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(71) Applicant: **Tridonic GmbH & Co. KG**
6851 Dornbirn (AT)

(72) Inventors:

- **Wild, Emanuel**
6850 Dornbirn (AT)
- **Wainowski, David**
6850 Dornbirn (AT)

(74) Representative: **Beder, Jens**
Mitscherlich PartmbB
Patent- und Rechtsanwälte
Karlstraße 7
80333 München (DE)

(54) ELECTRONIC DEVICE WITH CONNECTION TERMINAL

(57) The present invention relates to an electronic device comprising a circuit board (8), at least one contact pin (9a..9e) connected to a pole of the circuit board (8), a terminal connector (3) comprising at least one terminal connector unit and a housing (2a..2d) that at least partially encloses the circuit board (8) and the terminal connector (3), wherein each connecting unit comprises a first conductor connection terminal (14), a second conductor connection terminal (13) and a plug-in connector terminal (4) and is configured to electrically connect, to the contact

pin (9a..9e) connected to the first conductor connection terminal (14), an electrical conductor connected to the second conductor connection terminal (13) and at least one contact of a plug-in connector connected to at least one contact of the plug-in connector terminal (4), and the housing (2a..2d) has an opening through which the plug-in connector terminal (4) and/or the plug-in connector connected to the plug-in connector terminal (4) extends at least partially.

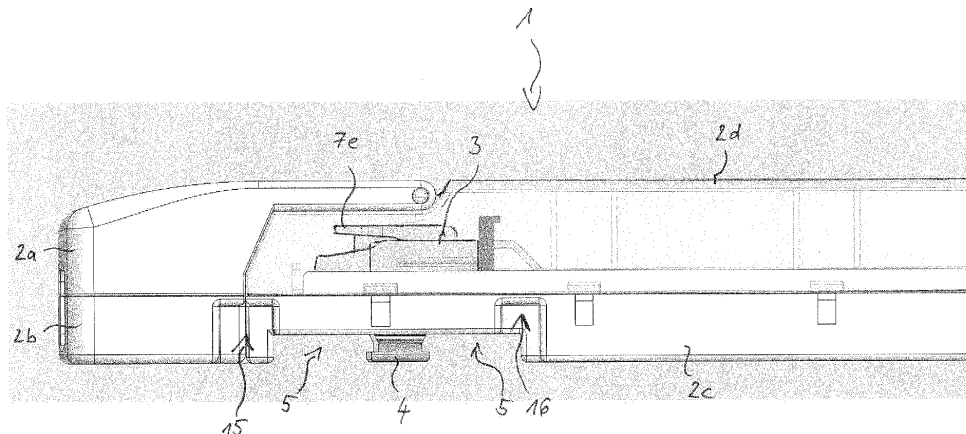


Fig. 1

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Description

[0001] The present invention relates to an electronic device having a multi-functional connection terminal. In particular, the present invention relates to an operating device for an illuminant having a terminal for electrically connecting sensor, main power and/or control cables.

[0002] In lighting systems, operating devices are used to drive lighting means such as gaseous-discharge lamps, halogen bulbs, light-emitting diodes (LED), wherein the operating device can be further configured to monitor operations of lighting means and/or to control color temperature or dimming.

[0003] Many operating devices comprise screw or spring terminals, to which sensor, power and/or control cables can be connected. Alternatively, the cables are connected by plug-in connectors for quick, safe and easy connection and disconnection, wherein the terminal of the operating device comprises a socket or plug connector for connecting the cable fitted with the respective plug-in connector (plug or socket). However, for each of the different connections, an operating device having a special terminal must be provided.

[0004] Further, for many purposes, an electronic device must be flat or slim, so that there are also limitations regarding the size of the terminal, i.e. number of electrical connections and/or the maximum cable cross-section. Further, in addition to the connection of the electronic device itself it is often necessary to extend connections to other devices. In order to facilitate such extension of the connection dedicated connection systems have been developed in the past that reduce mounting and connection times significantly. An example for such connection systems are LINECT® connectors that are provided additionally to the device connections.

[0005] It is an object of the present invention to provide an apparatus, which reduces the above problems. In particular, an object of the present invention is to provide an electronic device that offers a variety of connection options in an easy, compact and cost-efficient manner.

[0006] This object is achieved by the electronic device according to the enclosed independent claim 1. Advantageous features of the present invention are defined in the corresponding subclaims.

[0007] According to an aspect of the present invention, the electronic device comprises a circuit board, at least one contact pin connected to a pole of the circuit board, a terminal connector comprising at least one terminal connector unit and a housing that at least partially encloses the circuit board and the terminal connector. Each connecting unit comprises a first conductor connection terminal, a second conductor connection terminal and a plug-in connector terminal and is configured to electrically connect, to the contact pin connected to the first conductor connection terminal, an electrical conductor connected to the second conductor connection terminal and at least one contact of a plug-in connector connected to at least one contact of the plug-in connector terminal.

The housing has an opening through which the plug-in connector terminal and/or the plug-in connector connected to the plug-in connector terminal extends at least partially.

[0008] In this way, cables fitted with the plug-in connector and cables without the plug-in connector can be connected to the terminal connector of the electronic device, wherein an electrical conductor (wire) can be connected to the second conductor connection terminal and a cable fitted with the plug-in connector can be connected to the plug-in connector terminal (socket or plug). Alternatively, the plug-in connector can be a distribution connector (e.g., T-connector) to which a plurality of cables can be connected.

[0009] As the at least one contact pin is connected by a conductor connection terminal, the connection between the terminal connector and the circuit board can be made easily and inexpensively, and the terminal connector can be easily changed to adapt the electronic device to a particular application. The at least one contact pin is connected to the first conductor connection terminal during the manufacture of the electronic device. Alternatively, the at least one contact pin is connected on site.

