(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 667 394 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.11.2013 Bulletin 2013/48

(51) Int Cl.:
H01H 1/58 *(2006.01)* ***H01H 15/04*** *(2006.01)*

(21) Application number: **12382187.8**

(22) Date of filing: **22.05.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Gorlan Team, S.L.U.**
48330 Lemoa (Vizcaya) (ES)

(72) Inventor: **Gómez Barbero, José, Julio**
48330 LEMOA (VIZCAYA) (ES)

(74) Representative: **Carpintero Lopez, Francisco et al**
Herrero & Asociados, S.L.
Alcalá 35
28014 Madrid (ES)

(54) **Multiple-pole switch and/or circuit breaker for low voltage**

(57) The invention relates to a switch and/or circuit breaker incorporating various cut-off poles that can be connected in series to reduce the cut-off voltage. The electric breaker switch comprises two groups of fixed contacts and a group of moving contacts able to move between an electrical cut-off position and an electrical closure position in which, and it incorporates at least one integral part made of a conductor material forming two fixed contacts of the same group of contacts, connecting the poles of the switch associated with said contacts in series. As a result of said integral part, several poles are more effectively and more safely connected in series, preventing excessive overheating of the terminals and possible switch failures.

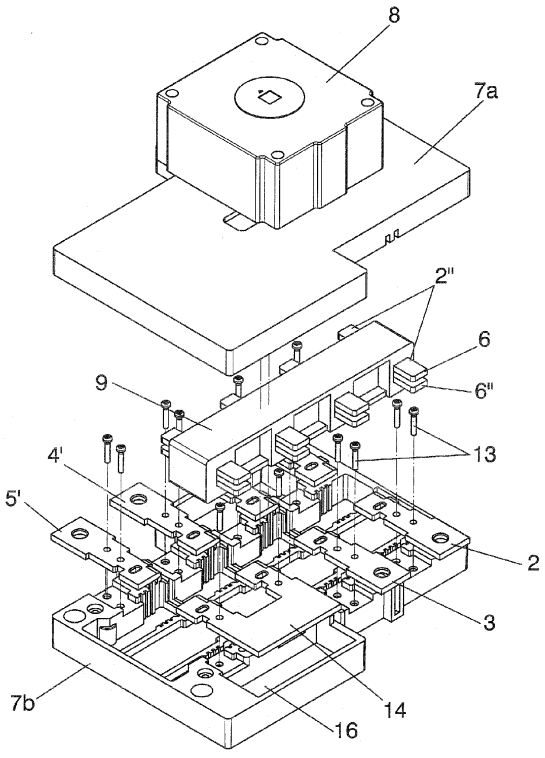

FIG. 3a

EP 2 667 394 A1

Description

Object of the Invention

[0001] The invention relates to a switch and/or circuit breaker incorporating various cut-off poles that can be connected in series to reduce the cut-off voltage.

[0002] An object of the invention is to provide a multiple-pole switch in which several poles are more effectively and more safely connected in series, preventing excessive overheating of the components and possible switch failures.

[0003] The invention essentially applies to switches for low voltage with self-cleaning blade contacts, although it can also apply to any other type of switch, such as for example cam switches.

Background of the Invention

[0004] Switches of any type or model are devices used to connect and disconnect a load from an electric power source. These switches are based on applying an external force which moves several moving contacts with respect to other fixed contacts, such that when the circuit is to be closed, the moving contacts come into contact with the fixed contacts, forming the connection between load and power source, and causing the corresponding installation to start operating.

[0005] The opposite process corresponds to the movement of the moving contacts with respect to the fixed contacts, such that these moving contacts move away from the fixed contacts, causing the circuit to open and therefore isolating the load from the power source, and as a result the installation stops.

[0006] An electric arc causing wear in the contacts is formed during the opening and closing process. To increase the opening and closing power of the contacts, contact reliability must be assured, and to do so it is necessary to reduce the effects of the electric arc on said contacts because the less wear that occurs in them, the more durable they will be or the greater closing and cut-off power they will withstand.

[0007] This functionality is applied both for alternating current and direct current, with the difference that in direct current, the wave does not cross zero, i.e., it is not cancelled, and therefore the arc extinction is much more complicated. Therefore, in the applications of direct current and as the voltage is increased, is necessary to connect various contacts in series for splitting the arc power, and such that a voltage smaller than the total working voltage and which will be proportional to the number of poles in series can be cut-off in each contact.

[0008] As shown in Figure 1 flat bars screwed to connecting contacts of the switch which acts as bridges between the contacts are currently used for connecting various contacts in series for splitting the arc power. Conventionally, such switches, for the case of four pole switches, is formed by a first group of fixed contacts (2,3, 4 and 5), a second group of fixed contacts (2',3', 4' and 5'), and a group of moving contacts (2", 3", 4", and 5"), able to move simultaneously between an electrical cut-off position and an electrical closure position in which, for each pole, a moving contact electrically connects a fixed contact of the first group with a fixed contact of the second group.

[0009] A bridge or flat bar (1, 11, 12) is screwed to the respective fixed contacts belonging to two consecutive poles for connecting two poles in series, using to that end screws (10) passing through corresponding holes made in the contacts and flat bar.

[0010] This conventional solution implies many drawbacks:

> First, the connection between terminals and flat bar are points with increase electrical resistance due to the electrical resistance per se through the gap of the material in that of the attachment between the three parts, and therefore are points which cause a temperature increase,

[0011] Since it is a threaded attachment, it can become loose with time due to temperature changes and vibrations. The threaded attachment requires verifying the coupling torque and its assembly because if said torque is not applied correctly damage can be produced by the effect of temperature increase due to a poor contact, whether due to the fact the torque is insufficient and the pressure in the connection area is insufficient or due to an excess of torque and the thread is destroyed or damaged, thereby also causing a similar defect of lack of pressure in the connection area.

[0012] The bridge installation operation requires a certain amount of time, whether at the factory or on site assembly, so there is extra cost involved in the installation.

[0013] All threaded attachment is exposed to the environment, and therefore withstanding the obvious cyclic environmental conditions, it undergoes expansions and contractions, and in order to prevent these deformations from entailing a failure in the connection area over time the installation must be periodically maintained for verifying and assuring that all the attachments are maintained within the corresponding safety parameters. In summary it is necessary to prevent a poor contact, the consequence of which is overheating and subsequently a fire and destruction of the equipment and installation itself, as well as maintaining the safety of the personnel.

Description of the Invention

[0014] The present invention completely and satisfactorily solves the aforementioned problem by means of the material defined in the attached independent claims.

[0015] The invention relates to a low voltage switch and/or circuit breaker, i.e., to a switch which in addition to performing the opening (disconnection) and making

the connection, also has isolating capacity, such that once the opening is performed, the fixed contact and the moving contact are at a sufficient distance for assuring the disconnection preventing the electric arc.

[0016] In this description of the invention, the term switch or switch device must be understood as a device with the function of a switch, or a device with the function of a switch and circuit breaker, or a circuit breaker device.

[0017] The switch object of the invention is characterised by being provided with a multiple terminal or contact, consisting of a single part configured for making up two or more contacts having different poles of the switch.

[0018] The advantage of removing the outer screwed bridges connecting two contacts in series and thus preventing all the drawbacks of heating and maintenance described above is obtained by means of this multiple contact formed by an integral part, i.e., a single body, because the electric current flows through an integral part, i.e., through a single body of continuous material and same section, instead of through the screwed bridge which has material interruptions and section changes, different material resistivity, etc.

[0019] More specifically, the invention relates to an electric breaker switch having two or more poles, comprising first and second groups of fixed contacts, and a group of moving contacts able to move between an electrical cut-off position and an electrical closure position in which, for each pole, a moving contact electrically connects a fixed contact of the first group with a fixed contact of the second group. The switch is **characterised in that** at least two fixed contacts of the same group of contacts are consist of or are part of an integral part made of a suitable conductor material connecting the poles of the switch associated with said contacts in series.

[0020] Each pole of the switch is formed by a pair of fixed contacts and a moving contact connecting or disconnecting them.

[0021] Said integral part is configured such that a first part determining a first fixed contact of one pole, a second part determining a second fixed contact, and a third part connecting with both fixed contacts is distinguished therein.

[0022] The invention also relates to a method of manufacturing an electric breaker switch device having two or more poles, which is characterised by assembling at least one multiple contact like the one described above in a same type of casing. Many configurations of the poles of switch are thus obtained in a simple and economical manner using one and the same type of casing or base, and one and the same type of multiple contact by simply placing this multiple contact in different positions of the casing.

Description of the Drawings

[0023] To complement the description which is being made and for the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description in which the following has been depicted with an illustrative and non-limiting character:

Figure 1 shows a four pole switch of the state of the art where drawing (a) is a perspective and exploded view, drawing (b) is a top plan view, and drawing (c) is a cross-section view according to lines A-A of drawing (b), and drawing (d) is a top plan view of the inside of the device, i.e., without the upper part of the casing.

Figure 2 shows in three plan views the operation of electrically opening and closing the inside of a multiple-pole switch of the state of the art, where drawing (a) shows the closure position of the contacts (electric connection), drawing (b) shows an intermediate position with the moving slider, and drawing (c) shows the open position of the contacts (electric disconnection).

Figure 3 shows a depiction similar to that of Figure 1 but of a preferred embodiment of the multiple-pole switch according to the present invention.

Figure 4 shows a depiction similar to that of Figure 3 of another embodiment of the multiple-pole switch according to the present invention.

Figure 5 shows a depiction similar to that of Figure 3 of another embodiment of the multiple-pole switch according to the present invention.

Figure 6 is a depiction similar to that of Figure 3 of another embodiment of the present invention.

Figure 7 is a depiction similar to that of Figure 3 of another embodiment of the present invention.

Preferred Embodiment of the Invention

[0024] Figure 3 shows an embodiment of a switch device according to the invention, in this case a four pole switch with two multiple contacts. Each pole of the switch is formed by a fixed contact of a first group of fixed contacts (2, 3, 4 and 5), a second fixed contact of second group of fixed contacts (2', 3', 4', and 5'), and a moving contact (2", 3", 4", and 5") able to move between an electrical cut-off position in which it is not in contact with the fixed contacts (corresponding to the position depicted in Figure 2c) and therefore making current circulation impossible, and an electrical closure position in which it electrically connects the two fixed contacts with which it is associated (corresponding to the position depicted in Figure 2a).

[0025] The moving contacts (2", 3", 4", and 5") are assembled equidistant to one another in a shuttle or slider (9) made of insulating material such that the moving contacts move together and simultaneously. The switch further comprises a casing (7) made of an electrically insulating material, inside which at least part of the fixed contacts, and the slider (9) with the moving contacts are housed, and such that the fixed contacts of the same

pole are facing one another in pairs.

[0026] The slider (9) can move linearly inside the casing between two end positions defined by the internal shape of the casing itself and is assembled between the two mentioned groups of fixed contacts such that it moves transversally with respect to them.

