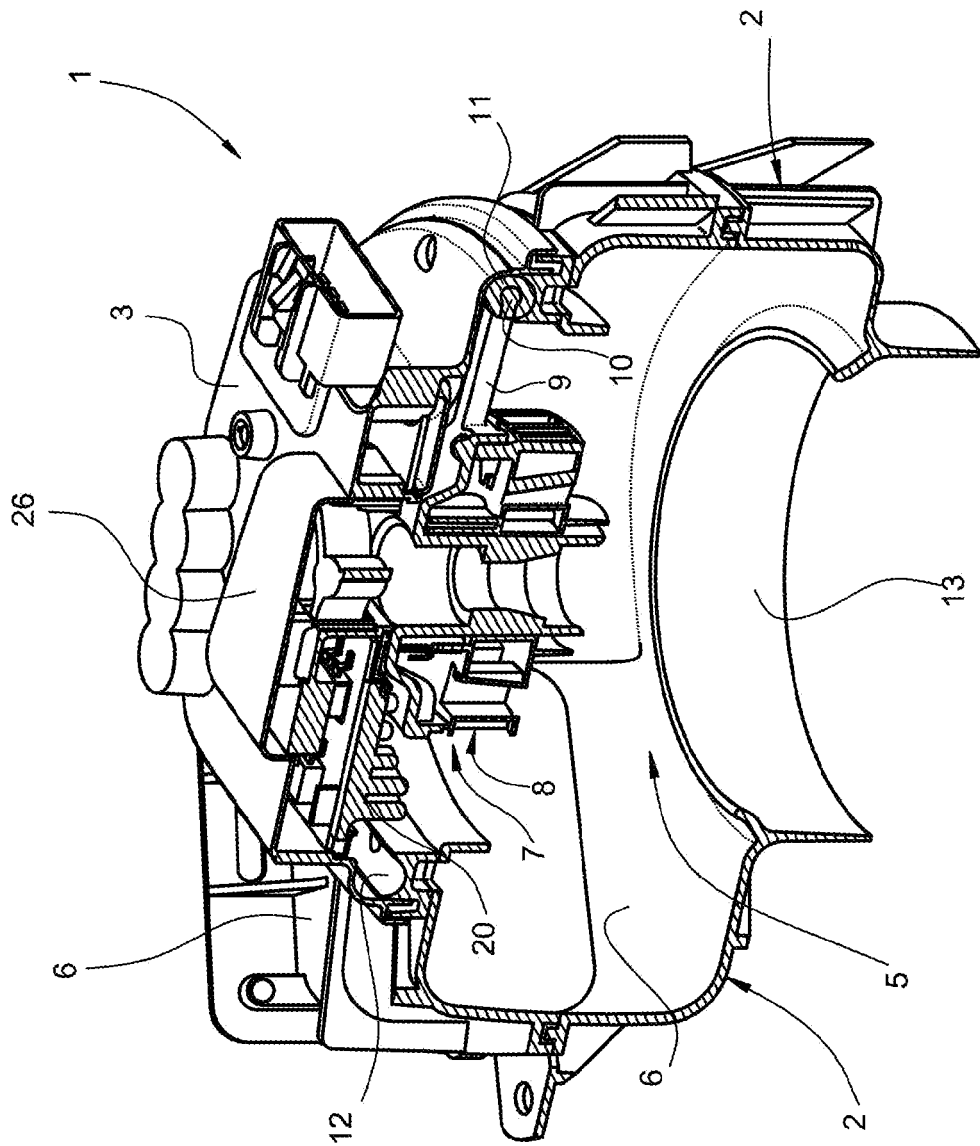


FIG. 4

