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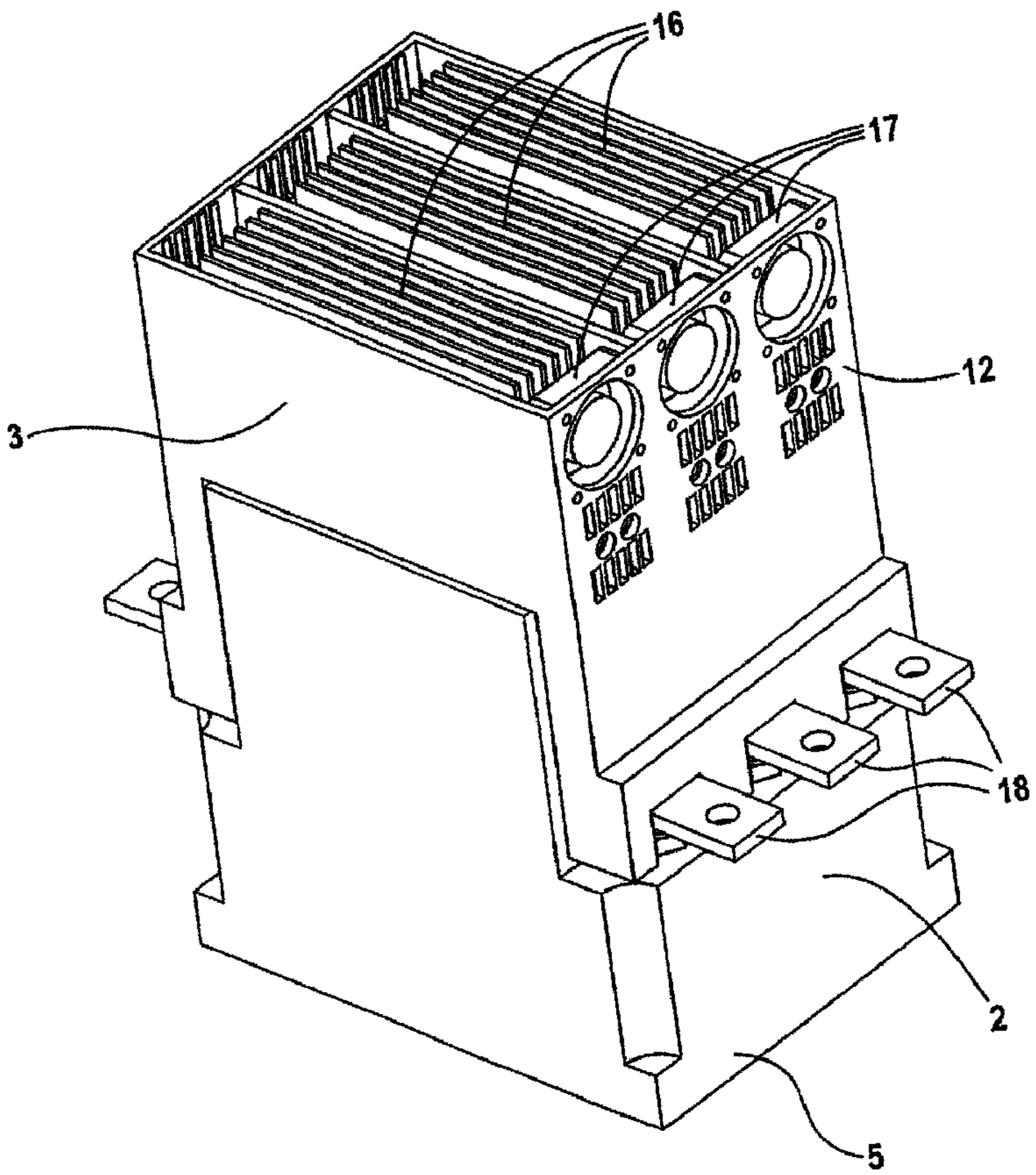
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(54) Titre : DISPOSITIF DE COMMANDE
(54) Title: CONTROL DEVICE



(57) Abrégé/Abstract:
The invention relates to a control device for a commercially available switchgear (2) and an electronic power module (3). The aim of the invention is to improve the compactness of such a device so that it can be used in a switchgear cabinet. To this end, the power

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(57) Abrégé(suite)/Abstract(continued):
module (3) is placed onto the switchgear (2) on the side facing away from its bottom wall (5) and the dimensions of the power module (3) are adapted to the base contour of the switchgear (2) so that the peripheral contour of the power module extends beyond the base contour only slightly, if at all, and at least the width b of the contactor does not extend beyond it.