[0010] The electronic device can be an operating device for an illuminant (e.g. a LED driver or a ballast for fluorescent lamps), a LED module, a sensor device or a lamp.

[0011] According to the invention, connectors known for example from the LINECT® system can be integrated directly into the device an additional connections and wiring is unnecessary. Apart from the fact that establishing the desired connections is facilitated, it is also an advantage that the amount of part that is needed for manufacturing is reduced, because the LINECT® connectors which are added anyway to the system now can fulfill the task of connecting the circuit board of the device to mains or a bus system directly.

[0012] The first conductor connection terminal and/or the second conductor connection terminal can be a screw terminal or a spring loaded terminal. Alternatively or in addition, at least one of the first conductor connection terminal and the second conductor connection terminal can comprise a clamping spring for clamping the contact pin or the electrical conductor, wherein the terminal connector comprises an insulating housing, and the clamping spring is arranged within the insulating housing.

[0013] In order to provide a defined and reduced contact surface and secure fixing of the at least one contact or the contact pin, the clamping spring can comprise a protrusion and/or a clamping edge for clamping the contact or the contact pin.

[0014] Alternatively or in addition, the terminal connector can comprise an actuating element operated by a user when inserting or pulling out the electric conductor or the contact pin. The actuating element is pivotally or movably supported in the insulator housing and is configured to strike an actuating section of the clamping spring by pivoting or moving the actuating element at

least from an open to a closed position and vice versa.

[0015] Alternatively or in addition, the plug-in connector terminal can comprise a locking element for locking/unlocking the plug-in connector connected to the plug-in connector terminal.

[0016] The electronic device can comprise a plurality of the contact pins connected to different poles of the circuit board, wherein the terminal connector comprises a plurality of the terminal connector units adjacent to each other, and the first conductor connection terminal of each terminal connector unit is configured to connect one contact pin of the plurality of the contact pins.

[0017] The plurality of the contact pins can form a pin header connected to a plurality of first conductor connection terminals.

[0018] Preferably, the contact pin(s) is/are soldered to the circuit board to connect the pole(s) of the circuit board.

[0019] The contact pin can comprise a first part soldered to the circuit board and a second part connected to the first conductor connection terminal, wherein the main extension direction of the first part is perpendicular to the main extension direction of the second part.

[0020] In addition, the electronic device can comprise a supporting structure for supporting the second part.

[0021] The supporting structure can comprise a plate arranged vertically on the circuit board, wherein the plate fixes the second part at least in lateral direction with respect to the main extension direction of the second part.

[0022] The supporting structure can further comprise at least one support element for supporting the plate, wherein each support element is mechanically coupled to the circuit board.

[0023] Alternatively or in addition, the first conductor connection terminal has a first insertion direction for the contact pin, the second conductor connection terminal has a second insertion direction for the electrical conductor and the plug-in connector terminal has a third insertion direction for the plug-in connector, wherein the first and the second insertion directions can be opposite to each other, and the first and the third insertion direction and the second and the third insertion direction can be substantially perpendicular to each other. In this way, the additional connection option (the plug-in connector terminal or the second conductor connection terminal) do not increase the size of the electronic device.

[0024] The electronic device can comprise the plug-in connector, which is configured to connect to the plug-in connector terminal by sliding the plug-in connector placed on the plug-in connector terminal in a direction that is perpendicular to the first, the second and the third insertion direction so that a latch of the plug-in connector engages a recess of the housing or the terminal connector and then moving the plug-in connector in the third insertion direction so that the at least one contact of the plug-in connector connects to the at least one contact of the plug-in connector terminal.

[0025] Preferably, the terminal connector is a LINECT® lighting connector and the plug-in connector preferably

is LINECT® plug connector (distribution connector/T connector), both are available on the market.

[0026] The invention is to be explained more detailed in the following with reference to the accompanying drawing, wherein:

FIG. 1 shows the electronic device according to an embodiment of the present invention in a side view,

FIG. 2 shows the electronic device shown in FIG. 1 in a perspective view with the cover for the connectors open,

FIG. 3 shows the terminal connector and the circuit board of the electronic device shown in FIG. 1 in a side view,

FIG. 4 shows the terminal connector and the circuit board of the electronic device shown in FIG. 1 from a top view,

FIG. 5 shows a terminal connector according to an embodiment of the present invention in a sectional view,

FIG. 6 shows a plug-in connector for the electronic device shown in FIG. 1 in a side view, and

FIG. 7 shows the plug-in connector shown in FIG. 6 from a top view.

[0027] In the figures 1 to 7, same reference signs refer to the same or analogous elements.

[0028] Fig. 1 shows the front section of an electronic device 1 according to an embodiment of the present invention. The electronic device 1 is an operating device for an illuminant (e.g. LED module). The housing of the electronic device consists of several parts 2a..2d, with the housing part 2d being shown transparent in Fig. 1, and encloses a circuit board (not shown) and partially a terminal connector 3.

[0029] The terminal connector 3 comprises a connection socket 4 having five electrical connectors (contact sockets) adjacent to each other to connect contact pins of a plug-in connector (not shown). A first recess 5, a second recess 16 and a third recess 16 are formed on the housing part 2c, wherein the first recess 5 extends into the housing from a bottom surface of the housing part 2c and the second recess 16 and a third recess 16 extend into the housing from a side surface of the housing part 2c. The first recess 5 has an opening/hole (not shown) through which the terminal connector 3 extends to the outside. The plug-in connector (not shown) is received in the first recess 5 and guide pins of the plug-in connector are received in the second recess 16 and the third recess 16, when the plug-in connector is connected to the terminal connector 3. The housing part 2d is a hinged flap that covers connections for wires.