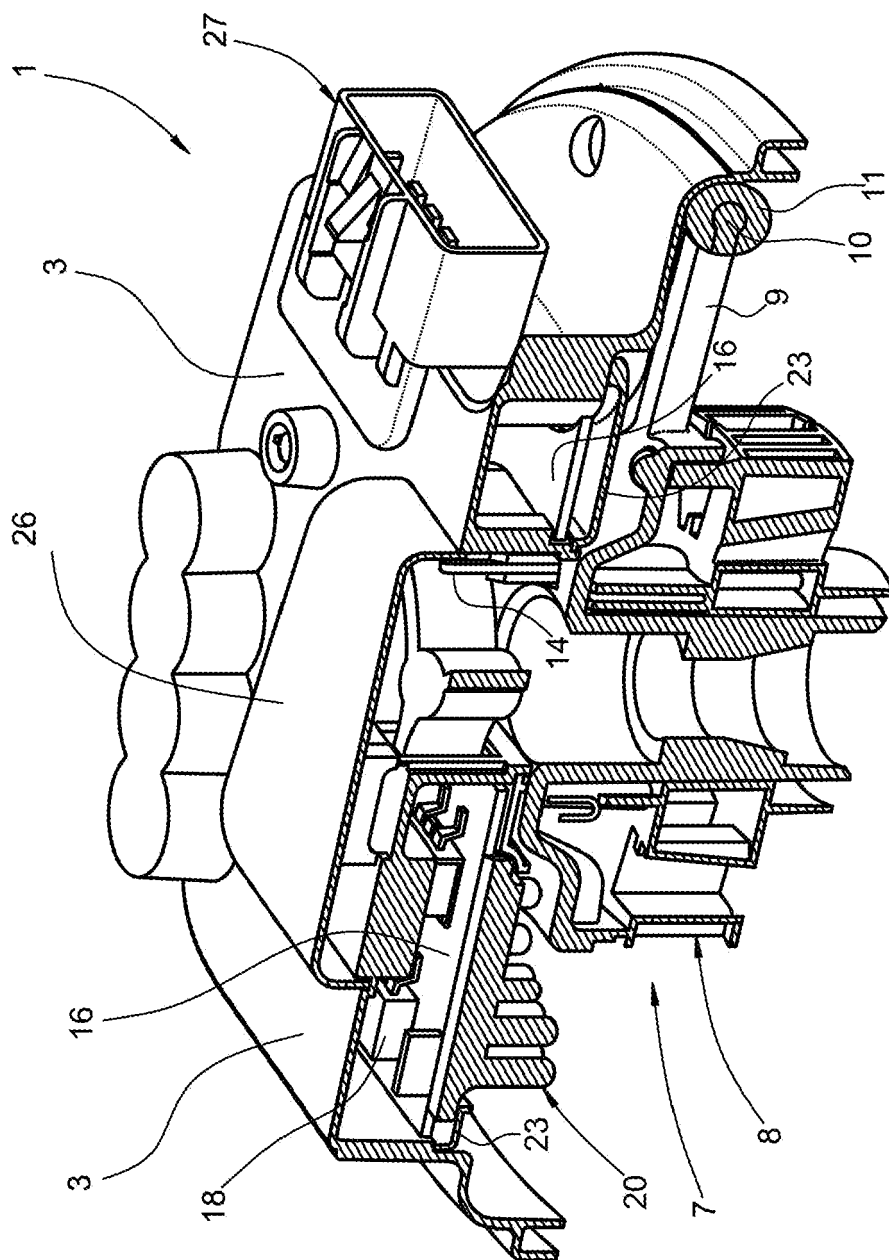


FIG.5

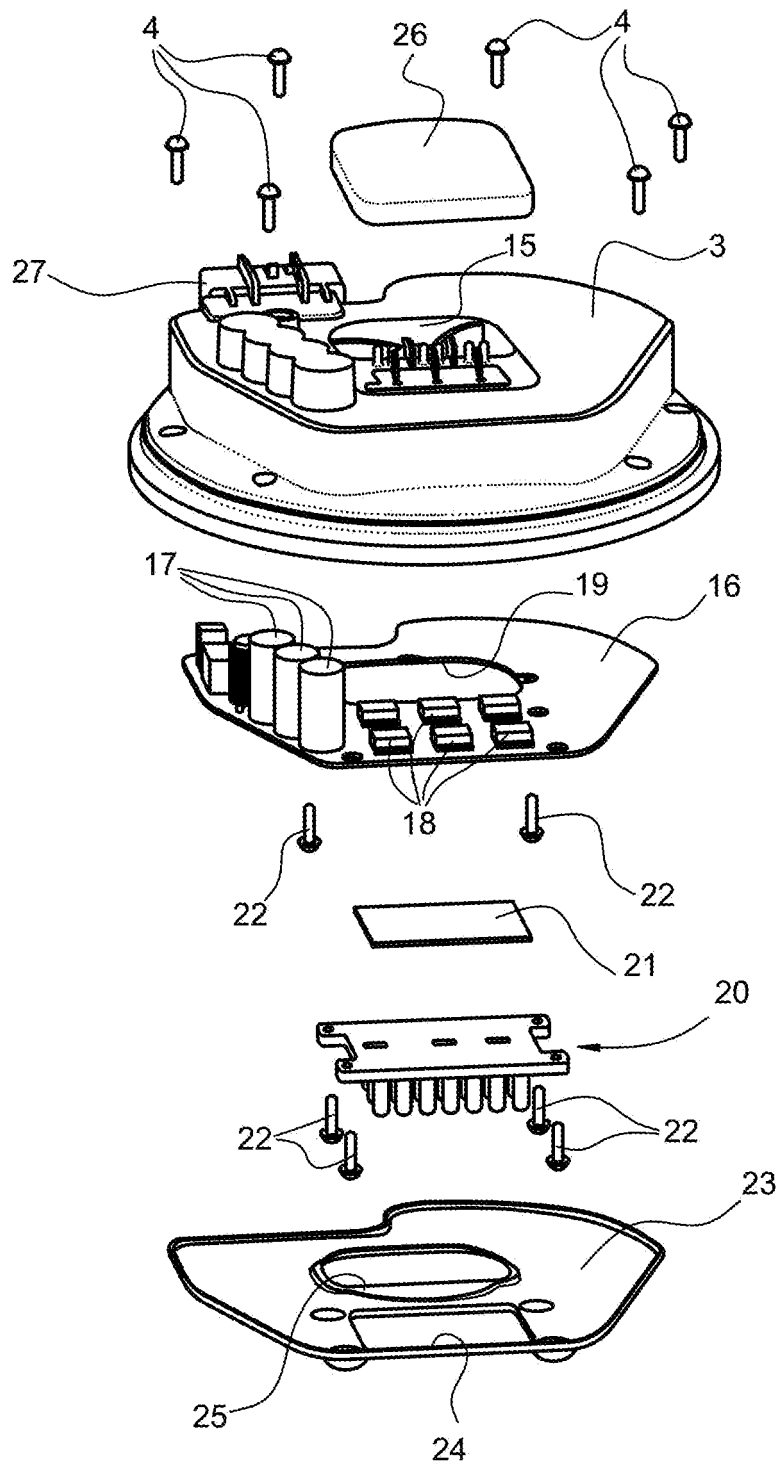