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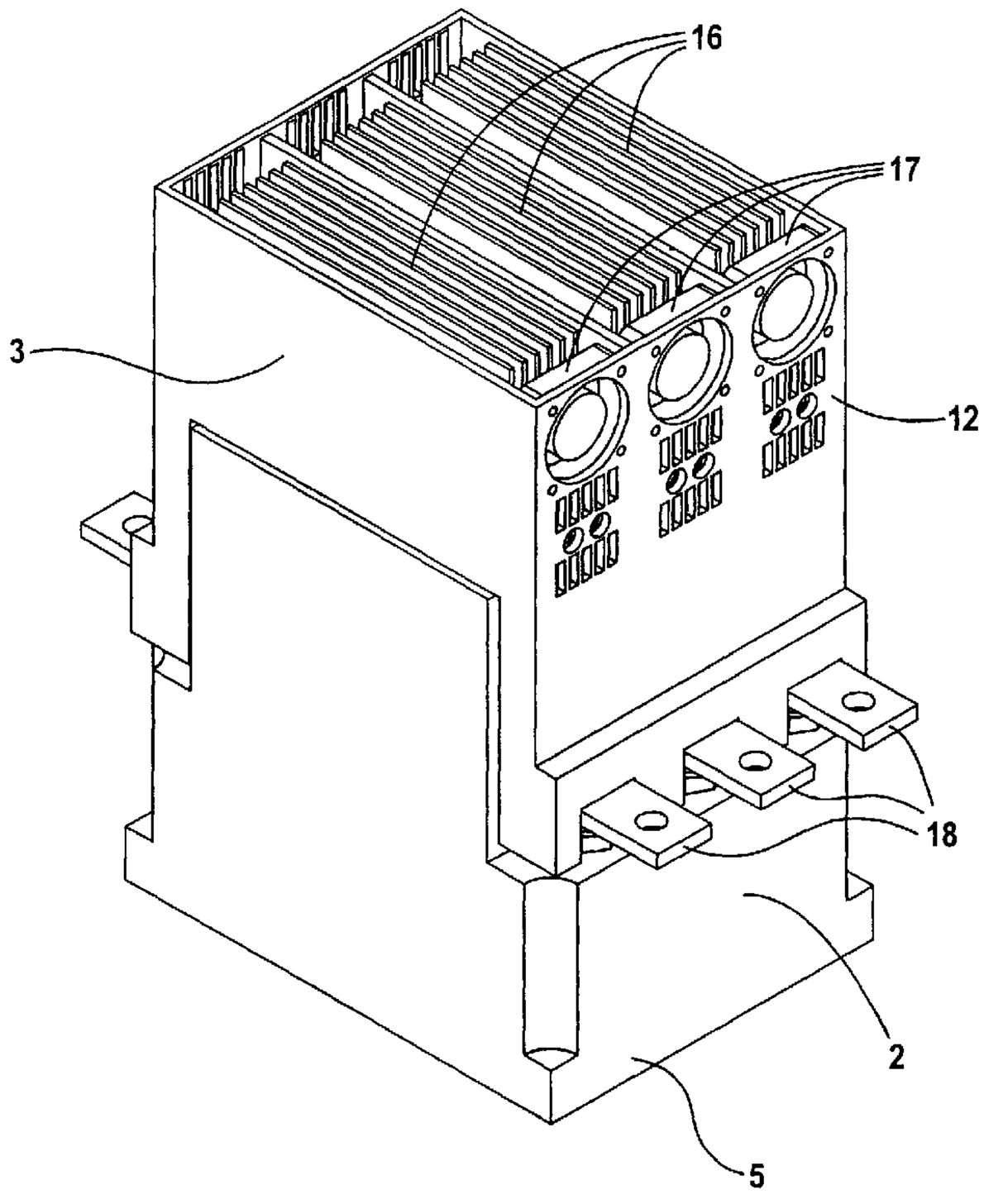
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(54) Title: CONTROL DEVICE

(54) Bezeichnung: STEUEREINRICHTUNG



(57) Abstract: The invention relates to a control device for a commercially available switchgear (2) and an electronic power module (3). The aim of the invention is to improve the compactness of such a device so that it can be used in a switchgear cabinet. To this end, the power module (3) is placed onto the switchgear (2) on the side facing away from its bottom wall (5) and the dimensions of the power module (3) are adapted to the base contour of the switchgear (2) so that the peripheral contour of the power module extends beyond the base contour only slightly, if at all, and at least the width b of the contactor does not extend beyond it.

(57) Zusammenfassung: Aufgabengemäß soll eine Steuereinrichtung mit einem handels-üblichen Schaltgerät (2) und einem elektronischen Leistungsmodul (3) in kompaktem Aufbau geschaffen werden, so dass diese für den Einsatz im Schaltschrank geeignet ist. Gemäß der Erfindung ist das Leistungsmodul (3) auf das Schaltgerät (2) auf seiner der Bodenwand (5) abgewandten Seite aufgesetzt und das Bauvolumen des Leistungsmoduls (3) an die Grundflächenkontur des Schaltgeräts (2) derart angepasst, dass die Umfangskontur des Leistungsmoduls diese allenfalls wenig überschreitet, zumindest die Baubreite b des Schützes nicht.

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Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Control device

The invention relates to a control device with an electromagnetic switchgear apparatus, which has a switchgear apparatus housing with a bottom wall, which is extended for the purpose of fixing the switchgear apparatus and forms the base area of the switchgear apparatus, and with an electronic power module - electrically connected to the switchgear apparatus - with a module housing for the soft starting of a motor or a group of motors, the switchgear apparatus serving as electrical bridging unit.

A control device of the generic type is constructed in a known manner from an electronic power module and a separate commercially available contactor. For the purpose of soft starting and during rotational-speed-controlled operation of a motor, the semiconductor valves of the electronic power module are operated by phase gating control. When the steady-state operation of the motor is reached, the current is taken over by bridging by means of the mechanical switching contact of the contactor, as is illustrated in a simplified manner in the single-phase electrical circuit according to FIG 1. Significantly smaller losses arise compared with electronic motor control units without bridging. In the steady-state ON operating state, the losses of a contactor amount to approximately 1/10 of the losses of power semiconductors. Through suitable driving of contactor and electronic power part by the control unit of the electronic power part during the transition from rotational-speed-controlled operation to steady-state operation, from steady-state operation to rotational-speed-controlled operation and from steady-state operation to the OFF state, the arc loading on the contactor contacts can be restricted to a minimum amount and the switching lifetime of the contacts can

thus be increased to the region of the mechanical switching lifetime of the contactor.

