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(54) **ARC EXTINGUISHING ASSEMBLY OF SWITCHING DEVICE AND SWITCHING DEVICE UTILIZING ARC EXTINGUISHING ASSEMBLY**

LICHTBOGENLÖSCHANORDNUNG EINE SCHALTVORRICHTUNG UND SCHALTVORRICHTUNG UNTER VERWENDUNG DER LICHTBOGENLÖSCHANORDNUNG

ENSEMBLE D'EXTINCTION D'ARC D'UN DISPOSITIF DE COMMUTATION ET DISPOSITIF DE COMMUTATION UTILISANT L'ENSEMBLE D'EXTINCTION D'ARC

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Description

Technical field

[0001] The present invention relates to an arc extinguishing assembly which is used for extinguishing electric arc generated in a switching device when a movable contact terminal and a fixed contact terminal are disconnected. The present invention also relates to a switching device utilizing the arc extinguishing assembly.

Background Art

[0002] The switching device is a device for switching on and off a circuit, such as a disconnecting switch, a fuse switch, a circuit breaker and the like. The switching device generally comprises a movable contact terminal, a fixed contact terminal and a drive mechanism for driving the movable contact terminal to contact or to be separated from the fixed contact terminal.

[0003] When the movable contact terminal and the fixed contact terminal of the switching device disconnect the circuit, the gas thereinbetween generates a discharging phenomenon under the effect of a high electric field, namely, electric arc. Due to the existence of the electric arc, the time for the switching device to disconnect the circuit is delayed, and the movable contact terminal and the fixed contact terminal are burned, which may even cause the ignition and explosion of the switching device in extreme circumstances. The switching device is generally provided with an arc running board and an arc extinguishing chamber. The arc running board is used for enabling the electric arc to enter the arc extinguishing chamber. The arc extinguishing chamber is provided with a plurality of arc isolation boards in parallel, and the electric arc entering the arc extinguishing chamber is isolated by each arc isolation board in short electric arcs so as to be extinguished. In the existing switching devices, especially in the small-sized switching devices, the electric arc cannot rapidly enter the arc extinguishing chamber through the arc running board, and thus the electric arc extinguishing time is prolonged. Document EP1998349 discloses an arc extinguishing assembly of a switching device, comprising an arc extinguishing chamber provided with a plurality of arc isolation boards spaced apart; a fixed contact terminal provided with a fixed contact, and an arc guide portion spaced apart from the arc isolation boards; a movable contact terminal provided with a movable contact that is able to contact or be separated from the fixed contact; a first arc guide board prepared from electromagnetic pure iron; and a second arc guide board prepared from electromagnetic pure iron, arranged to be opposite to the first arc guide board.

Summary of the present invention

[0004] The present invention aims at providing an arc extinguishing assembly of a switching device, so that the electric arc can rapidly enter the arc extinguishing chamber through the arc running board.

[0005] Another aim of the present invention is to provide the switching device utilizing the arc extinguishing assembly.

[0006] Provided in the present invention is an arc extinguishing assembly of the switching device comprising an arc extinguishing chamber, a fixed contact terminal, a movable contact terminal, an arc running board, a first arc guide board and a second arc guide board. The arc extinguishing chamber is provided with a plurality of arc isolation boards arranged spaced apart from each other. The fixed contact terminal is provided with a fixed contact and an arc guide portion which is spaced apart from the arc isolation boards. The movable contact terminal is provided with a movable contact which contacts or is separated from the fixed contact. The arc running board is provided with a first connecting end which is connected to the movable contact terminal and a second connecting end which extends to the arc extinguishing chamber and is spaced apart from the arc isolation boards. The first arc guide board is prepared from electromagnetic pure iron, and the second arc guide board is prepared from electromagnetic pure iron, with the first arc guide board and the second arc guide board being arranged oppositely, and the fixed contact terminal and the arc running board being arranged between the first arc guide board and the second arc guide board.

[0007] In the arc extinguishing assembly of the switching device, by means of the first arc guide board and the second arc guide board prepared from the electromagnetic pure iron, a magnetic field force applied onto the electric arc by the first arc guide board and the second arc guide board can be increased, so that the electric arc can be rapidly moved to an arc chamber. In addition, even if in the narrow space of a small-sized switching device, the electric arc can still be rapidly moved to the arc chamber by means of a high magnetic field generated by the first arc guide board and the second arc guide board.

[0008] In a further schematic embodiment of the arc extinguishing assembly of the switching device, the coercivity of the electromagnetic pure iron from which the first arc guide board is prepared is less than or equal to 96A/m, the maximum magnetic permeability thereof is greater than 0.0075H/m, and the magnetic induction intensity B_{200} is greater than 1.2T.

[0009] In another schematic embodiment of the arc extinguishing assembly of the switching device, the coercivity of the electromagnetic pure iron from which the second arc guide board is prepared is less than or equal to 96A/m, the maximum magnetic permeability thereof is greater than 0.0075H/m, and the magnetic induction intensity B_{200} is greater than 1.2T.

[0010] In yet another schematic embodiment of the arc extinguishing assembly of the switching device, the arc running board is prepared from electromagnetic pure iron, and a magnetic field generated by the magnetized

arc running board can also generate magnetic blow for the electric arc.