FIG. 6

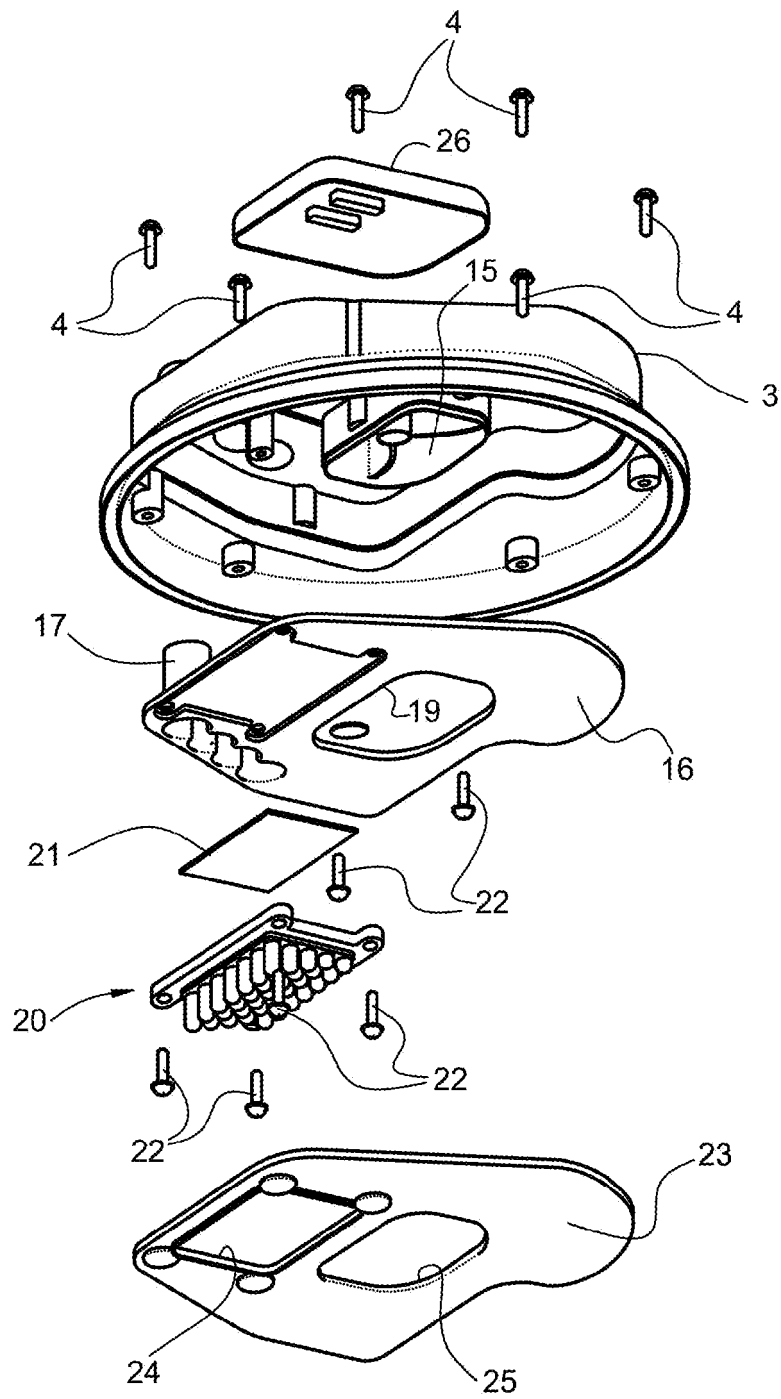