[0030] Fig. 2 shows the electronic device 1 with the flap open. As shown in Fig. 2, the terminal connector 3 comprises a first set of five conductor connection terminals arranged adjacent to each other to connect the electrical conductors L, PE, N of a power cable and to connect two electrical conductors of a control cable (e.g., DALI line). The electrical conductors can be inserted into openings 6a..6e of the conductor connection terminals, wherein each of the actuating elements 7a..7e can be pressed by the user to insert/remove an electrical conductor into/from the respective conductor connection terminal. Alternatively, two five pole cables can be connected to the conductor connection terminals 6a..6e to loop the mains supply and control signals (e.g., DALI-signals).

[0031] Each of the five conductor connection terminals is connected to one of the five electrical connectors (contact sockets) of the connection socket 4. In this way, cables can be connected to the electronic device 1 by the conductor connection terminals and/or the connection socket 4 when the cable is fitted with the plug-in connector.

[0032] The electronic device 1 further comprises a rectifier, a PFC (Power Factor Correction) circuit, a DC-to-DC converter and a microcontroller or another controlling means for controlling at least the DC-to-DC converter. At least a part of these electronic components is mounted on the circuit board or a printed circuit board (PCB) and is electrically connected to the terminal connector 3.

[0033] FIG. 3 and FIG. 4 show the terminal connector 3 and a section of the circuit board 8 in a side view and from a top view, respectively. The circuit board 8 is electrically connected to the terminal connector 3 by five contact pins 9a..9e soldered to the circuit board 8. The contact pins 9a..9e are connected to different poles 10a..10e of the circuit board 8 and are connected to a second set of five conductor connection terminals of the terminal connector 3, wherein each contact pin 9a..9e (e.g., copper wire) is bent so that a first part 9a₁..9e₁ of the contact pin 9a..9e is perpendicular and a second part 9a₂..9e₂ of the contact pin 9a..9e is parallel to the printed circuit board 8. The first part 9a₁..9e₁ is connected/soldered to one of the different poles 10a..10e and the second part 9a₂..9e₂ (marked by the dashed line in FIG. 3 and FIG. 4) is inserted into one conductor connection terminal of the second set.

[0034] The second part 9a₂..9e₂ of the contact pins 9a..9e is fixed/positioned by a first plate 11a and the second part 9d₂..9e₂ of the contact pins 9d..9e is fixed/positioned by a second plate 11a. The first plate 11a and the second plate 11b stand vertically on the circuit board 8 and are supported by a plurality of holding and supporting elements 12a..12h.

[0035] The conductor connection terminal of the first set, the conductor connection terminal of the second set and the connector (contact socket) of the connection socket 4, which are connected to each other, form a terminal connection unit.

[0036] Fig. 7 shows a cross-sectional side view of the

terminal connector 3, in particular of a terminal connection unit. As shown in Fig. 5, an insulating housing 205 of the terminal connector 3, and thus of each terminal connector unit, comprises a front side 201, which features a first conductor insertion channel (opening 6e) of a conductor connection terminal 13 of the first set, and a bottom side 204 which integrally forms at least a part of a second conductor insertion channel 231 of the connection socket 4.

[0037] Here at the top of the respective terminal connector unit, the actuating element 7e is positioned at the top side 202 of the terminal connector 3.

[0038] A conductor connection terminal 14 of the second set is positioned at a back side 206 of the terminal connector 3, whereby the back side 206 is arranged opposite to the front side 201, with the top and bottom sides 202, 204 connecting the front side 201 with the back side 206.

[0039] Each terminal connection unit comprises a clamping insert built into the insulating housing 205 and configured to connect the contact pin 9a..9e, the electrical conductor and the contact pin of the plug-in connector to each other by. As shown in Fig. 5, the clamping insert is integrally formed as a metal part formed from a clamping spring 293, contact legs 292, 294, a contact clamp 291 and a pin (busbar piece) 290 that connects the clamping spring 293, the contact legs 292, 294 and the contact clamp 291 to each other. The contact clamp 291 (contact socket) is configured to contact the second part 9e₂ of the contact pin 9e when inserted into the terminal connection unit according to a first insertion direction E1. The clamping spring 293 is configured to contact the electrical conductor N when inserted into the terminal connection unit according to a second insertion direction E2. The contact legs 292, 294 are configured to contact a contact pin of the plug-in connector when inserted into the terminal connection unit according to a third insertion direction E3. The first, the second and third insertion directions E1, E2, E3 are angled to each other, so that the contact pin 9e, the electrical conductor N and the plug-in connector can be connected to the same terminal connection unit at the same time.

[0040] The clamping spring 293 is moveable between a clamping position for clamping the electrical conductor at the clamping point 295 for an electrical connection and a release position for allowing the electrical conductor to be inserted into and removed from the clamping point 295. In order to provide a defined and reduced contact surface and secure fixing of the electrical conductor, the clamping spring 293 can comprise a clamping edge 296 for clamping the electrical conductor. The actuating element 7e is configured to move the clamping spring 293 between the clamping position and the release position. The actuating element 7e comprises a lever 242 and a press-element 241, whereby preferably the lever 242 and the press-element 241 are integrally formed and further integrally connected to the housing 205. The press-element 241 protrudes into the inside of the respective ter-

terminal connector unit, and is furthermore in contact with the clamping spring 293. As shown in Fig. 5, no actuating elements (release devices) are provided for the contact legs 9a..9e.

[0041] Fig. 6 and 7 show the plug-in connector in a side view and a top view, respectively. The plug-in connector is a T-connector and has a first part 17 comprising a 5-pin socket 18, a first 5-pin plug 19 and a second 5-pin plug 20 and has a second part 21 that covers the contact pins (not shown) of the second 5-pin plug 20 when the plug-in connector is not connected to the terminal connector 3. The second part 21 is movable in the direction of the first part 17 (indicated by the arrow F) so that the contact pins of the second 5-pin plug 20 can be inserted into the second conductor insertion channels 231 of the connection socket 4 when the plug-in connector is connected to the terminal connector 3.