[0011] In yet another schematic embodiment of the arc extinguishing assembly of the switching device, a first plastic cover covering the first arc guide board and a second plastic cover covering the second arc guide board are further provided. A high temperature generated by the electric arc enables the first plastic cover and the second plastic cover to generate gas, so that the intensity of pressure inside the switching device is increased, causing air blow acting on the electric arc, so as to bend and stretch the electric arc and move it towards the arc chamber, and thus the extinguishing of the electric arc can be accelerated.

[0012] The present invention also provides a switching device comprising a housing and the above-mentioned arc extinguishing assembly. The arc extinguishing assembly is arranged in the housing.

Description of the drawings

[0013] The following drawings are only used for schematic illustration and allowing interpretation of the present invention and are not intended to limit the scope of the present invention.

Figure 1 is used to illustrate a schematic structure diagram of a schematic embodiment of the arc extinguishing assembly of the switching device.

Figures 2 to 5 are used to illustrate an electric arc generating and extinguishing process.

Figure 6 is used to illustrate a schematic structure diagram of another schematic embodiment of the arc extinguishing assembly of the switching device.

Figure 7 is used to illustrate a schematic structure diagram of a schematic embodiment of the switching device.

Description of reference numerals

[0014]

10 arc extinguishing chamber
12 arc isolation board
20 fixed contact terminal
22 fixed contact
24 arc guide portion
30 movable contact terminal
32 movable contact
40 arc running board
42 first connecting end
44 second connecting end
50 first arc guide board
52 first plastic cover
60 second arc guide board
62 second plastic cover
70 housing

Particular embodiments

[0015] In order that the technical characteristics, technical purpose and technical effect of the present invention can be more clearly understood, the particular embodiments are now illustrated by referring to the drawings, and identical reference numerals in all drawings represent identical parts.

[0016] In this context, "schematic" represents "serving as an example, instance or description", and any of the illustrations and embodiments described as "schematic" in this context should be explained as a more preferred or more advantageous technical solution.

[0017] In order to simplify the figures, only the parts which are related to the present invention are schematically shown in the figures, and they therefore do not represent real structures of a product. In addition, in order to make the drawings simple and easy to understand, in some drawings having parts with the same structure or function, only one of them is drawn or marked exemplarily.

[0018] Herein, "a" not only represents "only this one", but can also mean "more than one".

[0019] Herein, "first", "second" and the like are only used for differentiating components from one another, rather than meaning the degree of importance and order of them.

[0020] Figure 1 is used for illustrating a schematic structure diagram of a schematic embodiment of the arc extinguishing assembly of the switching device. As shown in Figure 1, the arc extinguishing assembly of the switching device comprises an arc extinguishing chamber 10, a fixed contact terminal 20, a movable contact terminal 30, an arc running board 40, a first arc guide board 50 and a second arc guide board 60.

[0021] The arc extinguishing chamber 10 here is a special mechanism provided for extinguishing the electric arc in the switching device. The arc extinguishing chamber 10 is provided with a plurality of arc isolation boards 12 which arc isolation boards 12 are spaced apart and isolated from one another. After the electric arc enters the arc extinguishing chamber 10, the electric arc is segmented by the arc isolation boards 12 into a plurality of segments, so that the electric arc can be extinguished. The arc extinguishing chamber can adopt any of the known structures and no further description is needed here.

[0022] The fixed contact terminal 20 is provided with a fixed contact 22 and an arc guide portion 24. The movable contact terminal 30 is provided with a movable contact 32. The fixed contact 22 can be separated from and/or contact the movable contact 32 so as to realize the switch-on or switch-off of the switching device.

[0023] When the fixed contact 22 is separated from the movable contact 32, the electric arc is firstly generated

between the fixed contact 22 and the movable contact 32. The arc guide portion 24 provided on the fixed contact terminal 20 is equal in potential with the fixed contact 22, which arc guide portion 24 extends from the fixed contact 22 to the arc extinguishing chamber 10, and the arc guide portion 24 is provided spaced apart from the arc isolation boards 12, that is to say, the arc guide portion 24 is isolated from the arc isolation boards 12.

[0024] The arc running board 40 is provided with a first connecting end 42 and a second connecting end 44. The first connecting end 42 can be connected to the movable contact terminal 30, so that the arc running board 40 and the movable contact terminal 30 are equal in potential. The second connecting end 44 extends from the first connecting end 42 to the arc extinguishing chamber 10, and the second connecting end 44 and the arc isolation boards 12 are arranged spaced apart, that is to say, the second connecting end 44 is isolated from the arc isolation boards 12, so that the electric arc between the first connecting end 42 and the fixed contact 22 can be guided inbetween the second connecting end 44 and the arc extinguishing chamber 10. Although in the embodiment shown in Figure 1, the arc running board 40 and the movable contact terminal 30 are two seperate parts, it is possible for these to be different portions of one component.