The known control devices are constructed in accordance with FIG. 2 with a commercially available contactor and an electronic power module arranged alongside as separate components which are electrically interconnected.

The invention is based on the object of providing a control device of the abovementioned type with a commercially available switchgear apparatus and an electronic power module, which control device has a compact construction such that it is suitable for use as a control device or hybrid contactor in a switchgear cabinet.

The object is achieved in that the electronic power module is placed onto the switchgear apparatus on its side remote from the bottom wall, and in that the structural width b of the power module does not exceed the width of the base area of the switchgear apparatus. This makes it possible to use the control device in a switchgear cabinet of suitable depth, without the space requirement being increased in terms of width by the electronic power module. The arrangement of the electronic power module on the contactor affords the advantage, in the case of mounting in a switchgear cabinet, that the heat loss generated by the electronic power module can be dissipated well and without influencing other apparatuses.

An advantageous embodiment of the control device according to the invention exists if it is embodied as a motor control unit encapsulated toward the outside by the switchgear apparatus housing and the module housing, and if only connecting rails of the electronic power module and connection rails of the switchgear apparatus are accessible externally. Depending on the embodiment, the connecting rails of the electronic

power module or the connection rails of the switchgear apparatus or else both can be used for the connection of the control device. The pitch of the connection rails of the switchgear apparatus is maintained as a result of this, which makes it possible

to replace the switchgear apparatus by the higher-quality control device.

This embodiment advantageously corresponds to the type that is customary in electrical switchgear apparatuses, in particular contactors, where only the connection rails are externally accessible.

If the electronic power module is placed onto the switchgear apparatus housing in a positively locking manner, then the positively locking connection already results in a fixed mechanical connection between both components, so that additional connecting means that are costly and complicated in terms of mounting remain obviated.

A further advantageous embodiment of the invention exists if the connecting rails of the electronic power module and the connection rails of the switchgear apparatus serve for electrically and mechanically connecting both components.

Furthermore, it is advantageous if the internal space of the module housing has three mutually insulated chambers, in each of which an electronic switching unit is arranged. The situation in which a fault in one electronic switching unit spreads to an adjacent electronic switching unit is avoided in this way. With regard to the arrangement of the electronic switching units and their connection to the connection rails of the switchgear apparatus, it is advantageous if these are arranged according to a pitch and the position of the chambers is adapted thereto.

Furthermore, it is advantageous if the electronic switching units each have semiconductor cells which are electrically connected back-to-back and are clamped in

between two metal plates of high thermal conductivity, since, in the case of this embodiment, the metal rails serve not only for current transmission, but also for heat dissipation.

If one of the metal rails is connected to a heat sink, then the heat dissipation can be considerably improved by this measure.

In order that the heat loss caused by the electronic switching units can be dissipated particularly effectively, a fan is advantageously arranged in each of the chambers.

An additional improvement in the heat dissipation is achieved if the connecting rails have a high thermal conductivity.

The measures described for dissipating the heat loss as optimally as possible enable the components of the electronic power module to be arranged correspondingly compactly.

In accordance with this invention, there is provided a control device with an electromagnetic switchgear apparatus, which has a switchgear apparatus housing with a bottom wall, which is extended for the purpose of fixing the switchgear apparatus and forms the base area of the switchgear apparatus, and with an electronic power module - electrically connected to the switchgear apparatus - with a module housing, e.g. for the soft starting of a motor or a group of motors, the switchgear apparatus serving as electrical bridging unit of the electronic power module, the electronic power module being placed onto the switchgear apparatus on its side remote from the bottom wall, and the structural width b of the power module not exceeding the width of the base area of the switchgear apparatus, characterized in that the internal space of the module housing has three mutually insulated chambers, in each of which an electronic switching unit is

arranged, in that the electronic switching units each have semiconductor cells which are electrically connected back-to-back and are clamped in between two metal plates of high thermal conductivity, in that one of the metal plates is connected to a heat sink, and in that a fan is arranged in each of the chambers.

An exemplary embodiment of the invention is explained below with reference to a drawing.

An exemplary embodiment of the invention is explained in more detail below with reference to a drawing, in which:

FIG. 1 shows a single-phase electrical circuit for illustrating the basic method of operation of a control device,

FIG. 2 shows a known arrangement comprising a three-phase contactor and a separate electronic soft-start apparatus,

FIG. 3 shows a sectional view of the control device according to the invention,

FIG. 4 shows a perspective view of a control device according to the invention in three-phase construction with the module housing removed,

FIG. 5 shows a perspective view of a control device according to the invention with the cover removed, and

FIG. 6 shows, by way of example, the base area contour and peripheral contour in plan view of a control device according to FIGS. 3, 4, 5.