[0042] The plug-in connector has a first guide pin 22 and a second guide pin 23 that engage the second recess 16 and the third recess 16, respectively, to position the plug-in connector with respect to the connection socket 4.

Claims

1. An electronic device comprising

a circuit board (8),
at least one contact pin (9a..9e) connected to a pole of the circuit board (8),
a terminal connector (3) comprising at least one terminal connector unit, and
a housing (2a..2d) that at least partially encloses the circuit board (8) and the terminal connector (3), wherein
each connector unit comprises a first conductor connection terminal (14), a second conductor connection terminal (13) and a plug-in connector terminal (4) and is configured to electrically connect, to the contact pin (9a..9e) connected to the first conductor connection terminal (14), an electrical conductor connected to the second conductor connection terminal (13) and at least one contact of a plug-in connector connected to at least one contact of the plug-in connector terminal (4), and
the housing (2a..2d) has an opening through which the plug-in connector terminal (4) and/or the plug-in connector connected to the plug-in connector terminal (4) extends at least partially.

2. The electronic device according to claim 1, wherein the electronic device (1) is an LED driver, a ballast for fluorescent lamps, a LED module, a sensor device or a lamp.

3. The electronic device according to claim 1 or 2, wherein

at least one of the first conductor connection terminal (14) and the second conductor connection terminal (13) is a screw terminal or a spring loaded terminal.

4. The electronic device according to any one of the preceding claims, wherein

at least one of the first conductor connection terminal (14) and the second conductor connection terminal (13) comprises a clamping spring (293) for clamping the contact pin (9a..9e) or the electrical conductor,
the terminal connector (3, 24, 44) comprises an insulating housing (205) for carrying the first conductor connection terminal (14) and the second conductor connection terminal (13), and
the clamping spring (293) is arranged within the insulating housing (205).

5. The electronic device according to claim 4, wherein the clamping spring (293) comprises a protrusion and/or a clamping edge for clamping the contact pin (9a..9e) or the electrical conductor.

6. The electronic device according to claim 4 or 5, wherein
the terminal connector (3) comprises an actuating element (7a..7e) pivotally or movably supported in the insulator housing (205) and configured to strike an actuating section of the clamping spring (293) by pivoting or moving the actuating element (7a..7e) at least from an open to a closed position and vice versa.

7. The electronic device according to any one of the preceding claims, wherein

the electronic device (1) comprises a plurality of the contact pins (9a..9e) connected to different poles (10a..10e) of the circuit board (8), and
the terminal connector (3) comprises a plurality of the terminal connector units adjacent to each other, wherein the first conductor connection terminal (14) of each terminal connector unit is configured to connect one contact pin (9a..9e) of the plurality of the contact pins (9a..9e).

8. The electronic device according to claim 7, wherein the plurality of the contact pins (9a..9e) form a pin header connected to the first conductor connection terminals (14) of the plurality of the terminal connector units.

9. The electronic device according to any one of the preceding claims, wherein
the contact pin (9a..9e) is soldered to the circuit board (8) to connect the pole of the circuit board (8).

10. The electronic device according to claim 9, wherein

the contact pin (9a..9e) comprises a first part (9a1..9e1) soldered to the circuit board (8) and a second part (9a2..9e2) connected to the first conductor connection terminal (14), and the main extension direction of the first part (9a₁..9e₁) is perpendicular to the main extension direction of the second part (9a₂..9e₂).

11. The electronic device according to claim 10, wherein the electronic device (1) comprises a supporting structure (11a, 11b, 12a..12h) for supporting the second part (9a2..9e2).

12. The electronic device according to claim 11, wherein

the supporting structure (11a, 11b, 12a..12h) comprises a plate (11a, 11b) arranged vertically on the circuit board (8), and the plate (11a, 11b) fixes the second part (9a₂..9e₂) at least in lateral direction with respect to the main extension direction of the second part.

13. The electronic device according to claim 12, wherein the supporting structure (11a, 11b, 12a..12h) further comprises at least one support element (12a..12h) for supporting the plate (11a, 11b), wherein each the support element (12a..12h) is mechanically coupled to the circuit board (8).

14. The electronic device according to any one of the preceding claims, wherein

the first conductor connection terminal (14) has a first insertion direction (E1) for the contact pin (9a..9e), the second conductor connection terminal (13) has a second insertion direction (E2) for the electrical conductor and the plug-in connector terminal (4) has a third insertion direction (E3) for the plug-in connector, the first and the second insertion directions (E1, E2) are opposite to each other, and the first and the third insertion direction (E1, E₃) and the second and the third insertion direction (E2, E3) are substantially perpendicular to each other.

15. The electronic device according to claim 14, wherein

the electronic device (1) comprises the plug-in connector, and the plug-in connector is configured to connect to the plug-in connector terminal (4) by sliding the plug-in connector placed on the plug-in connector terminal (4) in a direction that is perpendicular to the first, the second and the third in-

sertion direction (E1, E2, E3) so that a latch of the plug-in connector engages a recess of the housing (2a..2d) or the terminal connector (3) and then moving the plug-in connector in the third insertion direction (E3) so that the at least one contact of the plug-in connector connects to the at least one contact of the plug-in connector terminal (4), wherein the terminal connector (3) and the plug-in connector preferably are LI-NECT[®] lighting connector and LINECT[®] plug connector, respectively.