[0025] The first arc guide board 50 and the second arc guide board 60 are arranged oppositely. The fixed contact terminal 20 and the arc running board 40 are arranged between the first arc guide board 50 and the second arc guide board 60. Both the first arc guide board 50 and the second arc guide board 60 are prepared from electromagnetic pure iron (soft magnetic iron). The first arc guide board 50 and the second arc guide board 60 can be magnetized by the current passing through the movable contact terminal 30 and the fixed contact terminal 20. When the electric arc is generated between the movable contact 32 and the fixed contact 22, the magnetic force applied onto the electric arc by a magnetic field generated by the first arc guide board 50 and the second arc guide board 60 enables the electric arc to move toward the arc extinguishing chamber 10, i.e., magnetic blow is applied onto the electric arc.

[0026] Figures 2 to 5 are used to illustrate the generation and extinguishing process of the electric arc; in order to clearly show the structure, the first arc guide board and the second arc guide board are drawn by dashed lines in each figure, and a connecting structure between the movable contact terminal and the arc running board is not shown in each figure. Referring to Figure 2 in combination with Figure 1, the switching device is currently in a switch-on state, and the fixed contact 22 of the fixed contact terminal 20 is in contact with the movable contact 32 of the movable contact terminal 30.

[0027] As shown in Figure 3, the switching device begins to transform from a switch-on state to a switch-off state, the fixed contact 22 begins to separate from the movable contact 32, and the electric arc is generated between the fixed contact 22 and the movable contact 32.

[0028] With the increasing distance between the movable contact 32 and the fixed contact 22, as shown in Figure 4, the electric arc is transferred between the fixed contact 22 and the first connecting end 42. The production of the first arc guide board 50 and the second arc guide board 60 from electromagnetic pure iron give them very high magnetic sensitivity. The first arc guide board 50 and the second arc guide board 60 are magnetized by the electric arc, enabling the magnetic field generated thereby to apply a very large magnetic field force onto the electric arc, that is to say, the first arc guide board 50 and the second arc guide board 60 produce magnetic blow for the electric arc, thus enabling the electric arc to be moved rapidly toward the arc extinguishing chamber 10.

[0029] As shown in Figure 5, the electric arc between the fixed contact 22 and the first connecting end 42 is moved to the arc extinguishing chamber 10. The electric arc exists among the second connecting end 44, a plurality of arc isolation boards 12 and the arc guide portion 24, and the electric arc is segmented by the arc isolation boards 12 of the arc extinguishing chamber 10 into multiple segments, so that the electric arc is extinguished.

[0030] In the arc extinguishing assembly of the switching device, compared with an ordinary ferromagnetic material, the use of electromagnetic pure iron to prepare the first arc guide board and the second arc guide board allows the magnetic field force applied onto the electric arc by the first arc guide board and the second arc guide board to be increased, so that the electric arc can be rapidly moved to an arc chamber. In addition, even if in the narrow space of a small-sized switching device, the electric arc can still be rapidly moved to the arc chamber by means of the high magnetic field generated by the first arc guide board and the second arc guide board.

[0031] In a schematic embodiment of the arc extinguishing assembly of the switching device, the coercivity of the electromagnetic pure iron from which the first arc guide board 50 is prepared is less than or equal to 96A/m, the maximum magnetic permeability thereof is greater than 0.0075H/m, and the magnetic induction intensity B_{200} is greater than 1.2T. In addition, the coercivity of the electromagnetic pure iron from which the second arc guide board is prepared is less than or equal to 96A/m, the maximum magnetic permeability thereof is greater than 0.0075H/m, and the magnetic induction intensity B_{200} is greater than 1.2T. In addition, in order to further accelerate the electric arc entering the arc extinguishing chamber 10, the arc running board 40 can also be prepared from the electromagnetic pure iron, e.g. the same electromagnetic pure iron from which the first arc guide board and the second arc guide board are prepared. A magnetic field generated by the magnetized arc running board 40 can also produce the magnetic blow for the electric arc. The smaller the coercivity is, the better magnetic induction characteristic the electromagnetic pure iron has; the greater the maximum magnetic permeability is, the better magnetic induction characteristic the elec-

tromagnetic pure iron has; and the greater the magnetic induction intensity B_{200} is, the better magnetic induction characteristic the electromagnetic pure iron has.

[0032] Figure 6 is used to illustrate a schematic structure diagram of another schematic embodiment of the arc extinguishing assembly of the switching device, in which the structures in the figure which are identical to those in Figure 1 will not be further described. As shown in Figure 6, the first arc guide board 50 is covered by a first plastic cover 52, and the second arc guide board 60 is covered by a second plastic cover 62. For example, the first plastic cover and the second plastic cover can cover the first arc guide board and the second arc guide board by means of injection molding. By means of the first plastic cover 52 and the second plastic cover 62, the electrical isolation of the first arc guide board 50 and the second arc guide board 60 from the fixed contact terminal 20, the movable contact terminal 30 and the arc running board 40 can be realized. In addition, when the electric arc is generated, the ambient air is rapidly heated up by the electric arc, and the first plastic cover 52 and the second plastic cover 62 are heated to generate gas, thereby increasing the intensity of pressure inside the switching device, so as to produce air blow acting on the electric arc, which bends and stretches the electric arc and moves it toward the arc extinguishing chamber 10, and thus the extinguishing of the electric arc can be accelerated.