The sectional view of the control device 1 according to the invention in accordance with Fig. 3 shows a commercially available contactor 2 with a power module 3 placed thereon, e.g. for the soft starting of a motor or a group of motors. The control device can also be operated in the application as a hybrid contactor. The contactor 2 is an electromagnetic switchgear apparatus with a switchgear apparatus housing 4 having a bottom wall 5, which, in its extended region, is provided with bored holes (not illustrated here) for fixing the contactor 2. In the internal space of the contactor 2, an electromagnetic system 6 is arranged on the bottom wall 5, the armature of which system is connected to a contact carrier 7, via which movable contacts 8 can be connected to fixed contacts 9. The contactor 2 is connected via connection rails 10 which are accessible outside the switchgear apparatus housing 4 and are electrically connected to the fixed contacts 9. The contact system 8, 9 is accommodated in a switching chamber 11, which lies in the upper region of the contactor 2, with arc runner plates (not illustrated here). The electronic power module 3 with its module housing 12 is placed onto the contactor 2, on its side remote from the bottom wall 5. The internal space of the module housing 12 comprises three chambers 13, in each of which is situated an electronic switching unit for in each case one of the three electrical phases of the three-phase system used for supply purposes. The electronic switching units are constructed in a sandwich design with two copper plates 14 which are arranged parallel and between which two power semiconductors 15 which are electrically connected back-to-back are clamped in by means of a clamping-in device 20. The upper copper plate 14 is fixedly connected to a heat sink 16 whilst complying with a minimum heat transfer resistance. Heat is dissipated by means of fans 17 fitted laterally to the module housing

12 of each chamber 13. Connected to each of the copperplates 14 is an L-shaped connecting rail 18 which is routed in the interspace between the switchgear apparatus housing 4 and the module housing 12 and bears in a planar manner on one of the two connection rails 10 of the contactor 2. The connecting rails 18

are composed of material that conducts heat well, as a result of which the continuous current-carrying capacity of the contactor 2 is increased.

Depending on the embodiment, the connecting rails 18 of the electronic power module or the connection rails 10 of the switchgear apparatus or else both can be used for the connection of the control device. The pitch of the connection rails of the switchgear apparatus is maintained as a result of this, which makes it possible to replace the switchgear apparatus by the higher-quality control device.

FIGS 4 and 5 each show a perspective view of the control device 1 according to the invention in a compact design, the module housing 12 being removed in Fig. 4 and only the cover of the module housing 12 being removed in Fig. 5.

The compact construction of the control device 1 according to the invention becomes possible essentially by virtue of the fact that the power loss of the electronic switching units is avoided in continuous operation. For this purpose, the electronic switching units are bridged by the contacts 8, 9 of the contactor 2 (Fig. 3).

For starting and rotational-speed-controlled operation, the electronic power semiconductors 15 (Fig. 3) undertake the switching task as switching elements, while only the contactor 2 (Fig. 3) carries the current in continuous operation. The starting loading during a soft start is determined by the starting current and the starting duration. In comparison with electronic motor control units without bridging, significantly smaller losses arise in the case of the present control device, since the losses of the contactor 2 in the

steady-state ON operating state amount to only 1/10 of the losses of power semiconductors.

The above-described compact construction of the motor device with the electronic power module placed onto the contactor represents an optimization of the structural volume, in which its peripheral contour does not at any point exceed the base area contour of the

contactor 2 by more than 30% and/or its width does not exceed the width b of the contactor 2. This is illustrated with reference to Fig. 6, which represents the base area contour of the contactor 2 by the solid line and the peripheral contour of the electronic power module 3 by the broken line.

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CLAIMS:

1. A control device with an electromagnetic switchgear apparatus (2), which has a switchgear apparatus housing (4) with a bottom wall (5), which is extended for the purpose of fixing the switchgear apparatus (2) and forms the base area of the switchgear apparatus (2), and with an electronic power module (3) - electrically connected to the switchgear apparatus (2) - with a module housing (12), e.g. for the soft starting of a motor or a group of motors, the switchgear apparatus (2) serving as electrical bridging unit of the electronic power module, the electronic power module (3) being placed onto the switchgear apparatus (2) on its side remote from the bottom wall (5), and the structural width b of the power module (3) not exceeding the width of the base area of the switchgear apparatus (2), characterized in that the internal space of the module housing (12) has three mutually insulated chambers (13), in each of which an electronic switching unit is arranged, in that the electronic switching units each have semiconductor cells (15) which are electrically connected back-to-back and are clamped in between two metal plates (14) of high thermal conductivity, in that one of the metal plates (14) is connected to a heat sink (16), and in that a fan (17) is arranged in each of the chambers (13).

2. The control device as claimed in claim 1, characterized in that it is embodied as a motor control unit encapsulated toward the outside by the switchgear apparatus housing (4) and the module housing (12), and in that only connecting rails (18) of the electronic power module (3) and connection rails (10) of the switchgear apparatus (2) are accessible externally.

3. The control device as claimed in claim 1 or 2, characterized in that the electronic power module (3) is placed onto the switchgear apparatus housing (4) in a positively locking manner.

4. The control device as claimed in any one of claims 1 to 3, characterized in that the connecting rails (18) of the electronic power module (3) and the connection rails (10) of the switchgear apparatus (2) serve for electrically and mechanically connecting both components.

5. The control device as claimed in any one of claims 1 to 4, characterized in that the connecting rails (18) of the electronic power module (3) are arranged according to a pitch of the switchgear apparatus (2) and the position of the chambers (13) is adapted thereto.

6. The control device as claimed in any one of claims 1 to 5, characterized in that the connecting rails (18) have a high thermal conductivity.