[0027] The casing is formed by a lower base (7b) and an upper base (7 a) coupled to one another, and with an opening through which an external control (8) is attached to the slider (9) to operate it manually. Alternatively, the slider can be moved, for example, by means of an automatic driving device.

[0028] The fixed contacts are assembled inside one of the parts of the casing, for example in the lower base (7b) by means of screws (13). The moving contacts (2", 3", 4", and 5") are in turn blades, i.e., they are made up of two pairs of overlapping flat bars (6,6') forming a space between them, inside which they are coupled to each fixed contact, such that each moving contact contacts the corresponding fixed terminal from the top and the bottom, as especially seen in Figure 1c. These moving contacts (2", 3", 4", and 5") are dual moving contacts because they are each made up of two pairs of connected flat bars (6,6'), where each pair is arranged to contact a fixed terminal of the same pole.

[0029] The switch incorporates a first integral part (14) configured such that it determines at least two fixed contacts of a same group of contacts, specifically in view of Figure 3d, the first integral part (14) has a first part (14a) determining a fixed contact (4) of a pole, a second part (14b) determining a second fixed contact (5) of another pole, and a third intermediate part (14c) connecting said first and second parts (a,b). Since the two fixed contacts (4, 5) are part of the same body or part, the poles associated with these terminals are connected in series, as seen in Figure 3d.

[0030] The switch of this preferred embodiment incorporates a second integral part (15) identical to the first part (14) but placed in the group of opposite fixed contacts, and forming the fixed contacts (2',3') corresponding to the other two poles of the switch, connecting them in series.

[0031] In this embodiment, the integral parts (14,15) are U-shaped, where each arm corresponds to each of the fixed terminals. In other embodiments, the integral part (14,15) can be formed to determine more than two fixed contacts, in which case it adopts an E shape or comb shape.

[0032] Preferably, the integral part has a constant thickness throughout and is made of the same type of material as the rest of the conventional fixed contacts, preferably metal, and has the same thickness, whereby gaps in the section of the material or changes in electrical resistivity for current circulation is prevented.

[0033] As seen in Figure 3, the conventional fixed contacts (2,3,4',5') have the shape of a flat bar and part of the same protrudes outside the casing (7) to enable its electrical connection with the wiring of an external electrical installation in an already known manner, for example for closing or opening the current circulation between an electrical power source and a load.

[0034] The two integral parts (14,15), which in this case are planar throughout, are completely housed inside the casing, which has the advantage that it cannot be touched by accident, i.e., there is no access to them and therefore the operator cannot have an electric or thermal accident. To that end, the casing is designed for a specific configuration of number and position of parts (14,15).

[0035] Since these integral parts (14,15) are internal parts, they can reach a temperature higher than a bridge or an external terminal, whereby the switch is designed to work within the temperature limits established in the corresponding product regulations. Furthermore, the invention has provided an air chamber (16) in the casing for receiving part of the parts (14,15) which, together with the walls made of insulating material forming the casing (7), provide a safe heat-electric insulation within the parameters established by the regulations.

[0036] Figure 4 shows a four pole switch similar to that of Figure 3, but in this embodiment, the integral parts (14,15) are arranged in the same group of fixed contacts, so a configuration of switch different from that of Figure 3 is obtained in which the conventional fixed contacts were located on opposite sides of the casing, whereas in the switch of this Figure 4 the conventional fixed contacts are located on the same side of the casing.

[0037] Furthermore, in the embodiment of the invention of Figure 4, the integral parts (14,15) are formed such that they have a bent portion (17,18) respectively determining an angle with respect to the rest of the part, in this case in a substantially orthogonal shape with respect to the rest of the part. The casing, specifically the lower base of the casing (7b) also has an air chamber (16) for housing, precisely those bent portions (17,18), the integral parts (14,15), such that the parts (14,15) are housed entirely inside the casing. Specifically, that bend is formed in the intermediate part (c) of the integral parts (14,15), and has the effect or advantage of reducing the space occupied by the parts (14,15) resulting in a more compact switch.

[0038] The preferred embodiment alternative of Figure 5 consists of a four pole switch similar to that of Figure 4, provided with two integral parts (14,15) with bent portions (17,18), but located in groups of opposite fixed contacts and with the particularity that these bent portions (17,18) protrude outside the casing (7) so they are exposed. Optionally, the switch incorporates insulating covers (19,20) configured to enable it to be coupled to the casing (7) to cover the bent portions (17,18) respectively. The effect or advantage of this alternative with couplable covers is that switches can be manufactured using an already existing casing or a universal casing that works for many switch configurations , i.e., with various positions, number and type of integral parts, and subsequently coupling the covers as deemed necessary to cover the parts protruding from the integral parts.

[0039] The embodiment of Figure 6 is similar to that of Figure 5, but in this case the integral parts (14,15) are completely planar and protrudes out of the casing, such that the covers (19,20) are of suitable size and shape for enclosing the protruding portions of the parts (14,15).

[0040] Alternatively, a universal casing can be provided for receiving several integral parts (14,15) with bent portions (17,18), placed in different positions whether on a single side or on both sides of the device, as has been depicted in Figure 7. The casing is sized for receiving many integral parts, on both sides of the slider, for which it has respective grooves (16,16'), one on each side of the casing for receiving the bent portions (17, 18) of the integral parts. In other words, the same casing can house one or several integral parts in any position inside the casing or can even be used for applications of alternating current which do not incorporate integral parts

[0041] The embodiments of Figures 3 to 6 can be combined with one another resulting in switches with one or more multiple contacts, i.e., with two or more integral parts having two or more poles, placed in one or the two groups of fixed contacts irrespectively, said parts being able to be internal or external planar parts or with a bent.

[0042] The invention is also applicable to switches of another type and with a greater or lesser number of poles.

[0043] Depending on the needs of each application, in the manufacturing of the switch one or more integral parts are installed in positions selected for connecting several poles in series, obtaining the configurations for four poles such as for example the following:

- 4+0. All the poles are attached in series, such that it would be connected to the power cable at one end and to the load at the other end, i.e., the four poles are attached and would be for example the positive cable. The circuit of the negative cable would not be able to be opened and closed and, therefore, it would be a cable which is on the outside of the switch (i.e., 0 of 4+0).
- 3+1. Three poles in series for making up for example the circuit of the positive and a pole for the circuit of the negative which, in this case, would also be able to open and close the circuit.
- 2+2. Both the circuit of the positive and that of the negative would comprise two poles in series.

Claims

1. Electric breaker switch device having two or more poles, comprising first and second groups of fixed contacts, and a group of moving contacts able to move between an electrical cut-off position and an electrical closure position in which, for each pole, a moving contact electrically connects a fixed contact of the first group with a fixed contact of the second group of contacts, **characterized in that** at least two fixed contacts of the same group of contacts are part of an integral part made of a suitable conductor material connecting the poles of the switch associated with said contacts in series.

2. Device according to claim 1, **characterized in that** the integral part is configured such that it has a first part determining a fixed contact of one pole, a second part determining a second fixed contact of another pole, and a third part connecting said first and second parts.

3. Device according to claim 1 or 2, **characterized in that** the integral part is U-shaped.

4. Device according to any of the preceding claims, **characterized in that** the integral part is substantially planar.

5. Device according to claim 2, **characterized in that** a portion of the third part of the integral part is bent forming an angle with respect to the rest of the part.

6. Device according to any of the preceding claims, **characterized in that** it further comprises a casing made of an electrically insulating material, inside which the moving contacts and at least part of the fixed contacts are housed, and such that the fixed contacts of the same pole are facing one another in pairs, and **in that** it further comprises a slider made of an insulating material able to move linearly in which the moving contacts configured for connecting the fixed contacts of the same pole are assembled.

7. Device according to claim 6, **characterized in that** it comprises at least one integral part housed in its entirely inside the casing.

8. Device according to claim 6 or 7, **characterized in that** it comprises at least one integral part having an inner part housed inside the casing, and another outer part projecting out of the casing.

9. Device according to claim 8, **characterized in that** it further comprises at least one cover made of an insulating material coupled to the casing, such that the outer part of the integral part is housed inside said cover.

10. Device according to claim 5, **characterized in that** the casing is sized for housing several integral parts with bent portions (17, 18) and internally has grooves (16,16') inside the casing where the bent part of the integral parts can be housed.