[0033] Figure 7 is used to illustrate a schematic structure diagram of a schematic embodiment of the switching device. As shown in Figure 7, the switching device comprises a housing 70 and the above-mentioned arc extinguishing assembly. Here, the arc extinguishing assembly is arranged in the housing 70.

Claims

1. An arc extinguishing assembly of a switching device, comprising
   an arc extinguishing chamber (10) provided with a plurality of arc isolation boards (12) spaced apart;
   a fixed contact terminal (20) provided with a fixed contact (22), and an arc guide portion (24) spaced apart from the arc isolation boards (12);
   a movable contact terminal (30) provided with a movable contact (32) that is able to contact or be separated from the fixed contact (22);
   an arc running board (40) provided with a first connecting end (42) connected to the movable contact terminal (30), and a second connecting end (44) extending to the arc extinguishing chamber (10) and spaced apart from the arc isolation boards (12);
   a first arc guide board (50) prepared from electromagnetic pure iron; and
   a second arc guide board (60) prepared from electromagnetic pure iron, arranged to be opposite to the first arc guide board (50), and the fixed contact terminal (20) and the arc running board (40) being arranged between the first arc guide board (50) and the second arc guide board (60).

2. The arc extinguishing assembly as claimed in claim 1, **characterized in that** the coercivity of the electromagnetic pure iron from which the first arc guide board (50) is prepared is less than or equal to 96A/m, the maximum magnetic permeability thereof is greater than 0.0075H/m, and the magnetic induction intensity B_{200} is greater than 1.2T.

3. The arc extinguishing assembly as claimed in claim 1, **characterized in that** the coercivity of the electromagnetic pure iron from which the second arc guide board (60) is prepared is less than or equal to 96A/m, the maximum magnetic permeability thereof is greater than 0.0075H/m, and the magnetic induction intensity B_{200} is greater than 1.2T.

4. The arc extinguishing assembly as claimed in claim 1, **characterized in that** the arc running board (40) is prepared from electromagnetic pure iron.

5. The arc extinguishing assembly as claimed in claim 1, **characterized in that** a first plastic cover (52) covering the first arc guide board (50) and a second plastic cover (62) covering the second arc guide board (60) are further provided.

6. A switching device, comprising:

   a housing (70); and
   the arc extinguishing assembly as claimed in any one of claims 1 to 5, arranged in the housing (70).

Patentansprüche

1. Lichtbogenlöschanordnung einer Schaltvorrichtung, umfassend:

   eine Lichtbogenlöschkammer (10), die mit mehreren voneinander beabstandeten Lichtbogentrennplatten (12) versehen ist;
   ein Feste-Kontakt-Anschluss (20), der mit einem festen Kontakt (22) versehen ist, und einen Lichtbogenführungsabschnitt (24), der von den Lichtbogentrennplatten (12) beabstandet ist;
   ein Bewegliche-Kontakt-Anschluss (30), der mit einem beweglichen Kontakt (32) versehen ist, der in der Lage ist, den festen Kontakt (22) zu kontaktieren oder davon getrennt zu werden;
   eine Lichtbogenlaufplatte (40), die mit einem ersten verbindenden Ende (42) versehen ist, das mit dem Bewegliche-Kontakt-Anschluss (30) verbunden ist, und ein zweites verbinden-

des Ende (44), das sich zu der Lichtbogenlöschkammer (10) erstreckt und von den Lichtbogentrennplatten (12) beabstandet ist;
eine erste Lichtbogenführungsplatte (50), die aus elektromagnetisch reinem Eisen hergestellt ist; und
eine zweite Lichtbogenführungsplatte (60), die aus elektromagnetisch reinem Eisen hergestellt ist, angeordnet gegenüber der ersten Lichtbogenführungsplatte (50), und wobei der Feste-Kontakt-Anschluss (20) und die Lichtbogenlaufplatte (40) zwischen der ersten Lichtbogenführungsplatte (50) und der zweiten Lichtbogenführungsplatte (60) angeordnet sind.

2. Lichtbogenlöschanordnung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Koerzitivfeldstärke des elektromagnetisch reinen Eisens, aus dem die erste Lichtbogenführungsplatte (50) hergestellt ist, kleiner oder gleich 96 A/m beträgt, wobei die größte magnetische Permeabilität davon über 0,0075 H/m beträgt und die magnetische Induktionsintensität B_{200} über 1,2 T beträgt.

3. Lichtbogenlöschanordnung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Koerzitivfeldstärke des elektromagnetisch reinen Eisens, aus dem die zweite Lichtbogenführungsplatte (60) hergestellt ist, kleiner oder gleich 96 A/m beträgt, wobei die größte magnetische Permeabilität davon über 0,0075 H/m beträgt und die magnetische Induktionsintensität B_{200} über 1,2 T beträgt.

4. Lichtbogenlöschanordnung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Lichtbogenlaufplatte (40) aus elektromagnetisch reinem Eisen hergestellt ist.

5. Lichtbogenlöschanordnung nach Anspruch 1, **dadurch gekennzeichnet, dass** weiterhin eine erste Kunststoffabdeckung (52), die die erste Lichtbogenführungsplatte (50) bedeckt, und eine zweite Kunststoffabdeckung (62), die die zweite Lichtbogenführungsplatte (60) bedeckt, vorgesehen sind.