FIG.7

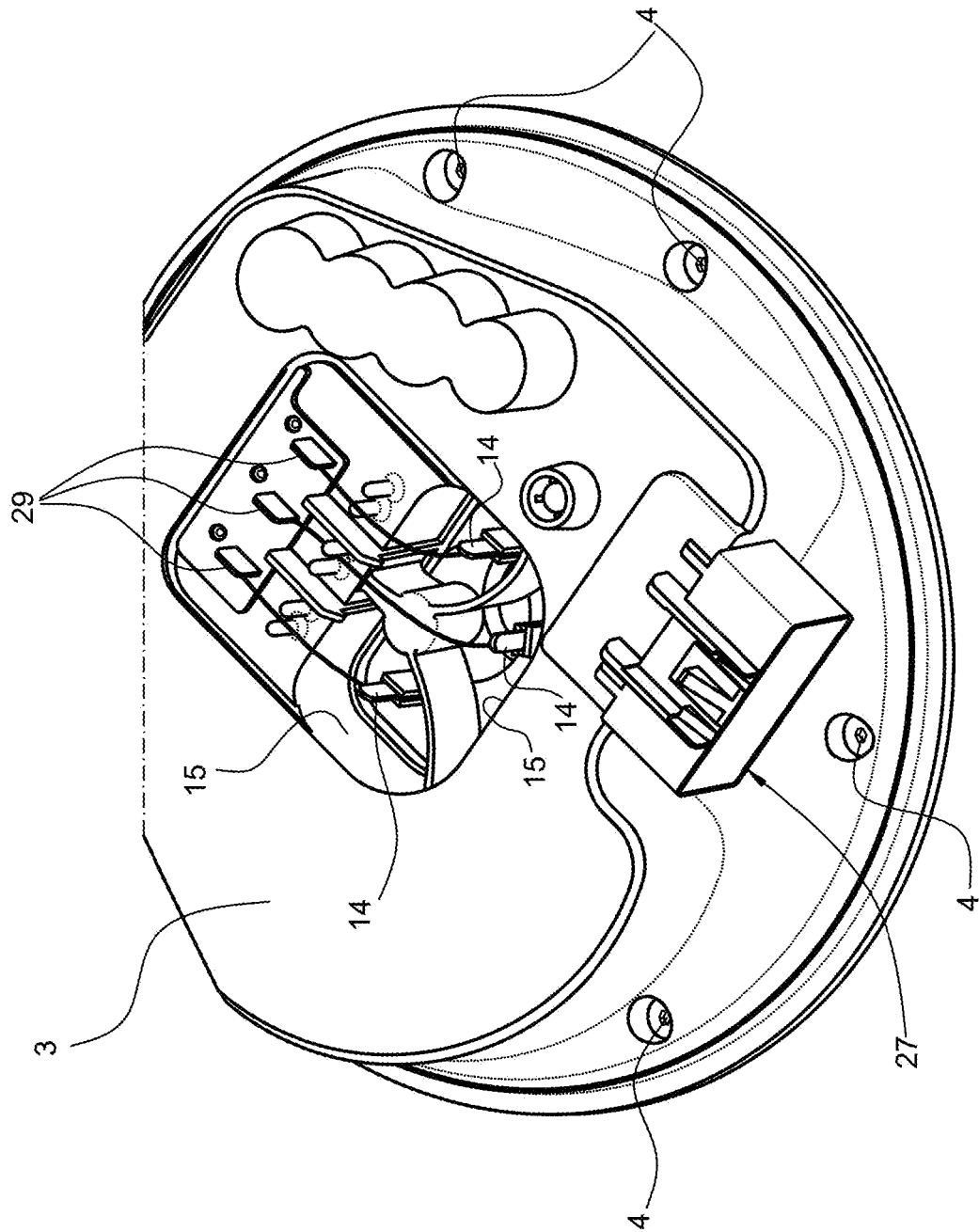


FIG. 8