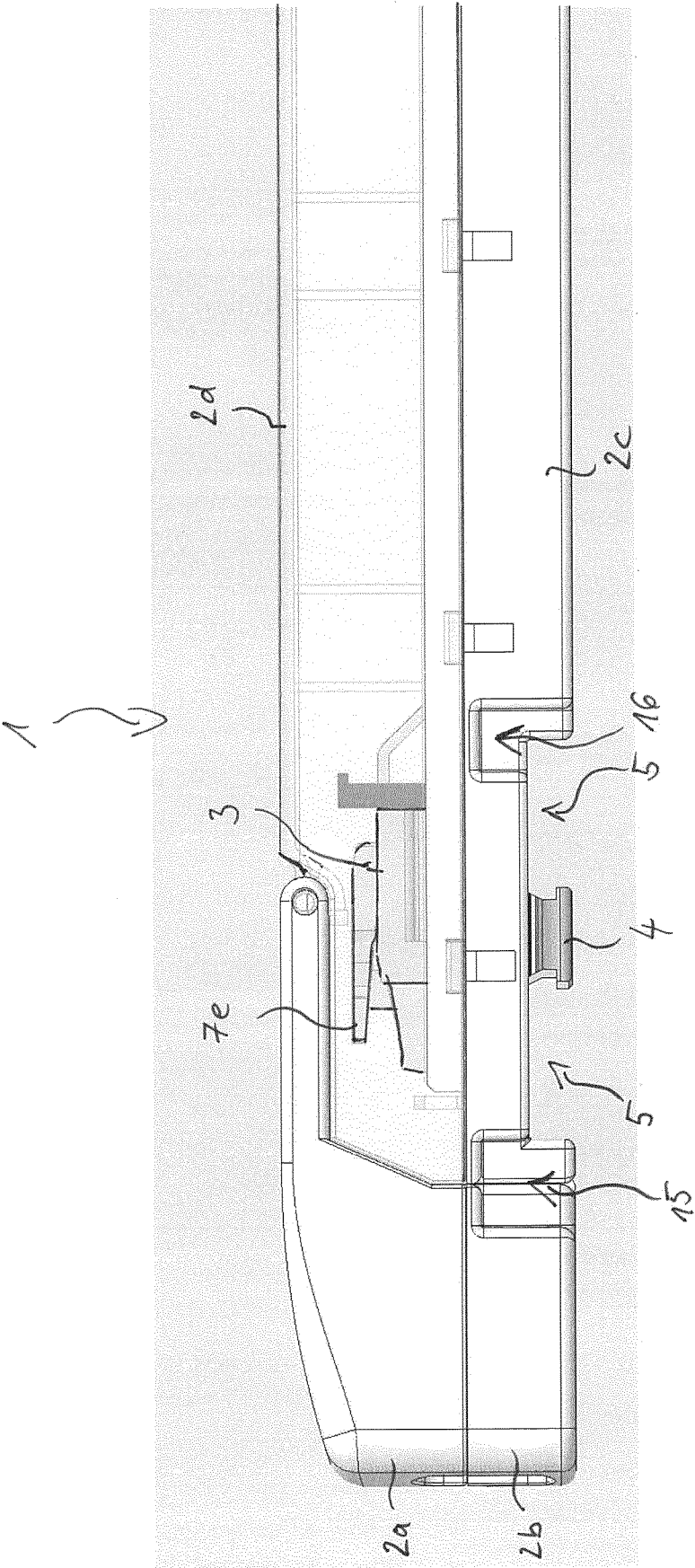


Fig. 1

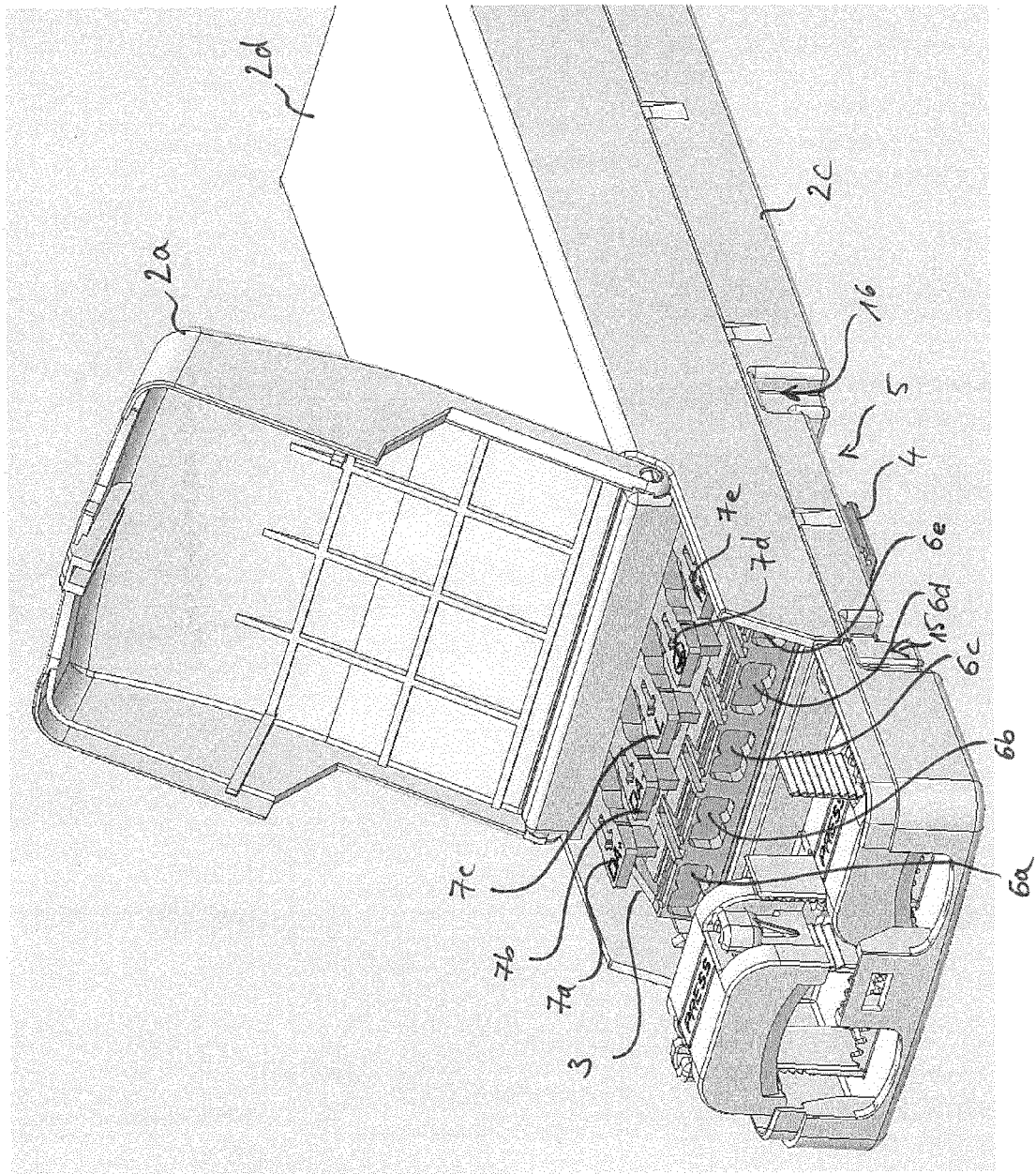


Fig. 2

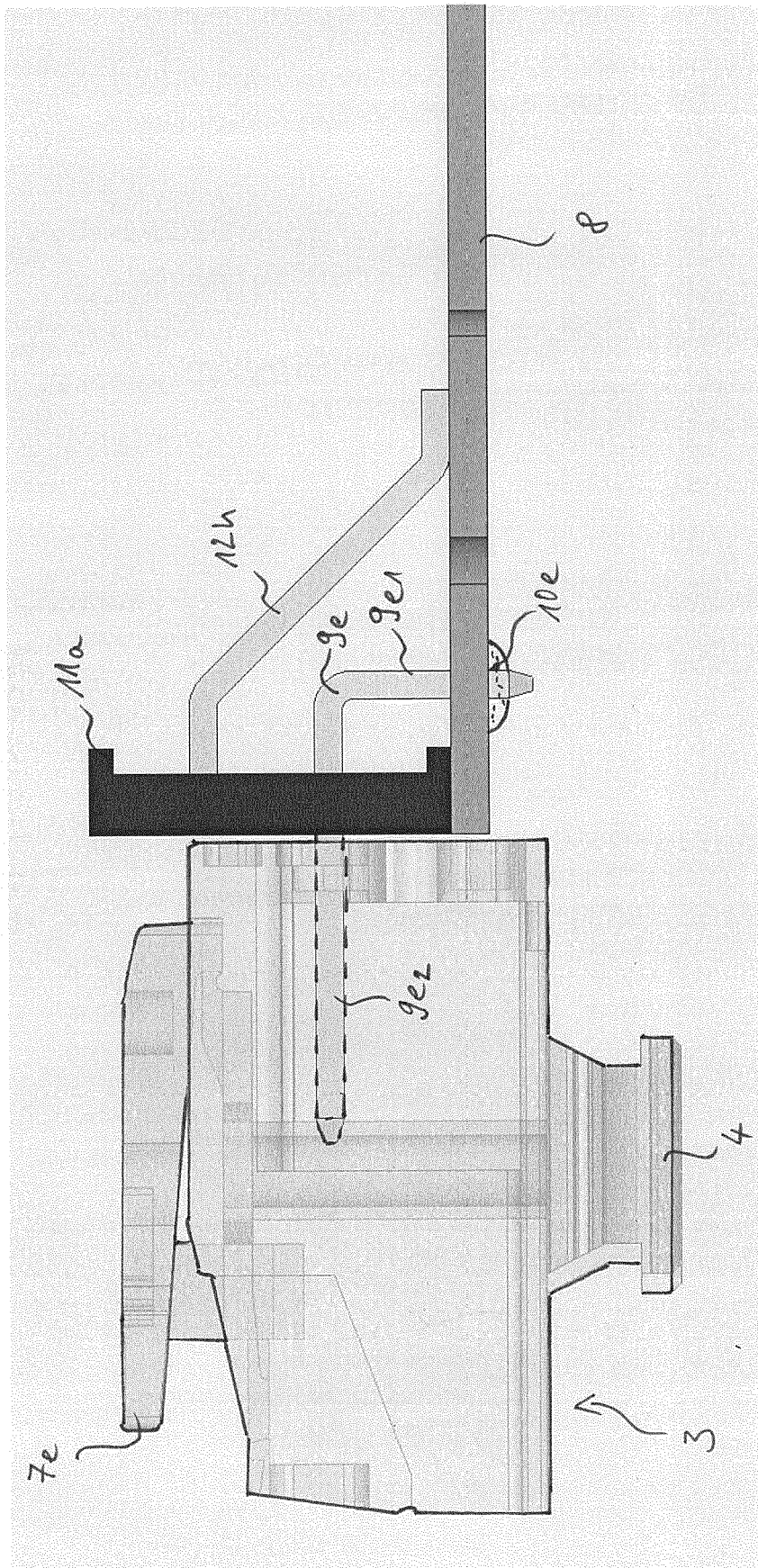


Fig. 3