6. Schaltvorrichtung, umfassend:

ein Gehäuse (70); und
die Lichtbogenlöschanordnung nach einem der Ansprüche 1 bis 5, in dem Gehäuse (70) angeordnet.

Revendications

1. Ensemble d'extinction d'arc d'un dispositif de commutation, comprenant :

une chambre d'extinction d'arc (10) munie d'une pluralité de panneaux d'isolation d'arc (12) espacés les uns des autres ;
une borne de contact fixe (20) munie d'un contact fixe (22) et d'une partie de guidage d'arc (24) espacée des panneaux d'isolation d'arc (12) ;
une borne de contact mobile (30) munie d'un contact mobile (32) pouvant être en contact avec le contact fixe (22) ou pouvant en être séparé ;
un panneau de tirage d'arc (40) muni d'une première extrémité de connexion (42) connectée à la borne de contact mobile (30), et d'une seconde extrémité de connexion (44) s'étendant jusqu'à la chambre d'extinction d'arc (10) et espacée des panneaux d'isolation d'arc (12) ;
un premier panneau de guidage d'arc (50) préparé à partir de fer électromagnétiquement pur ; et
un second panneau de guidage d'arc (60) préparé à partir de fer électromagnétiquement pur, disposé à l'opposé du premier panneau de guidage d'arc (50), et la borne de contact fixe (20) et le panneau de tirage d'arc (40) étant disposés entre le premier panneau de guidage d'arc (50) et le second panneau de guidage d'arc (60).

2. Ensemble d'extinction d'arc selon la revendication 1, **caractérisé en ce que** la coercivité du fer électromagnétiquement pur à partir duquel le premier panneau de guidage d'arc (50) est préparé est inférieure ou égale à 96 A/m, sa perméabilité magnétique maximale est supérieure à 0,0075 H/m, et l'intensité d'induction magnétique B200 est supérieure à 1,2 T.

3. Ensemble d'extinction d'arc selon la revendication 1, **caractérisé en ce que** la coercivité du fer électromagnétiquement pur à partir duquel le second panneau de guidage d'arc (60) est préparé est inférieure ou égale à 96 A/m, sa perméabilité magnétique maximale est supérieure à 0,0075 H/m, et l'intensité d'induction magnétique B200 est supérieure à 1,2 T.

4. Ensemble d'extinction d'arc selon la revendication 1, **caractérisé en ce que** la plage de tirage d'arc (40) est préparée à partir de fer électromagnétiquement pur.

5. Ensemble d'extinction d'arc selon la revendication 1, **caractérisé en ce qu'**un premier couvercle de plastique (52) couvrant le premier panneau de guidage d'arc (50) et un second couvercle de plastique (62) couvrant le second panneau de guidage d'arc (60) sont également fournis.

6. Dispositif de commutation, comprenant :

un boîtier (70) ; et
l'ensemble d'extinction d'arc selon l'une quelconque des revendications 1 à 5, disposé dans le boîtier (70).