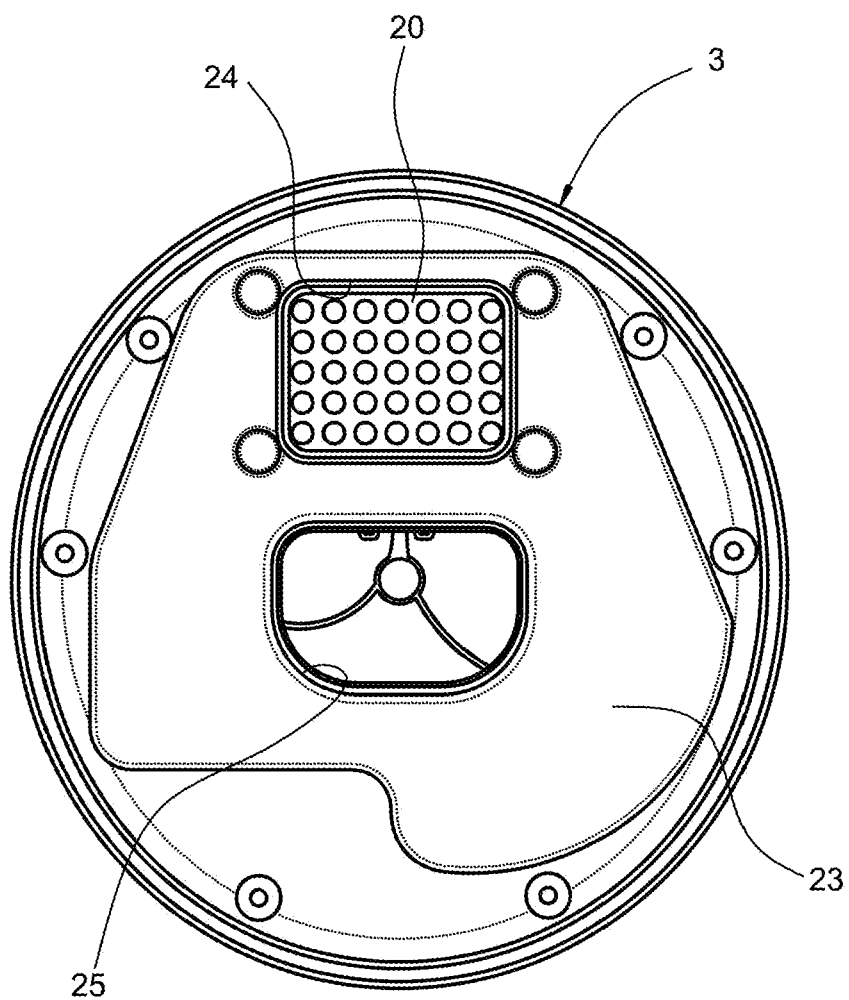


FIG.9

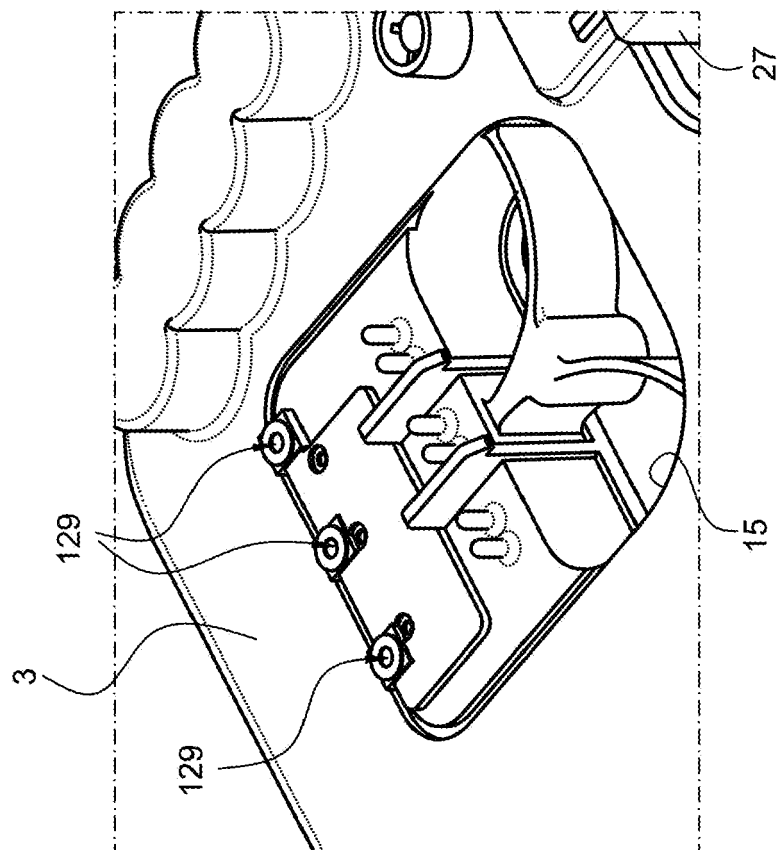