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PATENT AGENTS

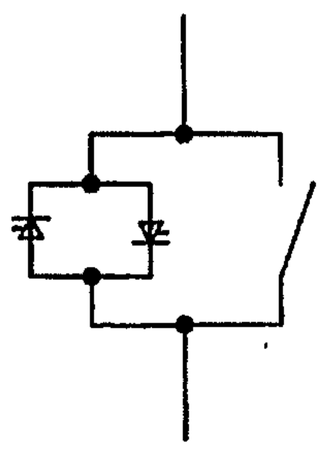


FIG 1

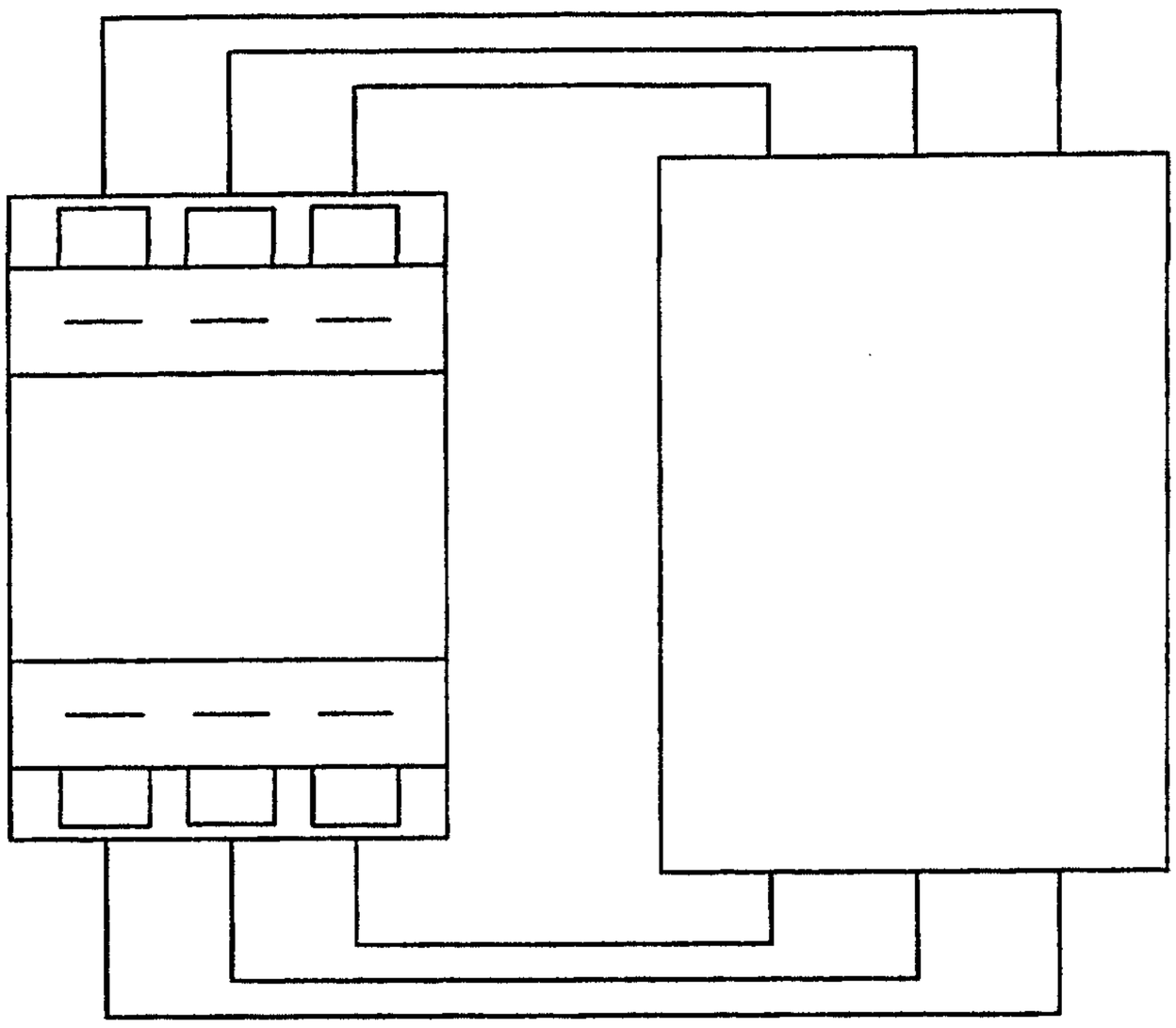


FIG 2

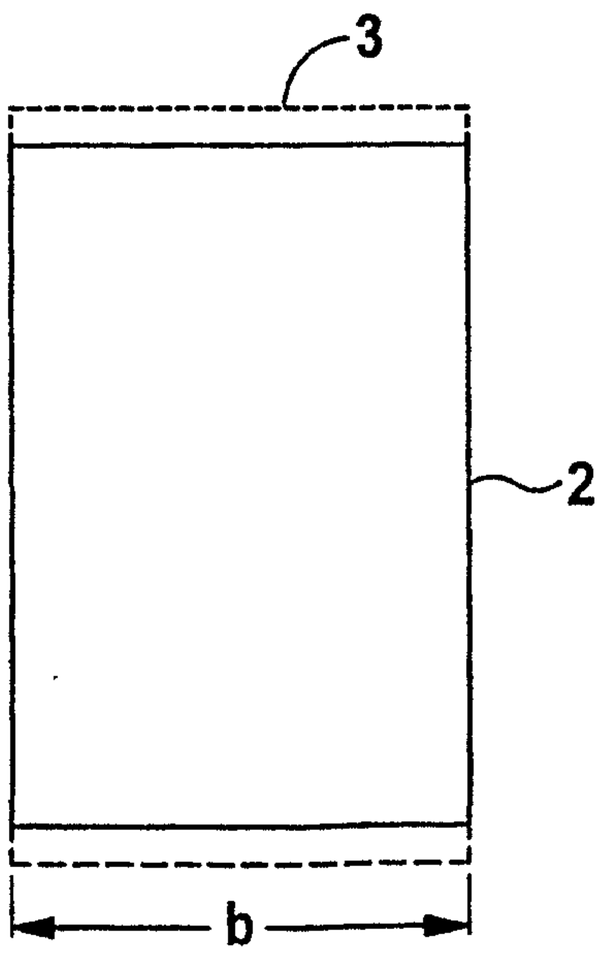