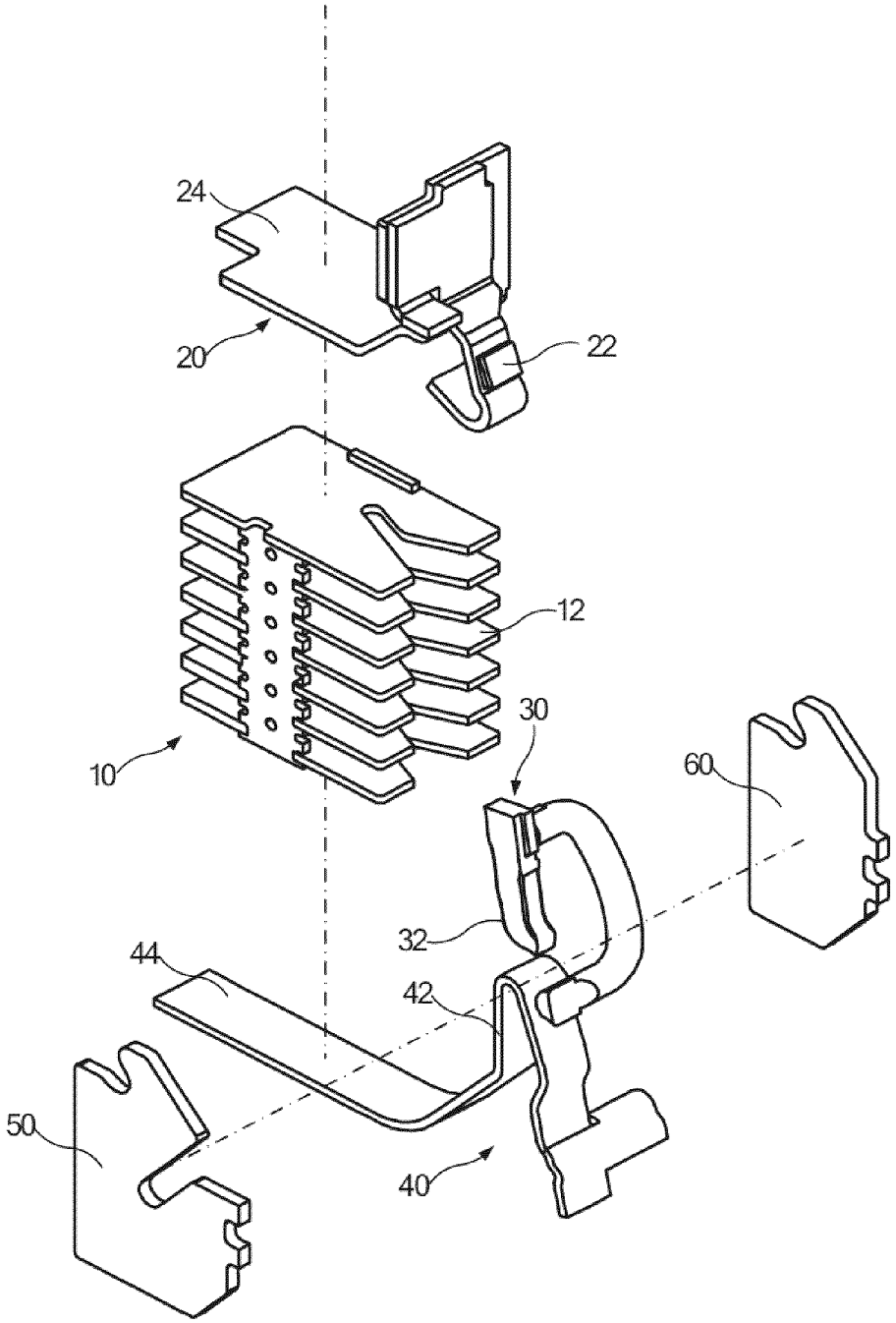

Fig. 1

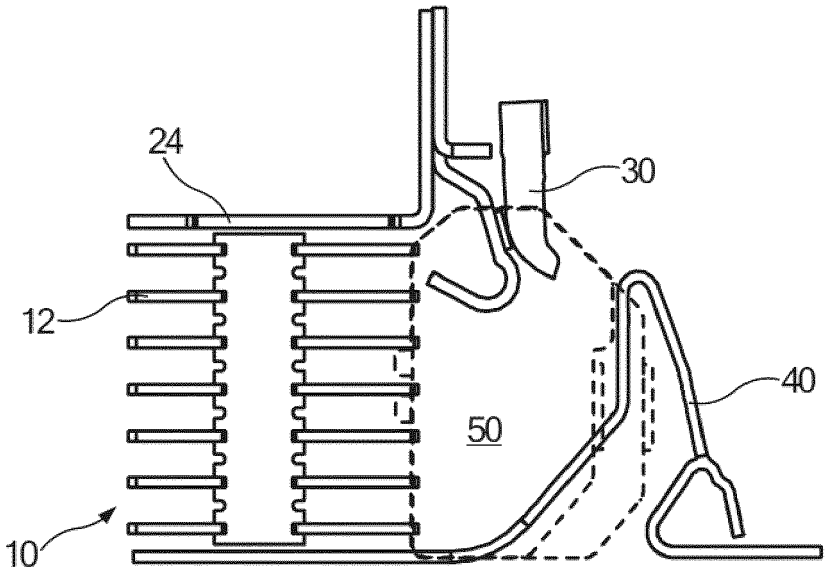

Fig. 2

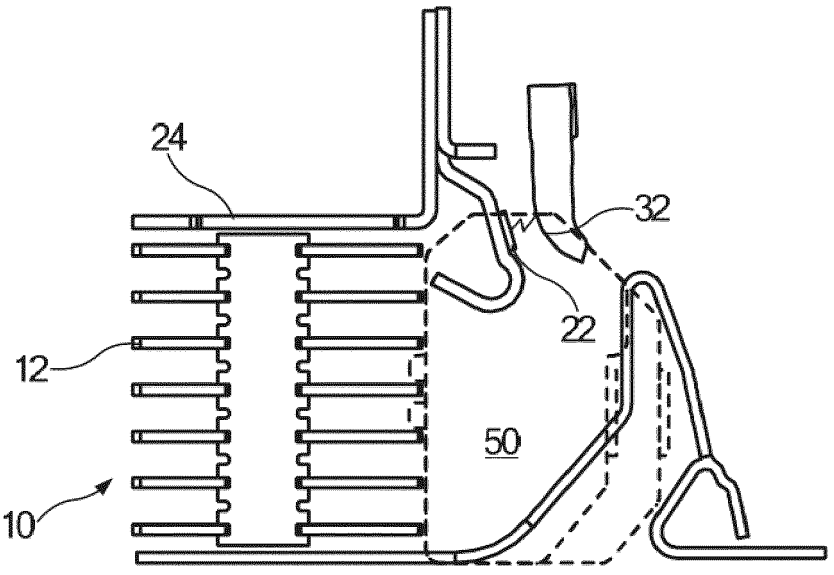

Fig. 3