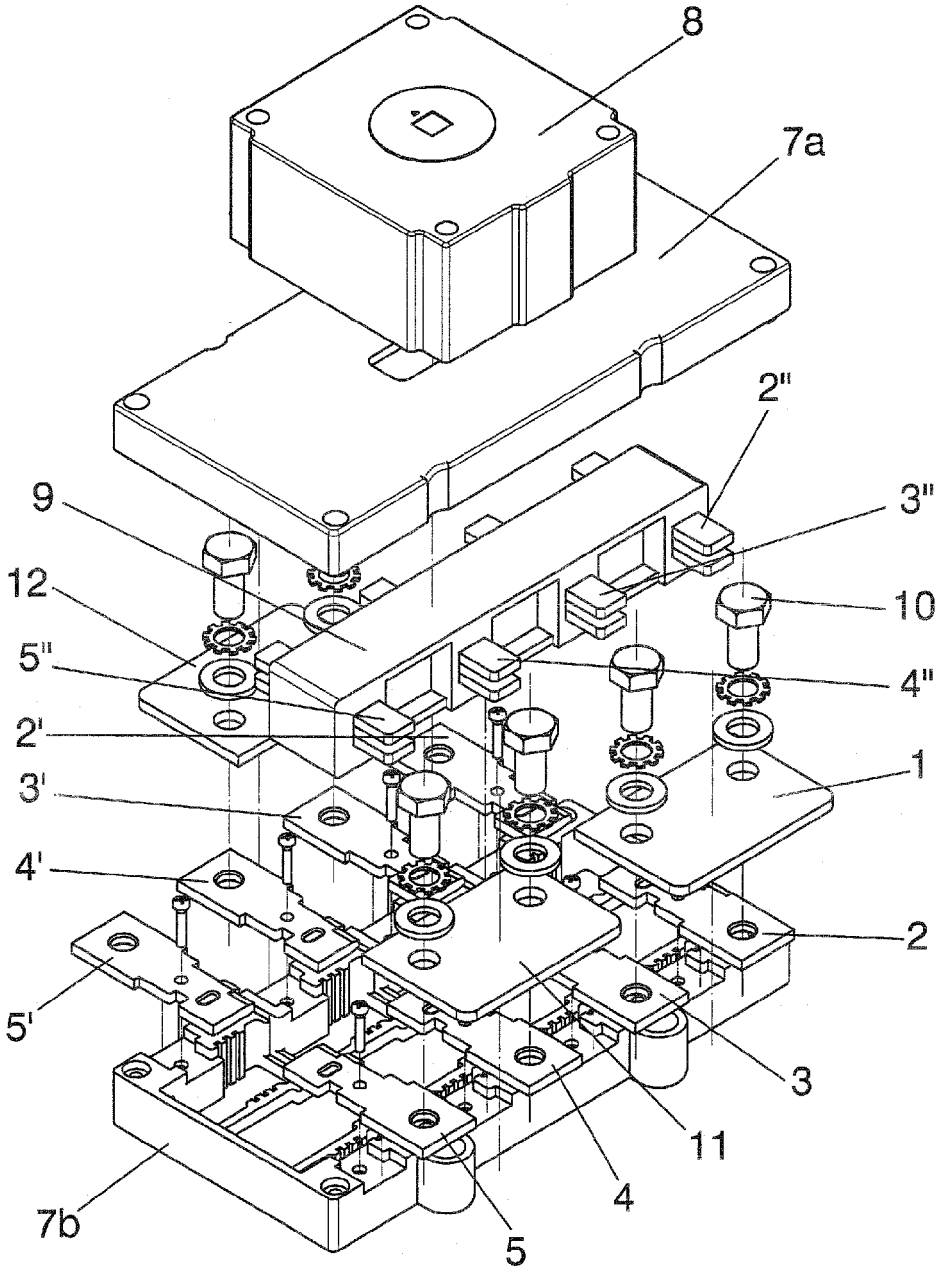

FIG. 1a

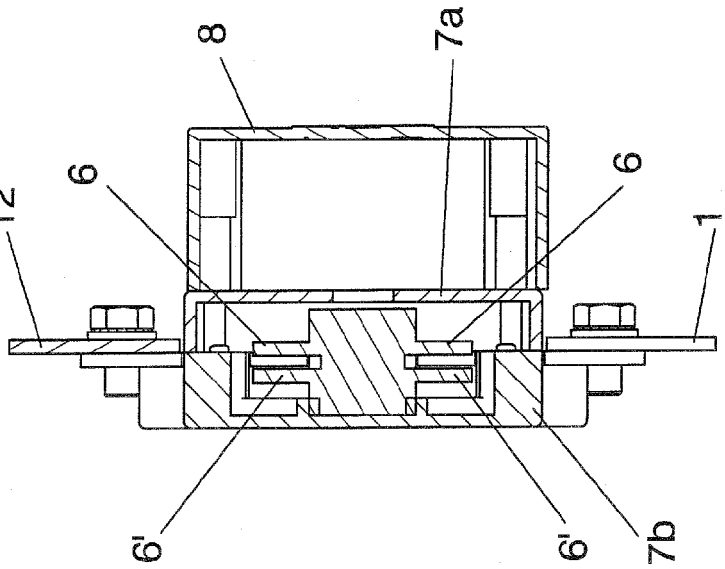

FIG. 1c

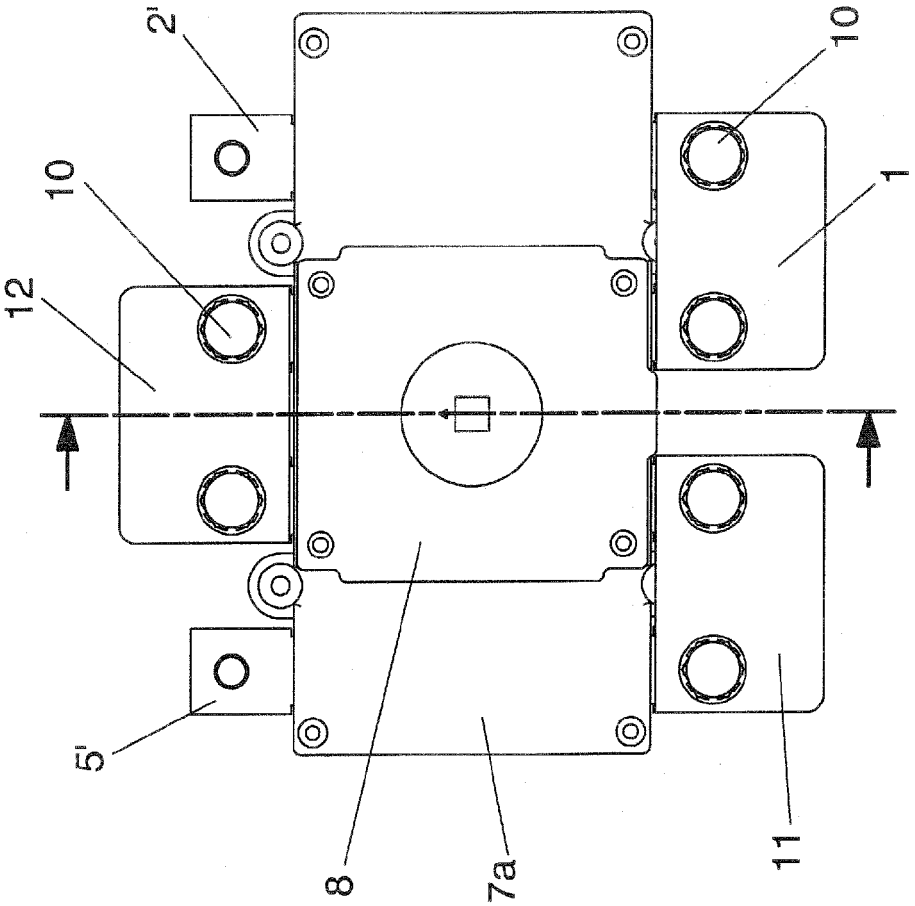

FIG. 1b

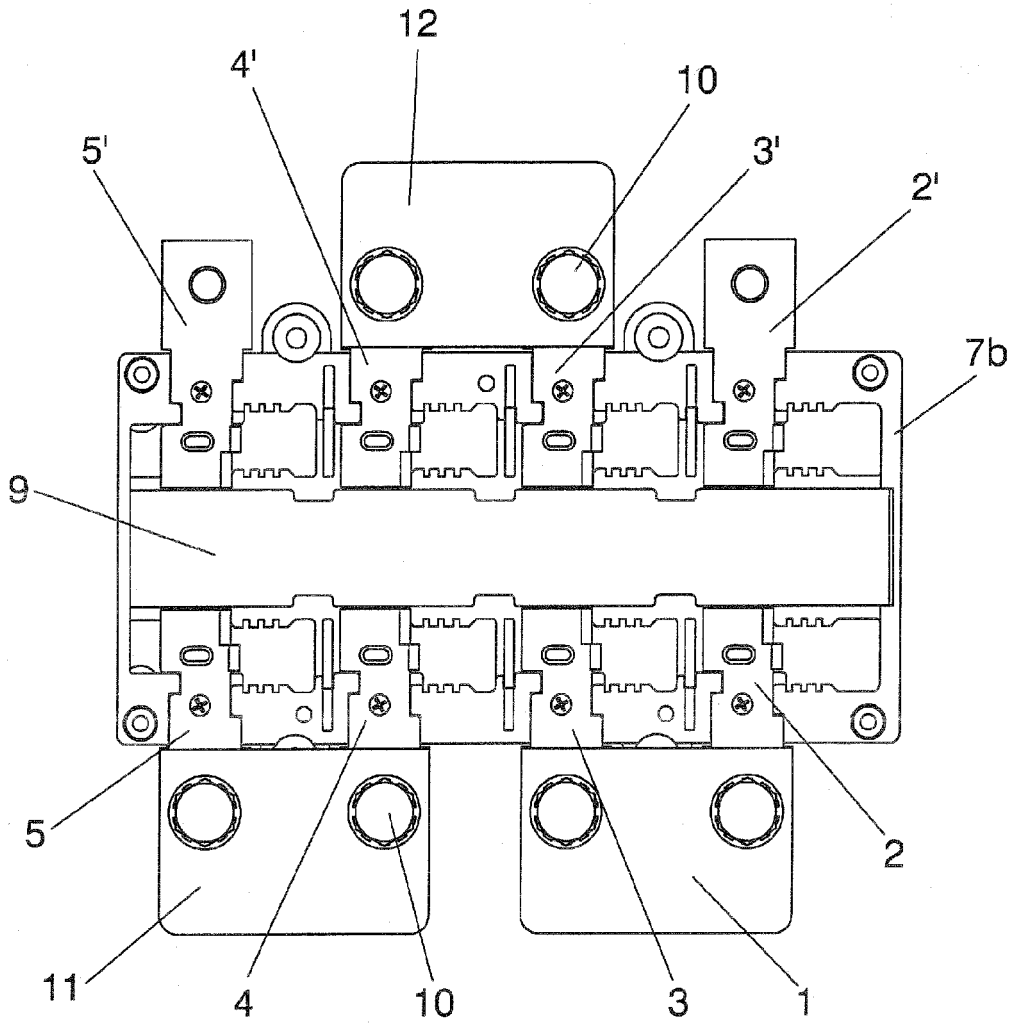

FIG. 1d

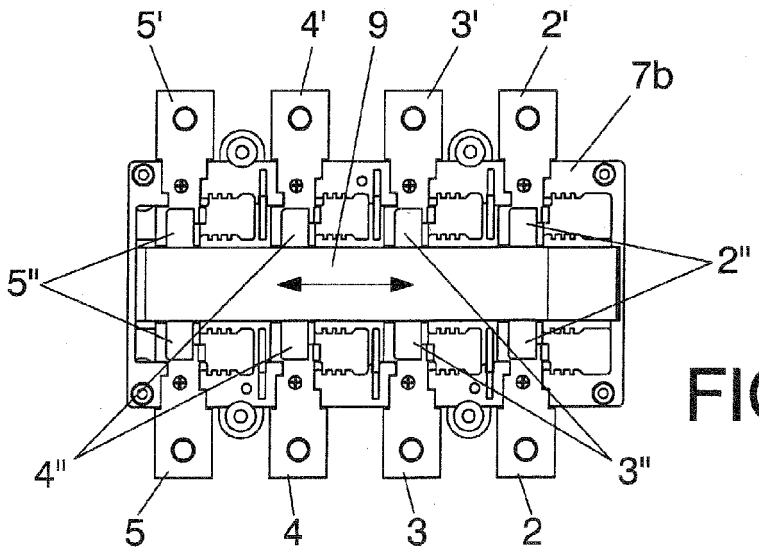

FIG. 2a

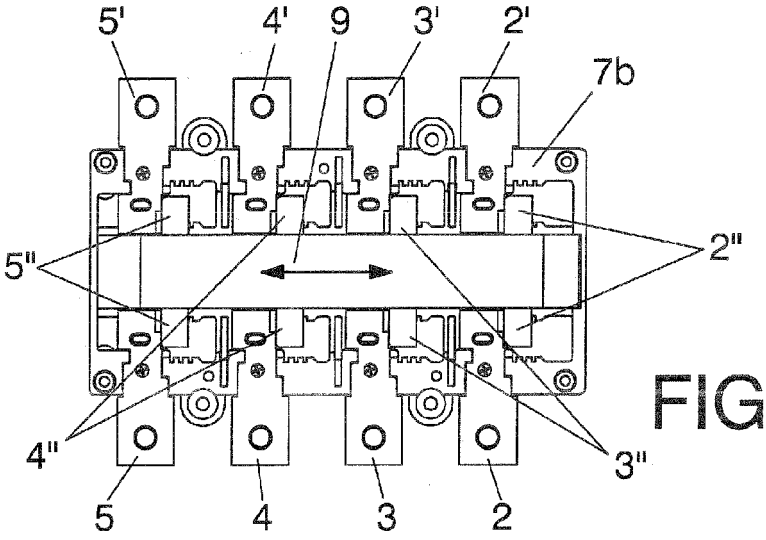

FIG. 2b

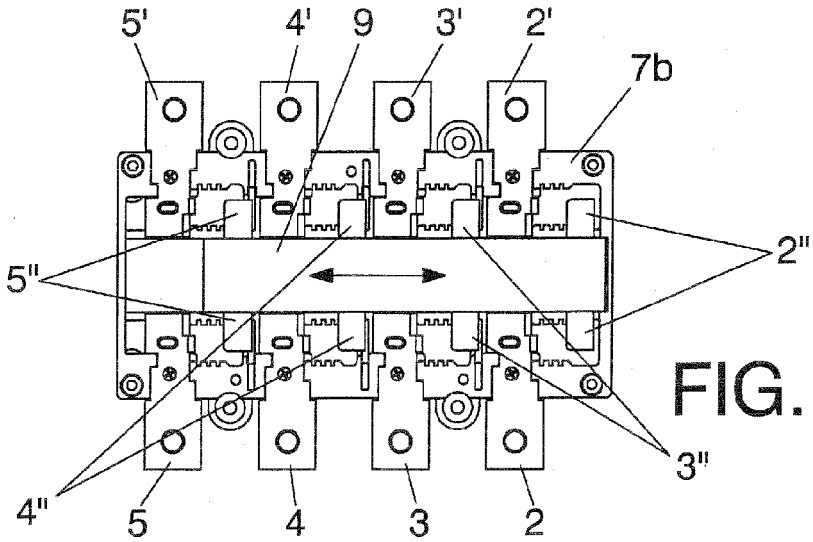

FIG. 2c

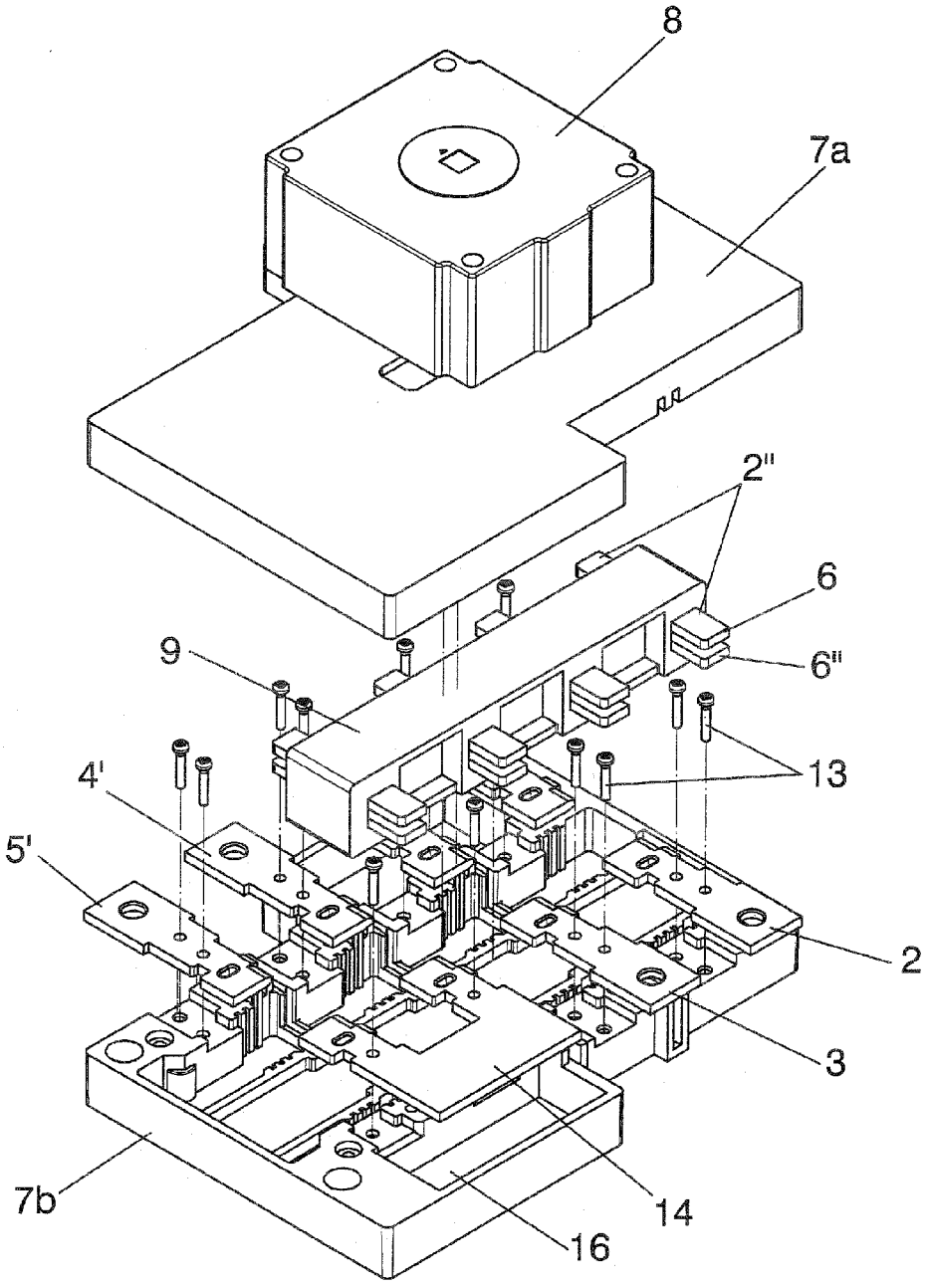

FIG. 3a

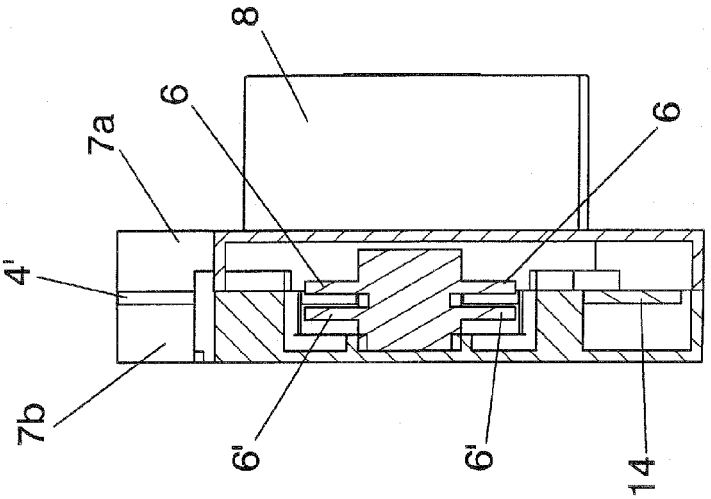

FIG. 3c

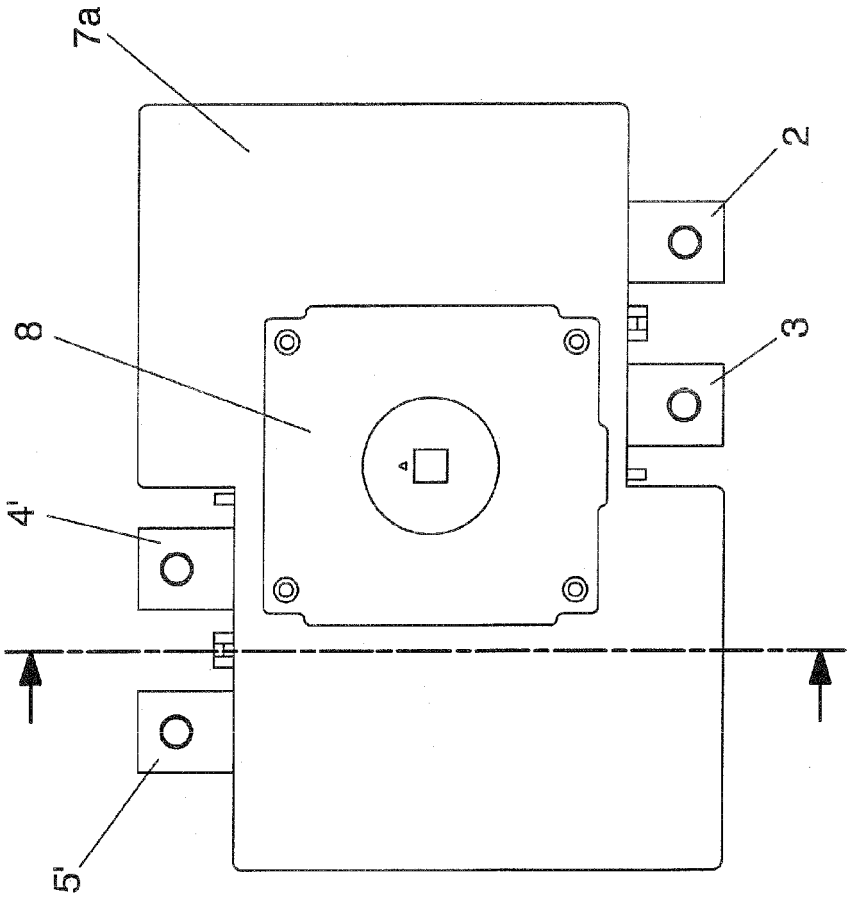