FIG 6

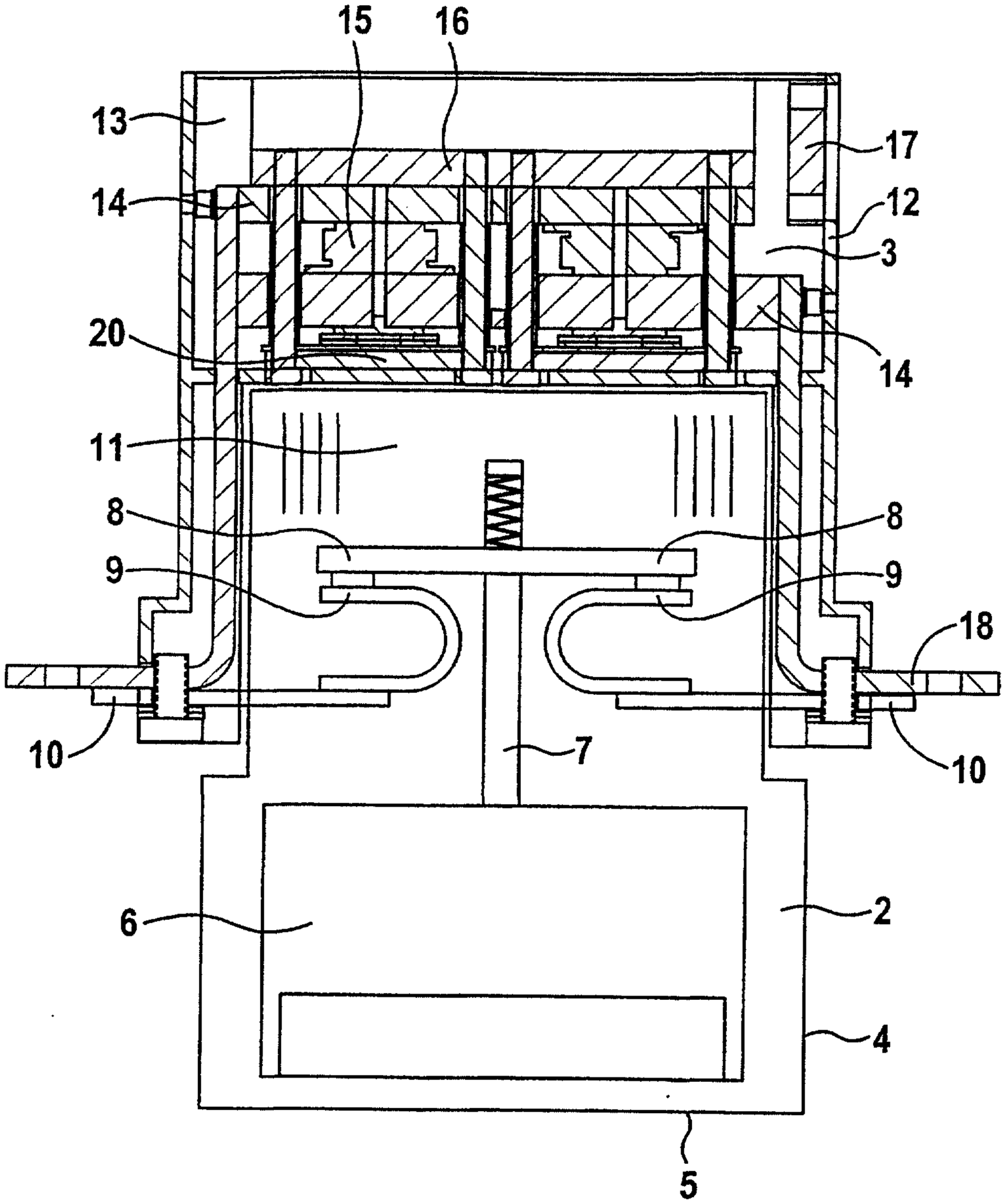


FIG 3

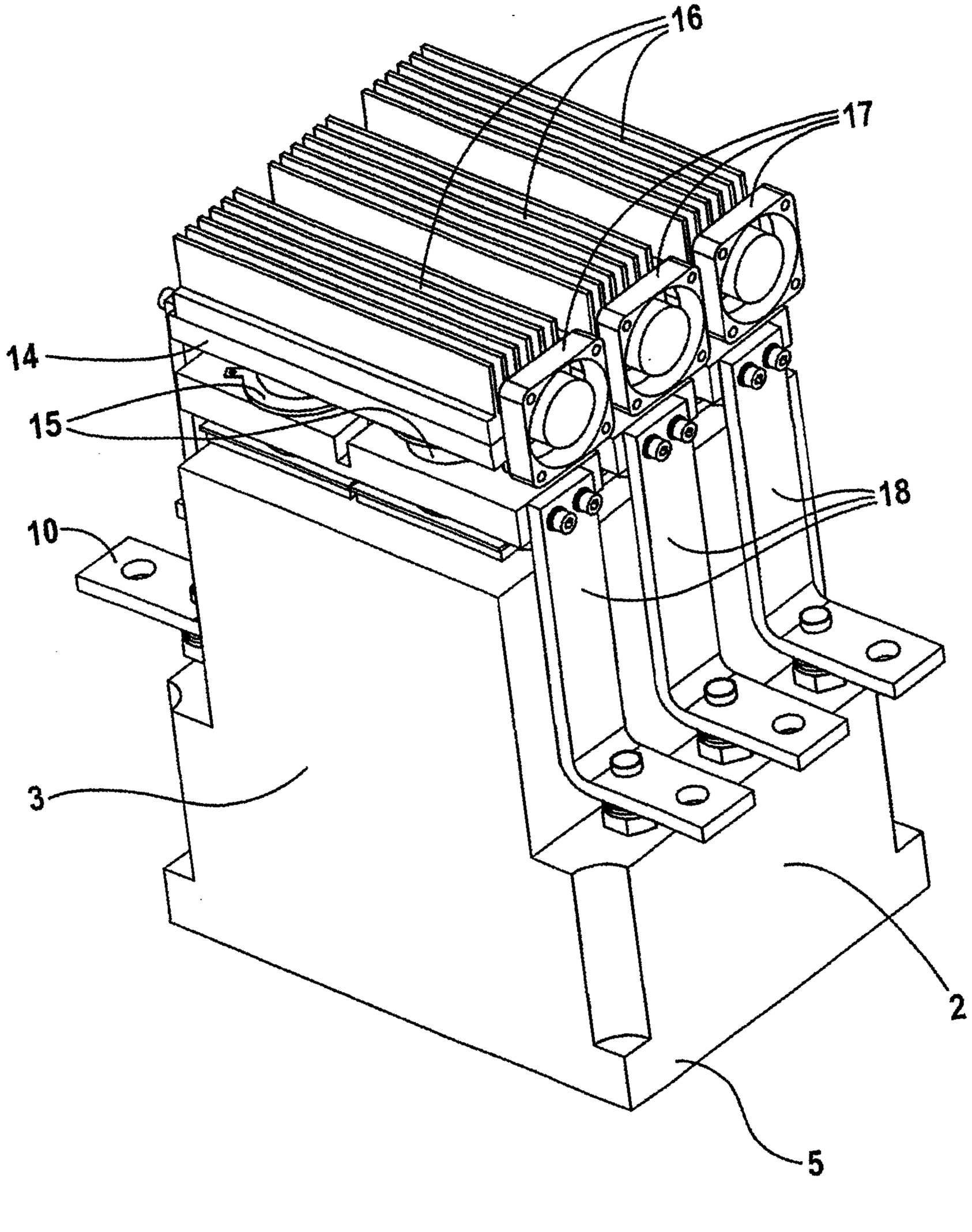


FIG 4