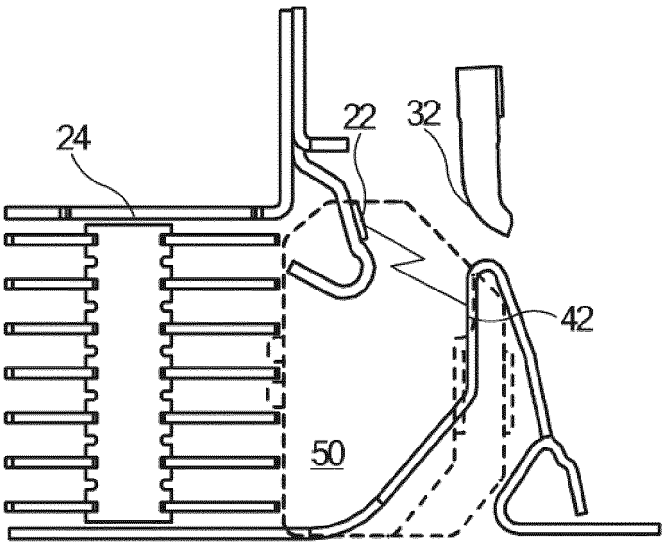

Fig. 4

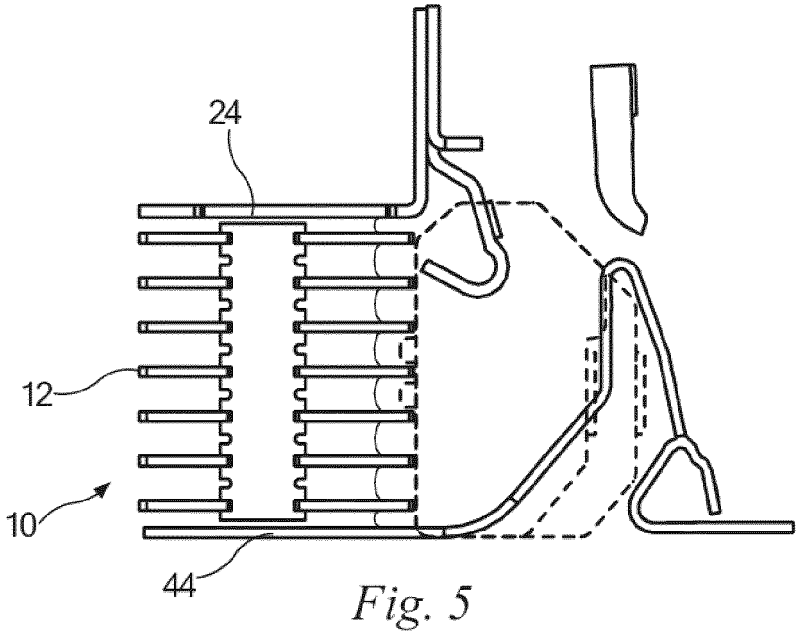

Fig. 5

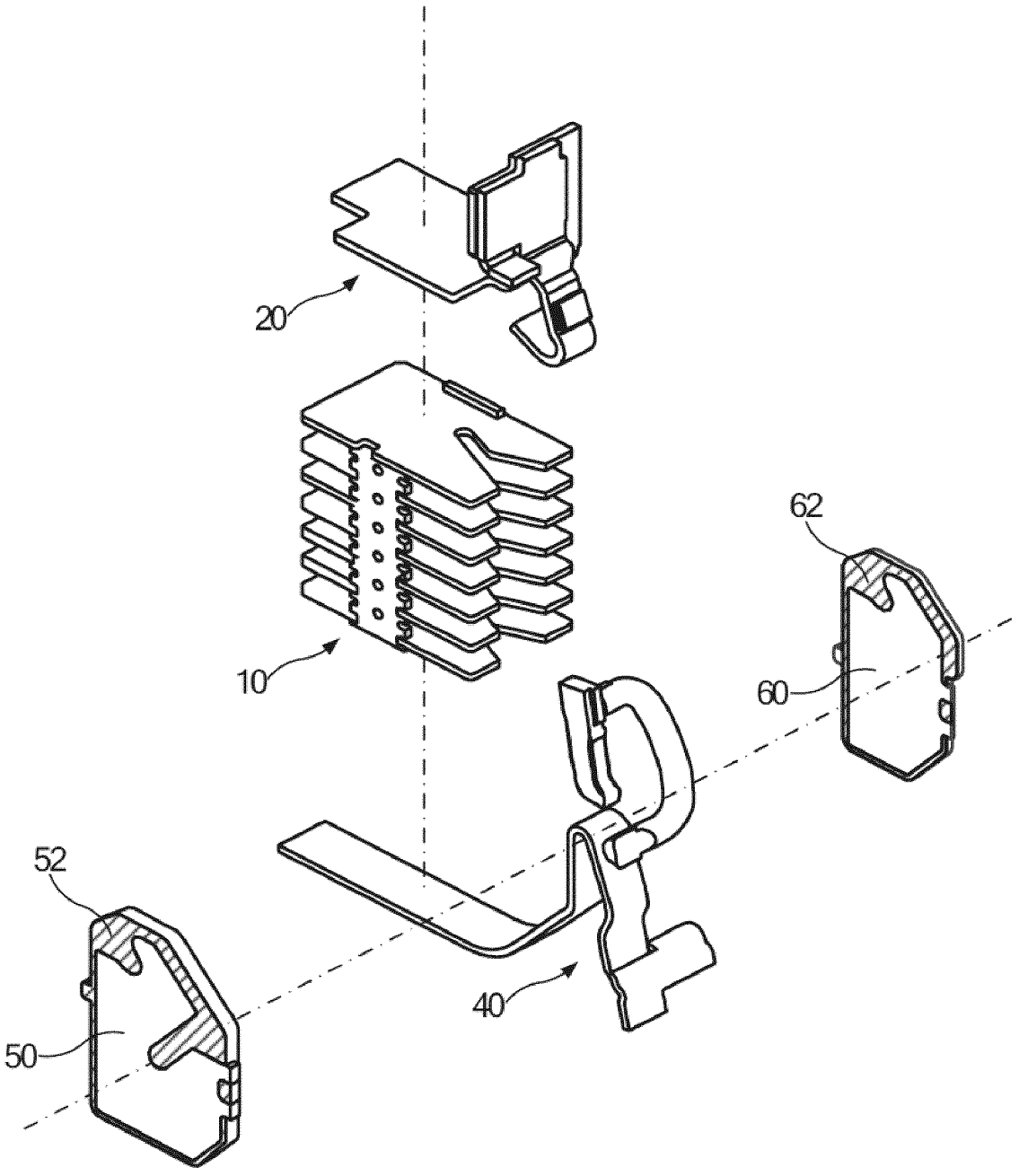

Fig. 6