FIG.10

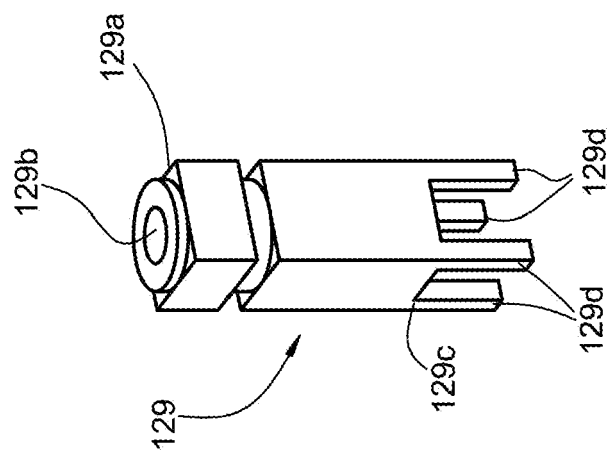


FIG.11

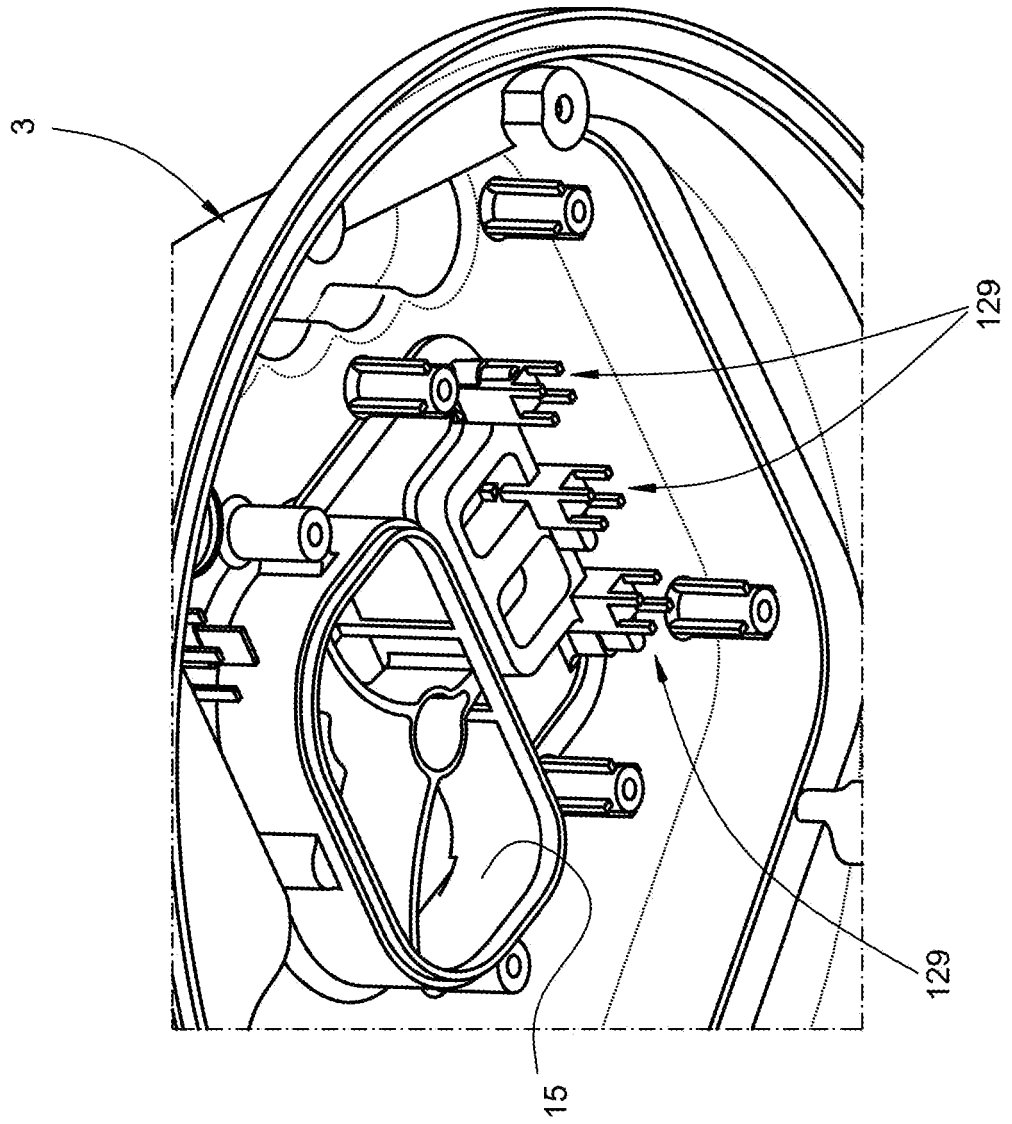


FIG.12