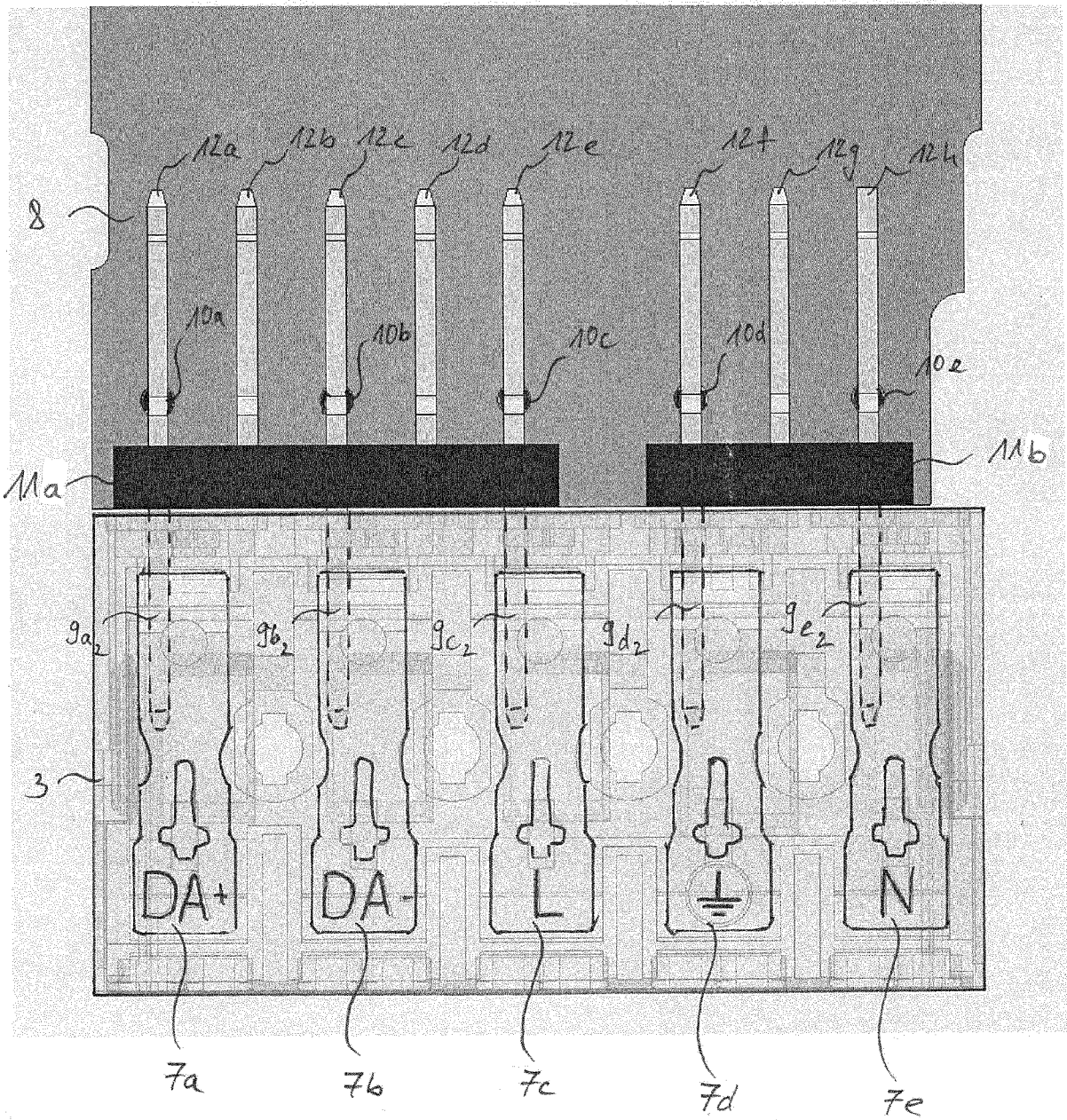


Fig. 4

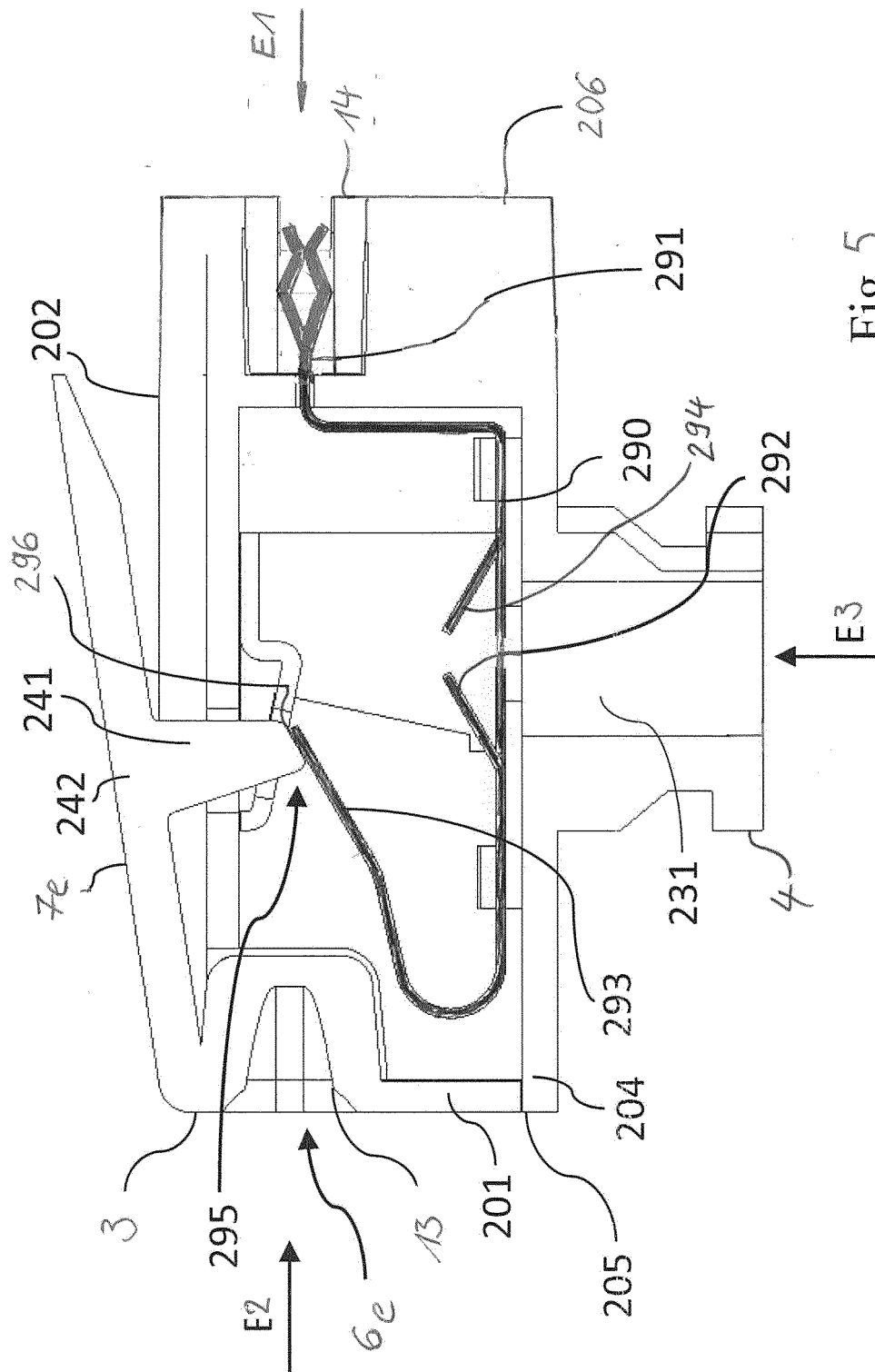


Fig. 5

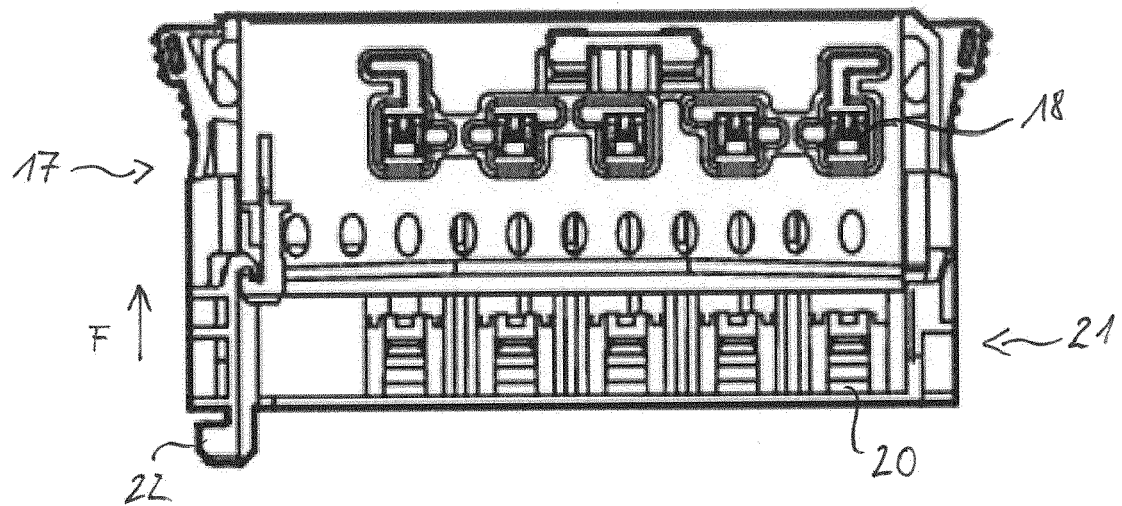


Fig. 6