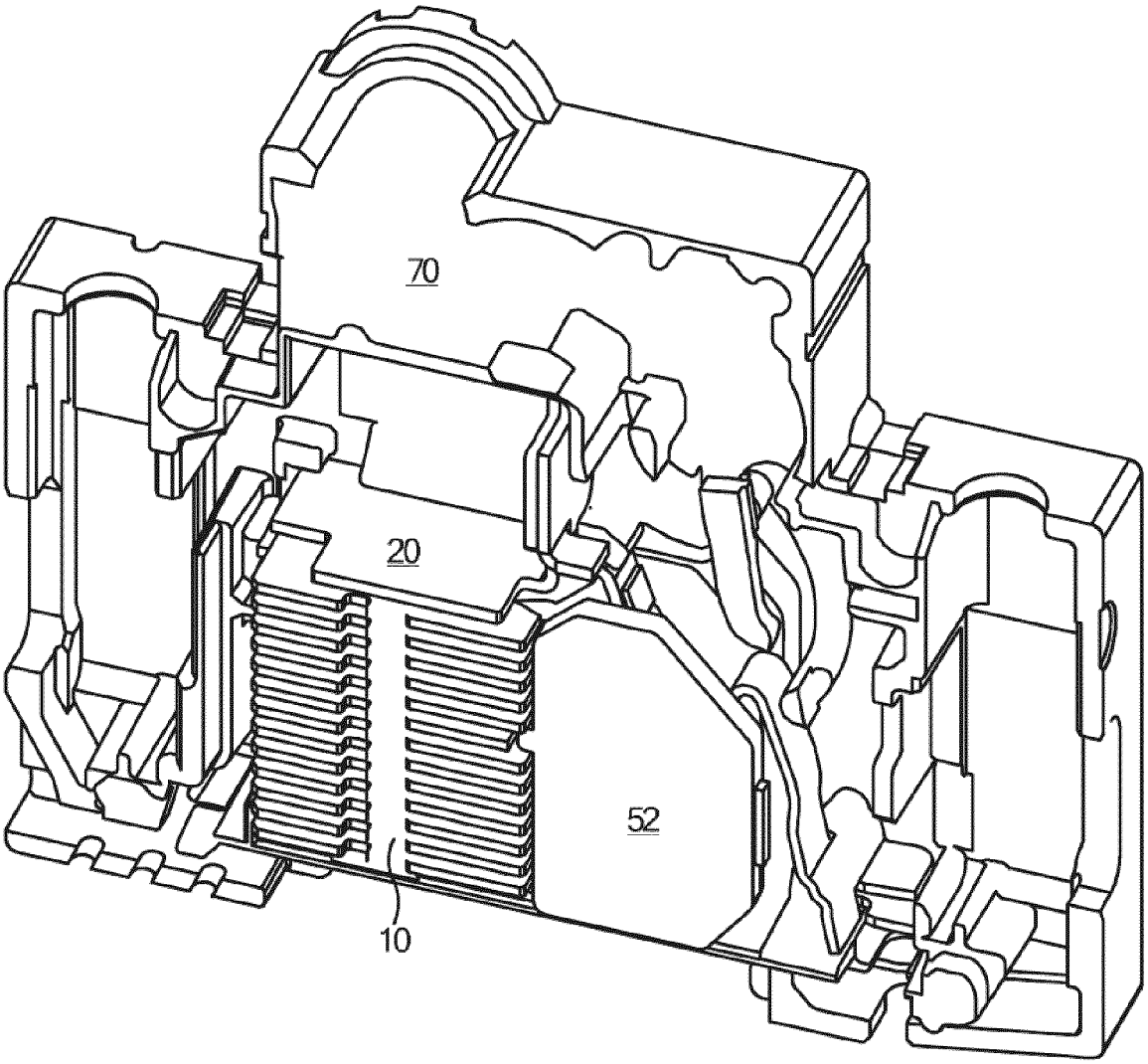

Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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