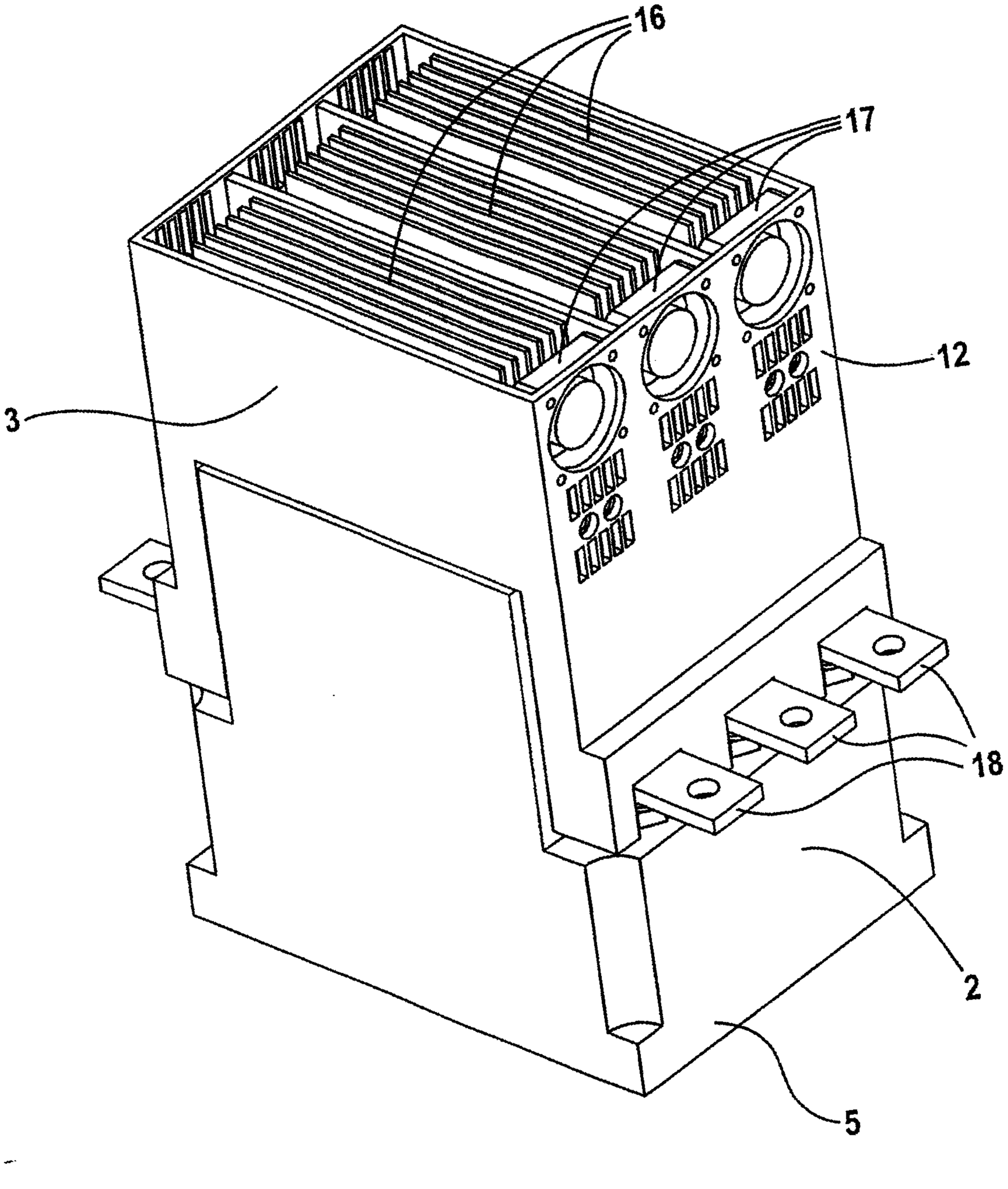
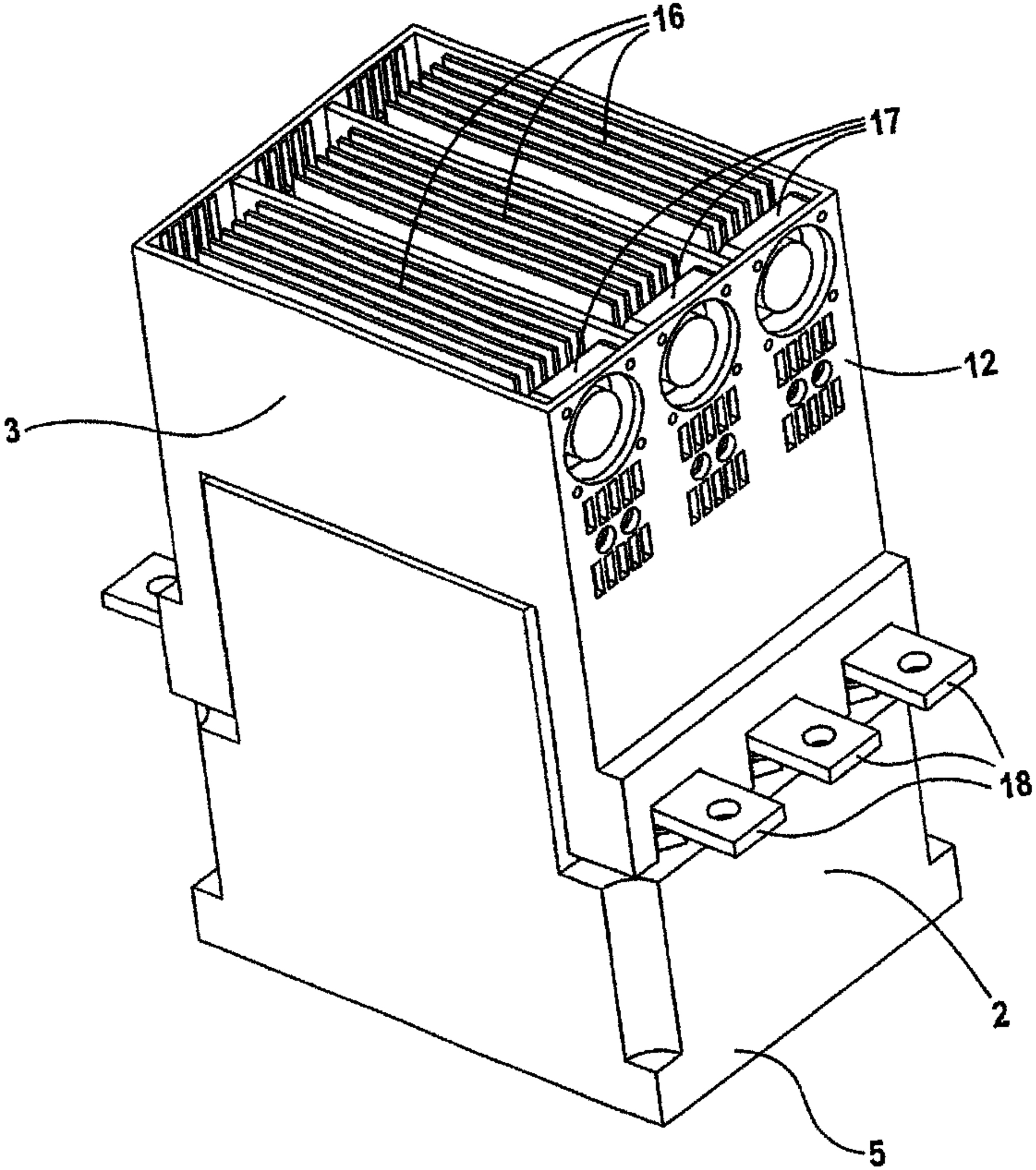


FIG 5


16
17
12
3
18
2
5