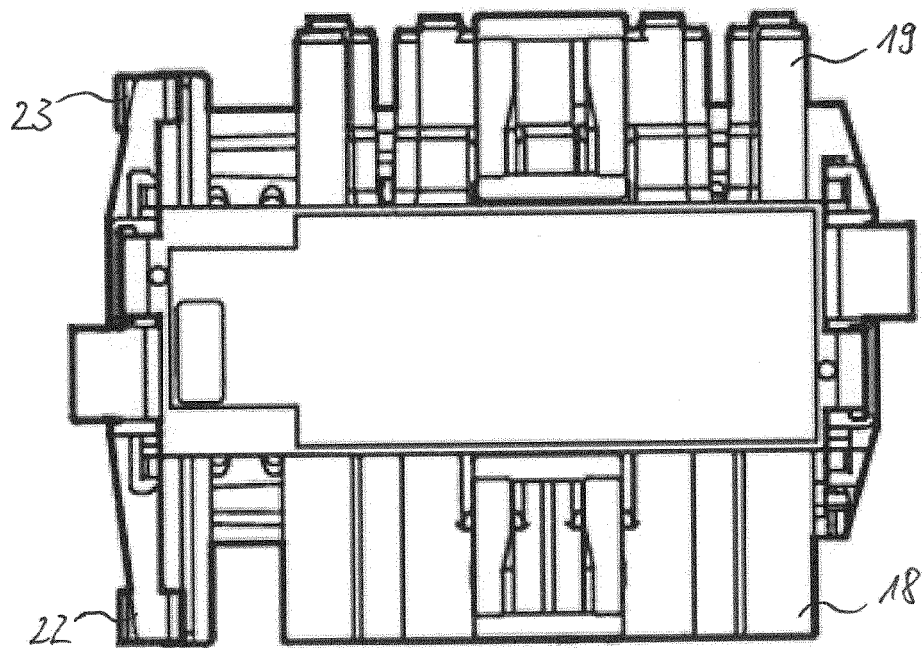


Fig. 7



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Application Number

EP 22 19 7042

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Place of search The Hague		Date of completion of the search 15 May 2023	Examiner Georgiadis, Ioannis
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