FIG. 3b

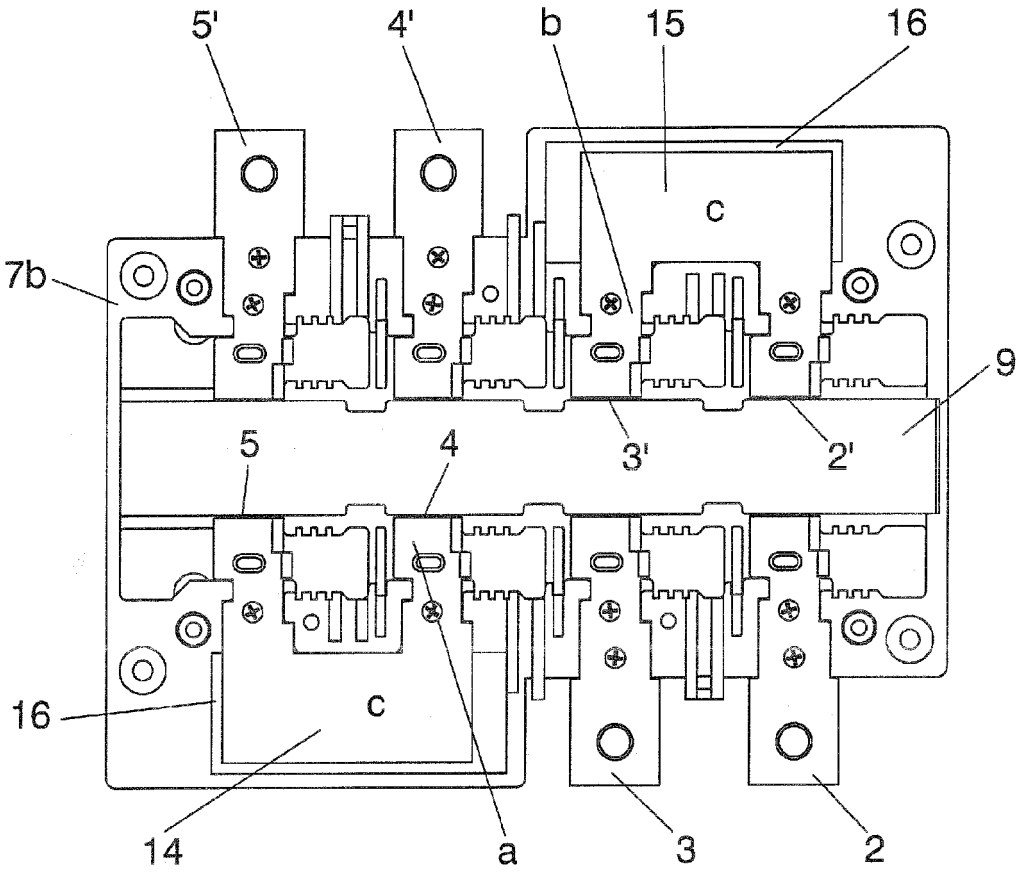

FIG. 3d

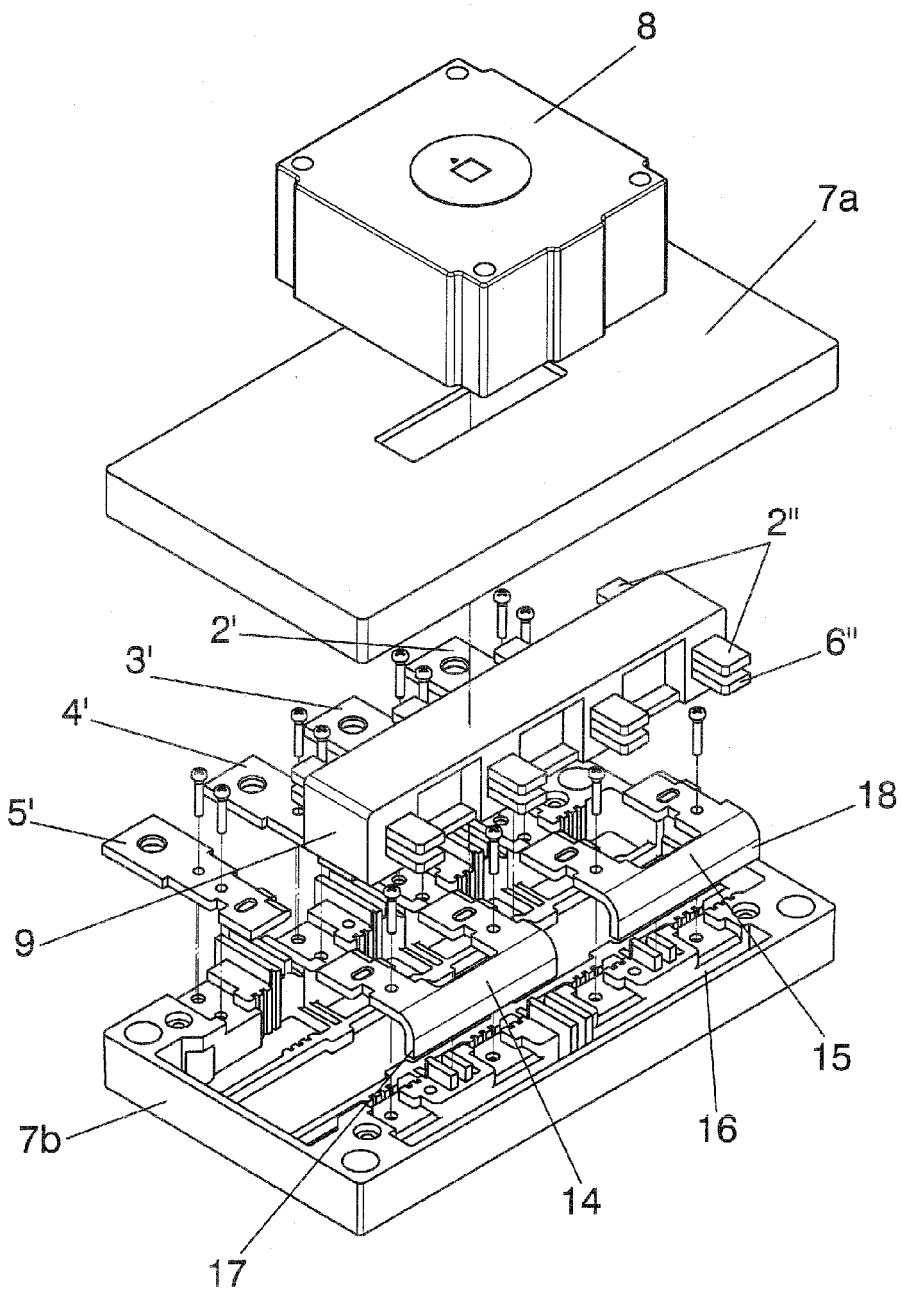

FIG. 4a

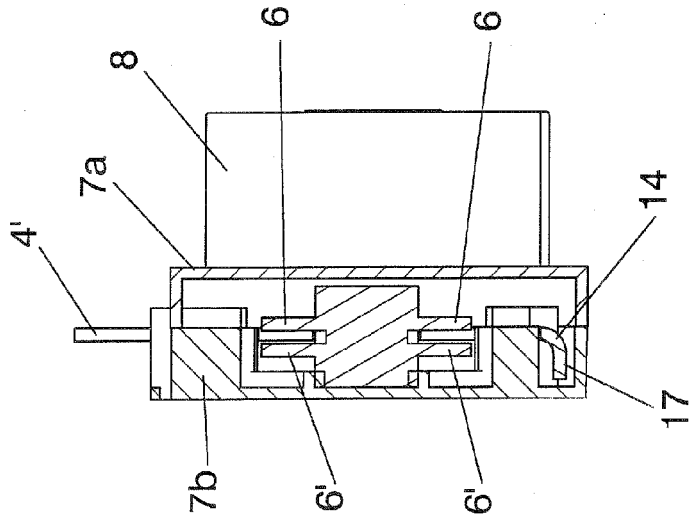

FIG. 4c

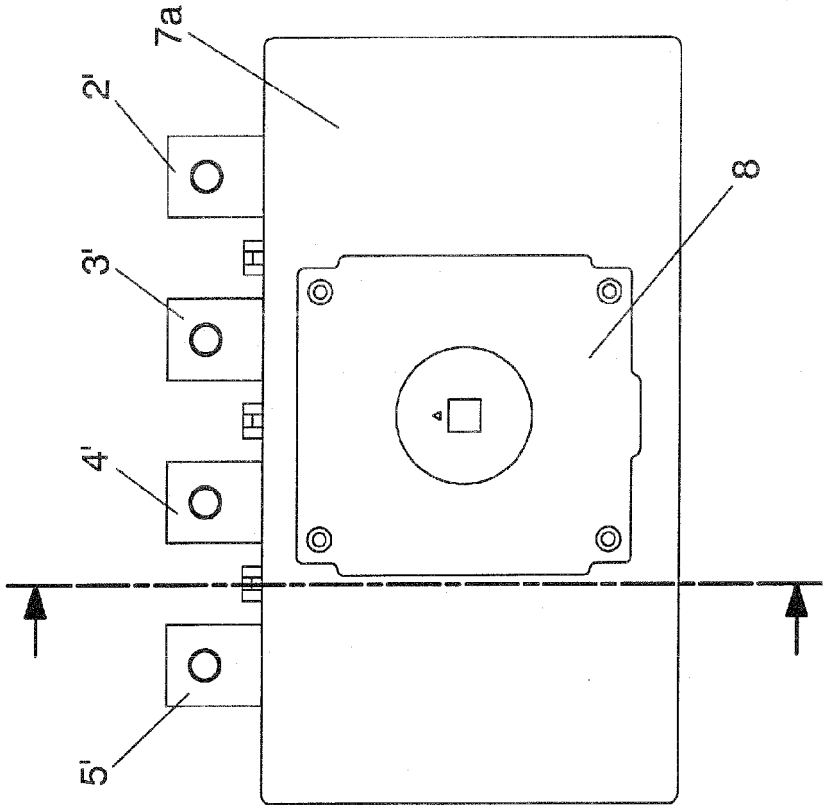

FIG. 4b

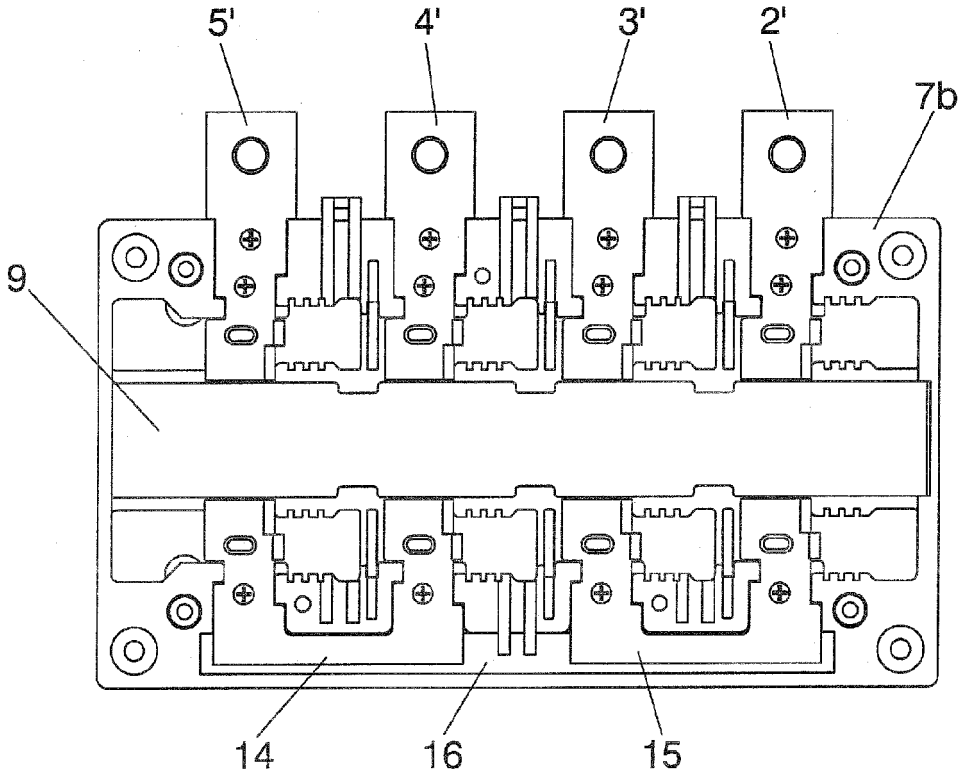

FIG.4d

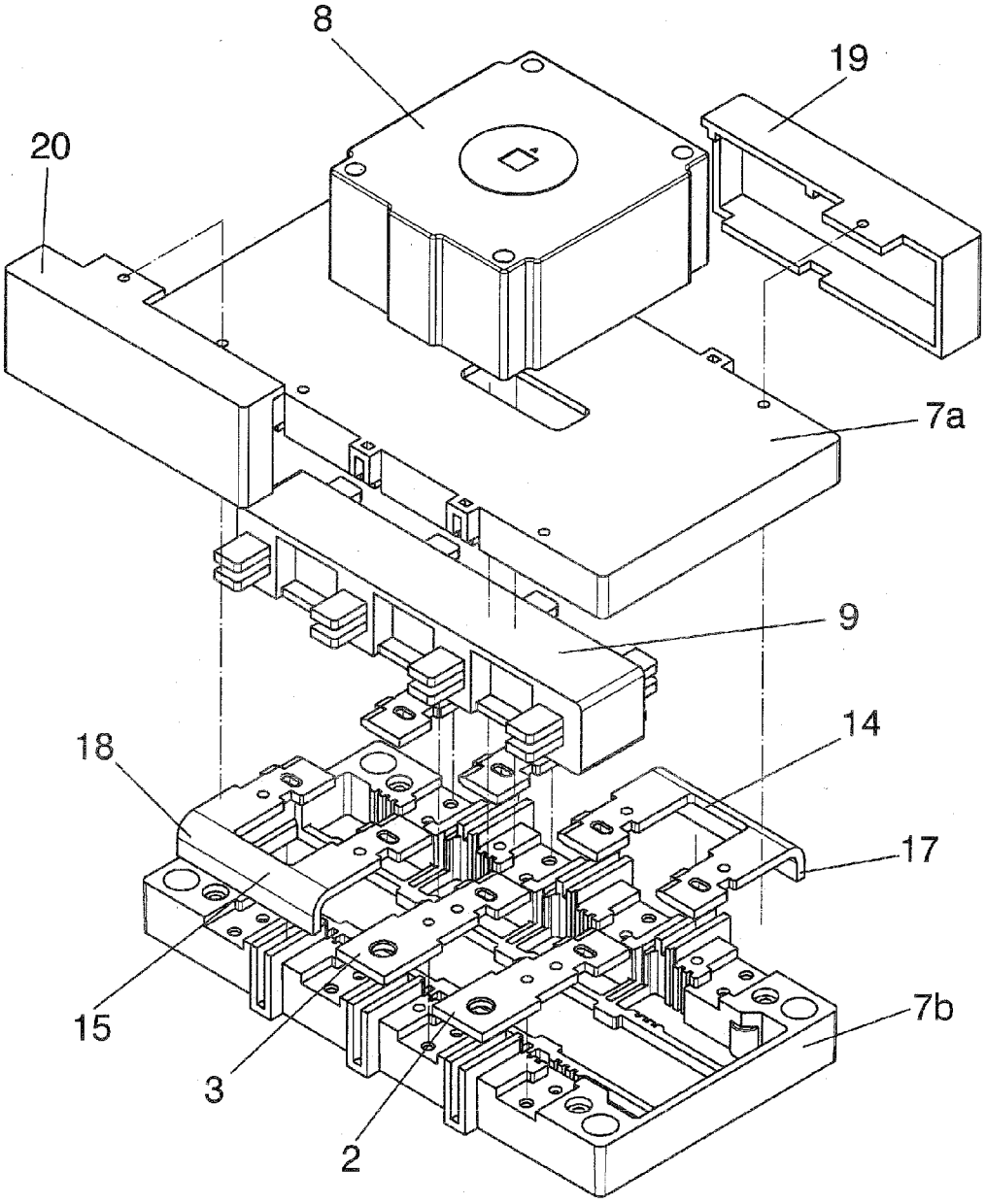

FIG. 5a

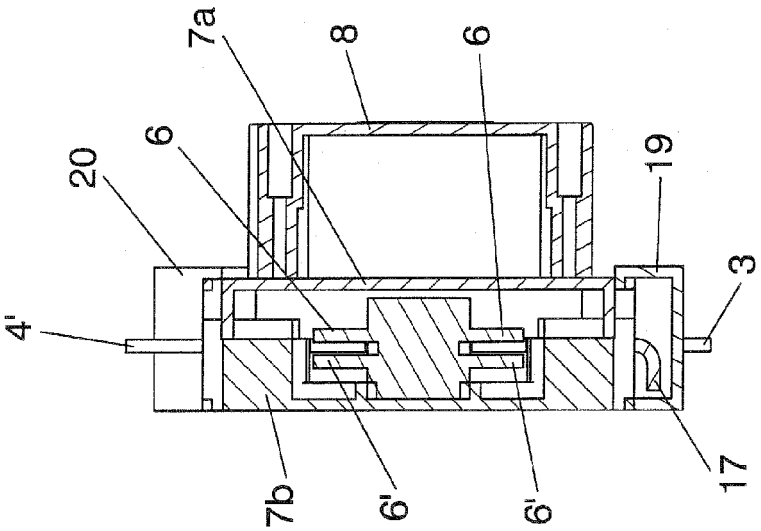

FIG. 5c

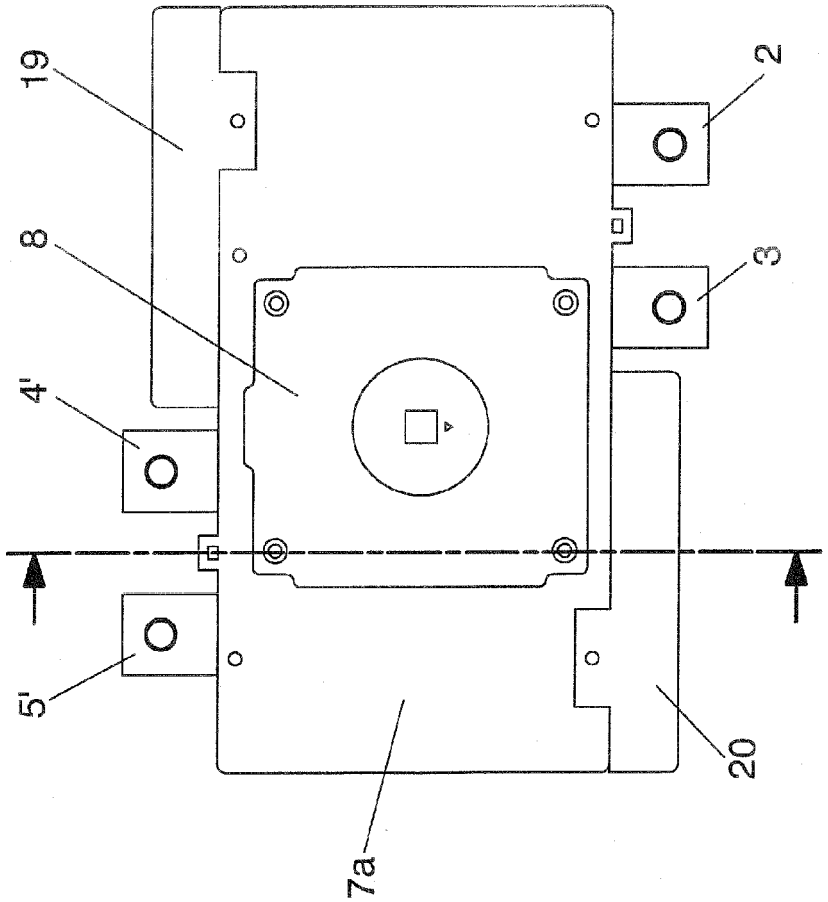

FIG. 5b

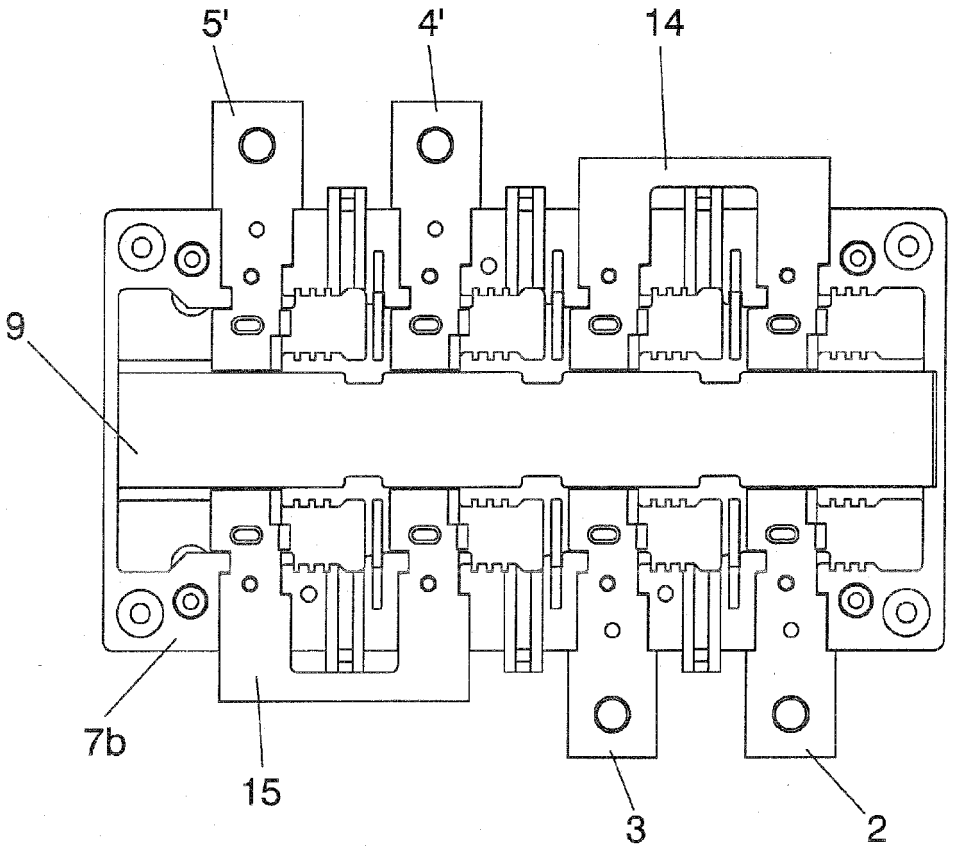

FIG. 5d

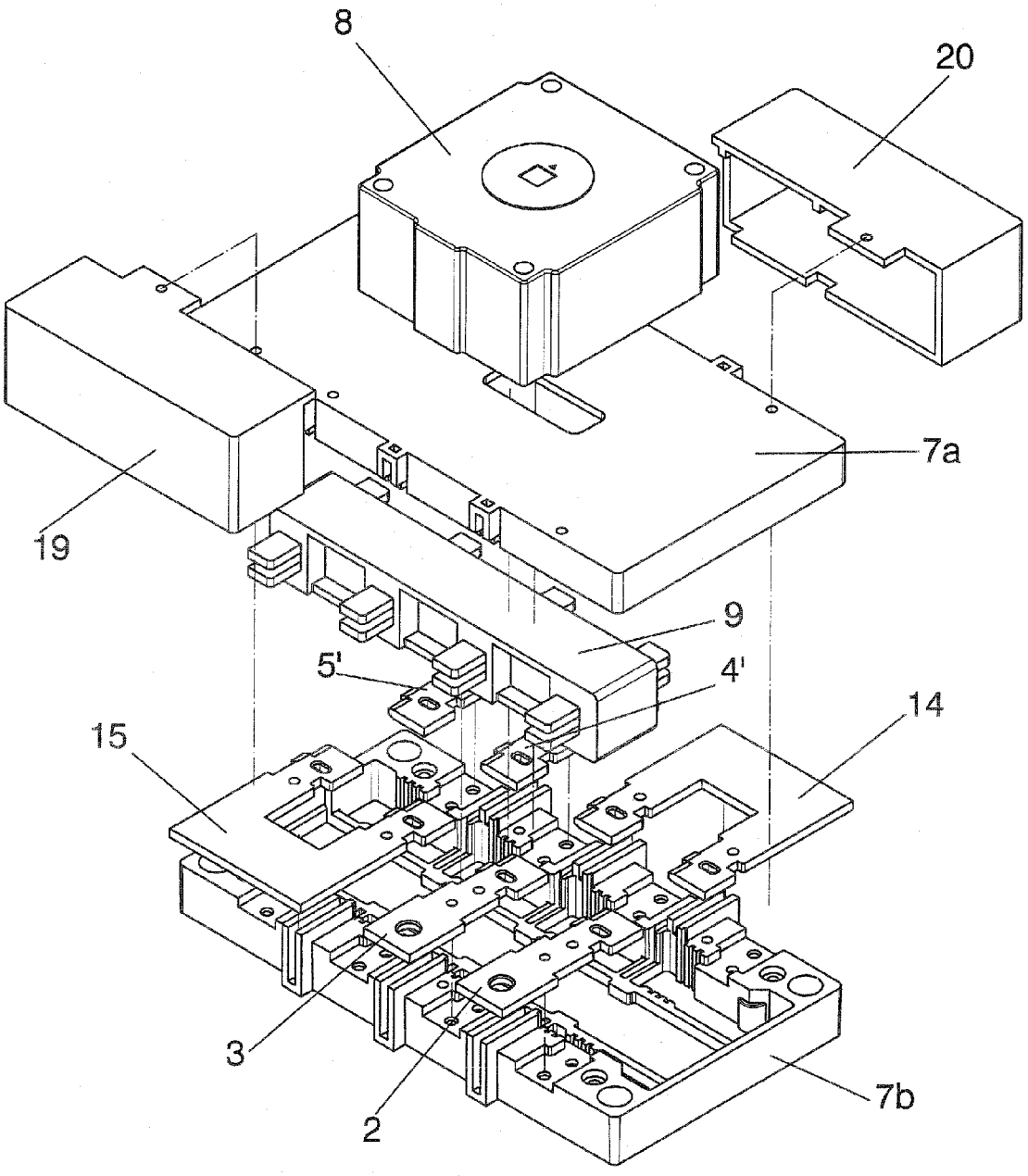

FIG. 6a

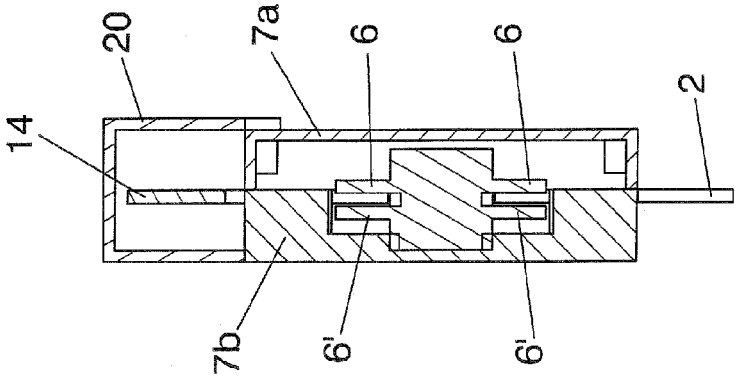

FIG. 6c

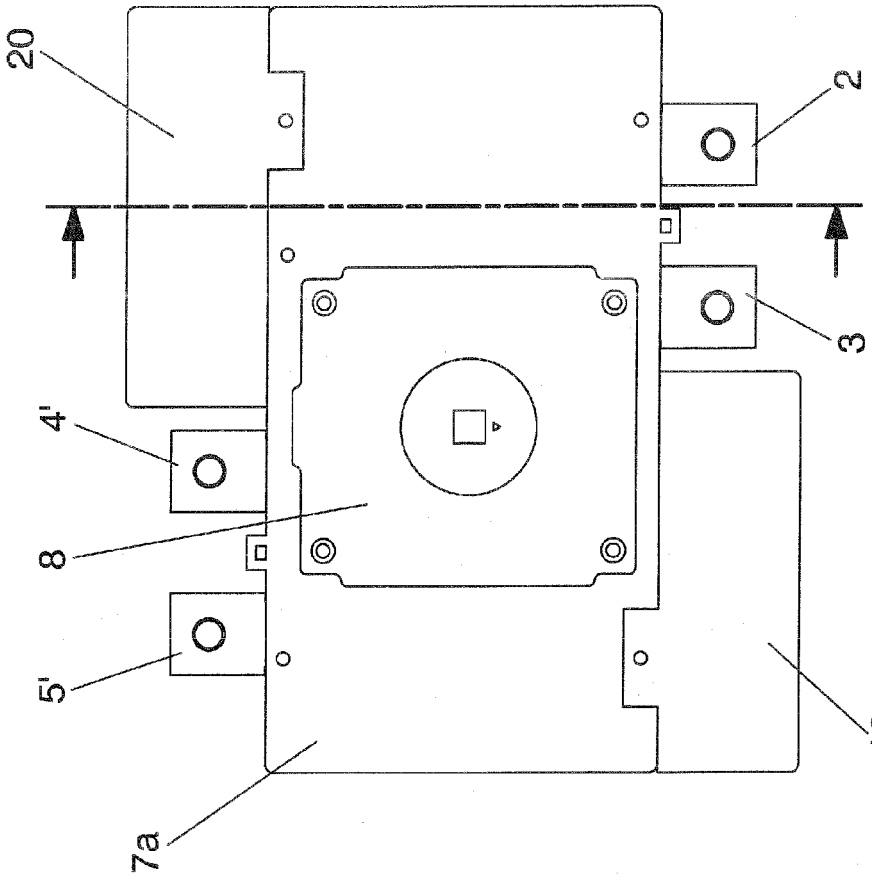

FIG. 6b

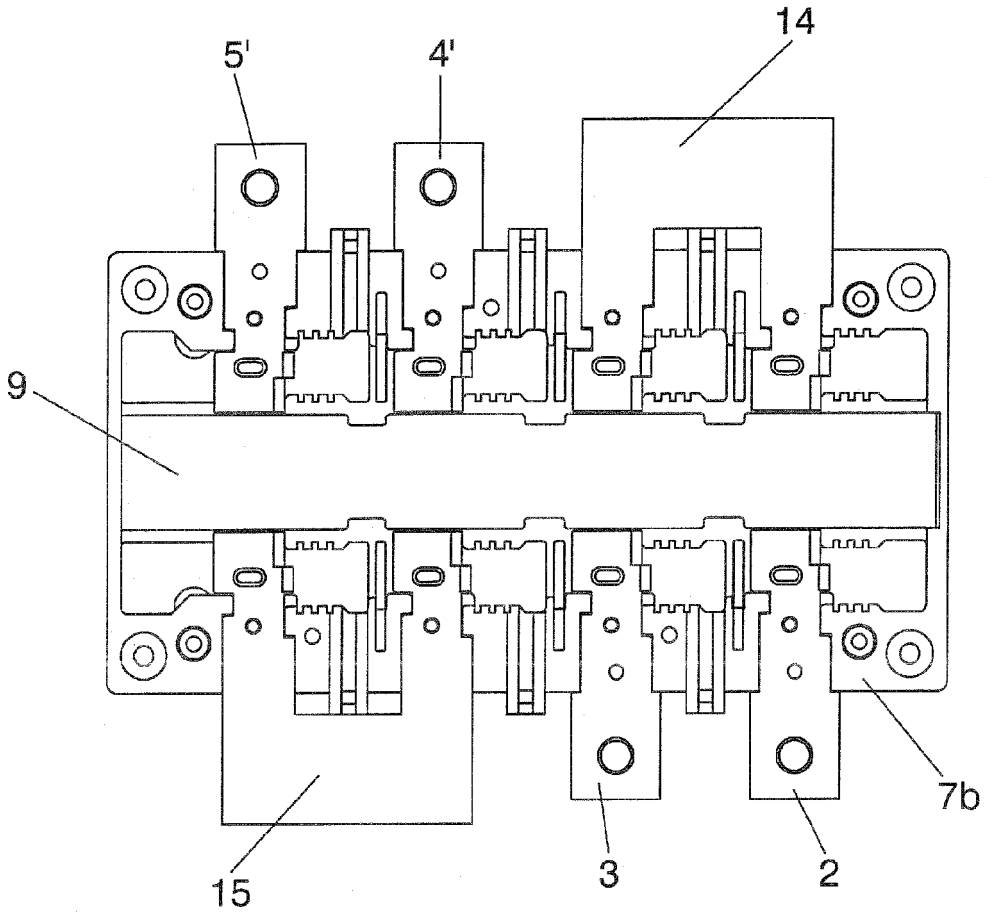

FIG. 6d

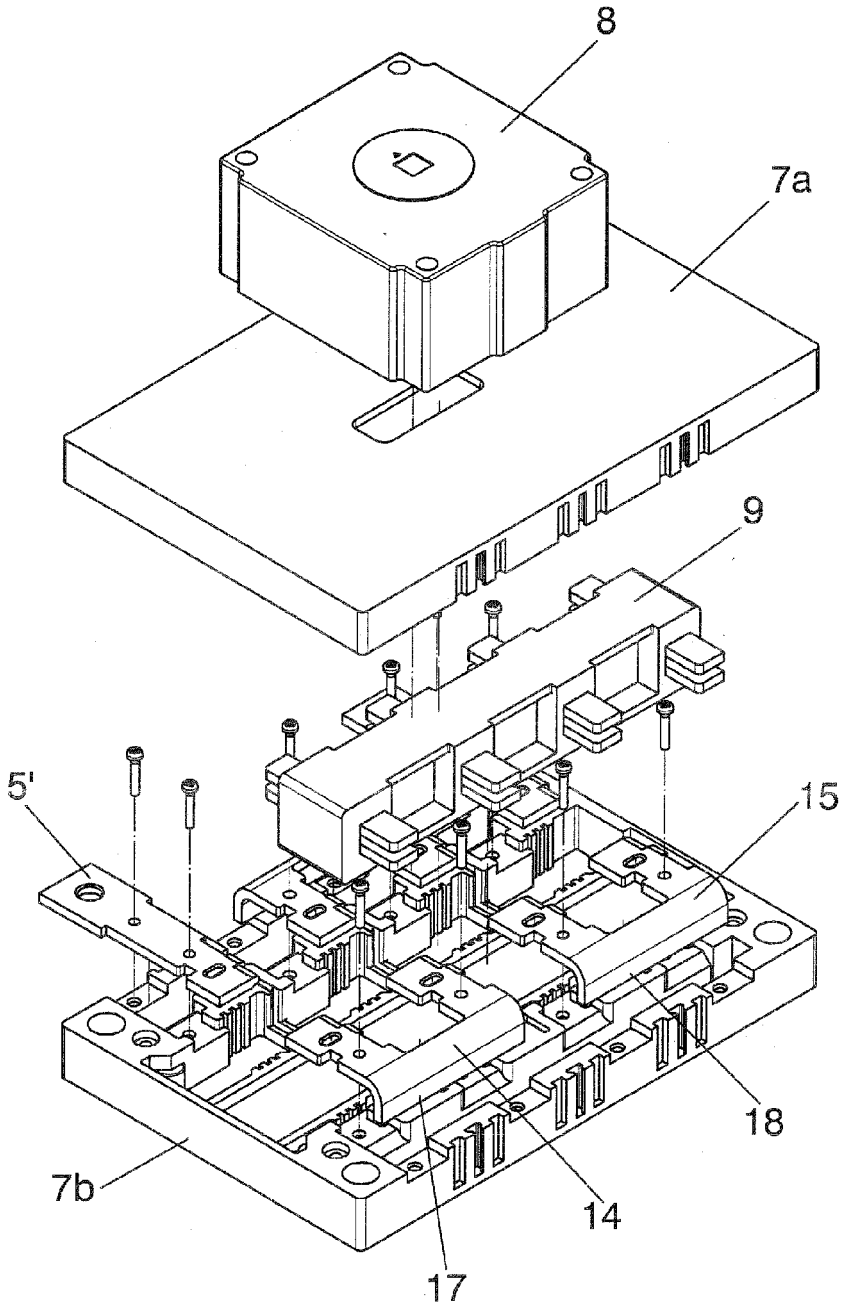

FIG. 7a

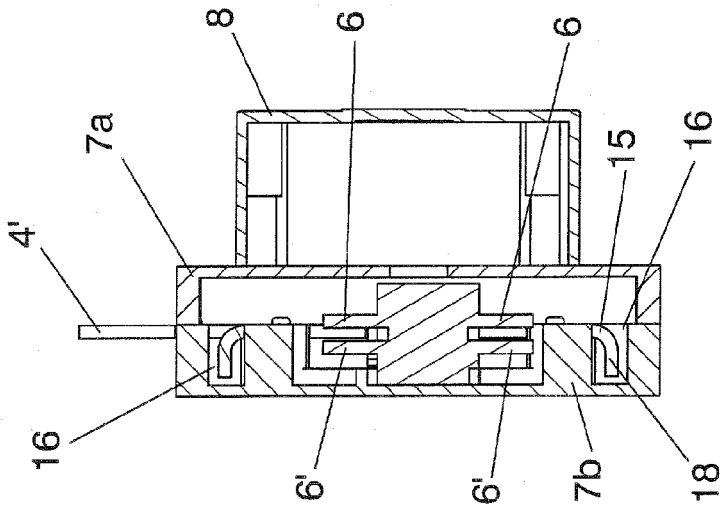

FIG. 7c

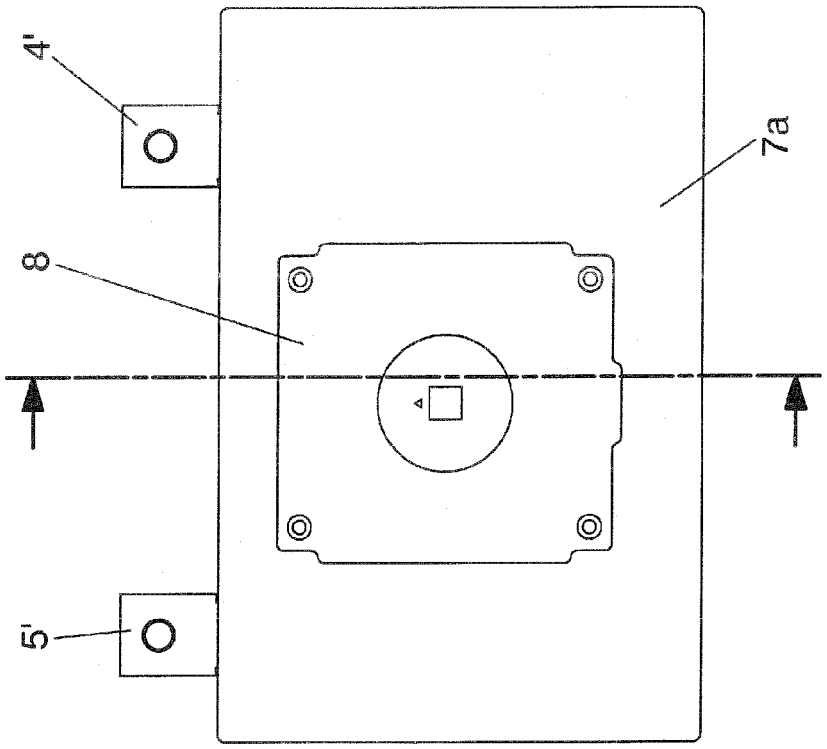

FIG. 7b

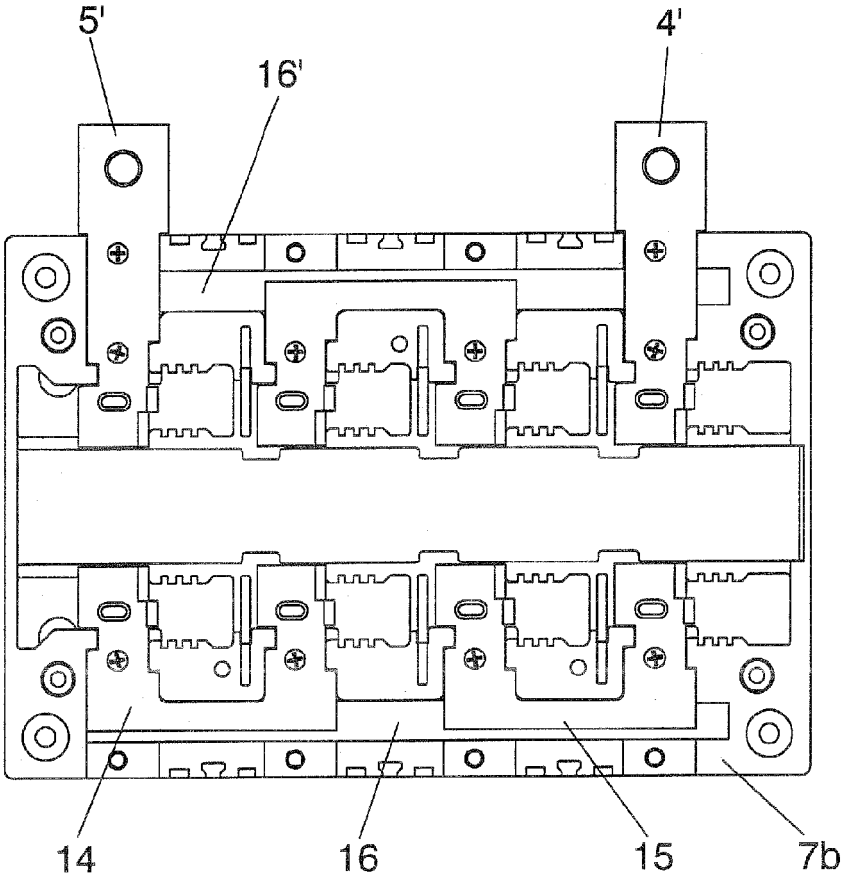

FIG. 7d

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 38 2187

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 2 230 901 A (MERLIN GERIN [FR]) 31 October 1990 (1990-10-31) * page 6, paragraph 1 - page 9, paragraph 1; figure 3 *	1-3,5-7, 9,10 4,8	INV. H01H1/58 H01H15/04
X Y A	DE 102 07 539 C1 (CHERRY GMBH [DE]) 9 October 2003 (2003-10-09) * column 6, line 8 - column 7, line 37; figures 1,2 *	1-4,6,7, 9 8 5,10	
X Y A	US 4 090 293 A (VAN DER DONK JOHANNES MARTINUS ET AL) 23 May 1978 (1978-05-23) * column 2, line 16 - line 42; figures 1A,1B *	1-6,8 9 7,10	
Y A	GB 926 705 A (MORECAMBE ELECTRICAL EQUIPMENT) 22 May 1963 (1963-05-22) * page 1, line 16 - line 78; figure 1 *	4,8,9 1-3,5-7, 10	

TECHNICAL FIELDS SEARCHED (IPC)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 October 2012	Pavlov, Valeri

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 38 2187

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

01-10-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2230901 A	31-10-1990	AU 622793 B2	16-04-1992
		AU 5380290 A	01-11-1990
		FR 2646568 A1	02-11-1990
		GB 2230901 A	31-10-1990
		ZA 9003131 A	27-02-1991
DE 10207539 C1	09-10-2003	NONE	
US 4090293 A	23-05-1978	AR 211156 A1	31-10-1977
		BR 7700096 A	06-09-1977
		DE 2700617 A1	14-07-1977
		ES 227508 U	16-05-1977
		ES 454919 A1	01-12-1977
		FR 2337942 A1	05-08-1977
		GB 1510443 A	10-05-1978
		IT 1082980 B	21-05-1985
		JP 1008574 C	31-07-1980
		JP 52086192 A	18-07-1977
		JP 55000864 B	10-01-1980
		NL 7600236 A	14-07-1977
		US 4090293 A	23-05-1978
GB 926705 A	22-05-1963	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82