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(54) Contact assembly of switching device and switching device thereof

(57) A contact assembly of a switching device, comprising a fixed contact member (10) and a moveable contact component (20). The moveable contact component comprises a pair of first conductive members (22) and a pair of second conductive members (24). The first conductive members have contact ends (222). The second conductive members are provided between the first conductive members. The fixed contact member may contact the contact ends or the second conductive members, and the arc erosion resistance performance of the first conductive members is poorer than that of the second conductive members, and when the second conductive members are out of contact with the fixed contact member, the contact ends may contact the fixed contact member. In the contact assembly of the switching device, when the moveable contact component is separated from the fixed contact member, an arc is produced between the first conductive members and the fixed contact member, and the first conductive members have arc erosion resistance performance superior to that of the second conductive members; therefore, erosion of the contacts by the arc can be effectively reduced, and the service life of the switching device is extended.

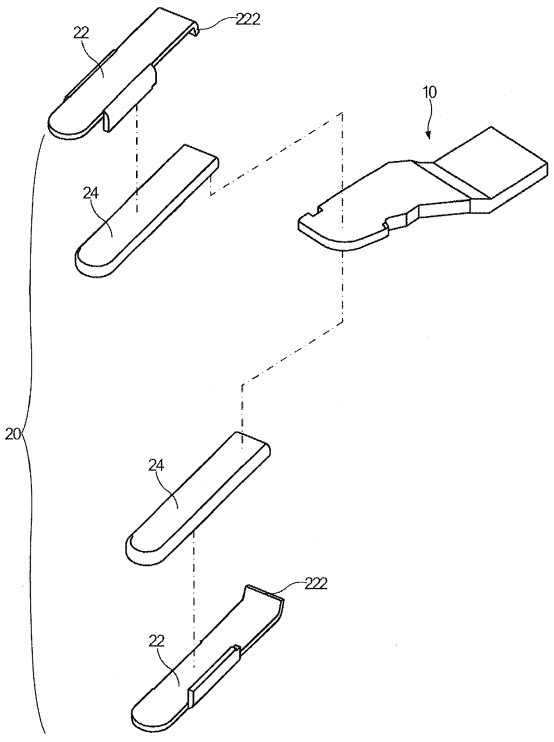

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a contact assembly which may achieve electrical connections, and in particular to a contact assembly of moveable and fixed contacts in a load isolation switch. The present invention further relates to a switching device using the contact assembly.

BACKGROUND ART

[0002] In a switching device, the current of a circuit in normal working conditions can be connected, carried and broken by the contact or separation of a moveable contact and a fixed contact. In order to reduce the on-resistance after the moveable contact contacts the fixed contact, the existing moveable contact and fixed contact are made of metal copper. When the moveable contact is separated from the fixed contact, an arc will be produced between the moveable contact and the fixed contact. The high temperature produced by the arc will cause the metal copper of the moveable contact and the fixed contact to be eroded, and the erosion of the moveable contact will frequently cause malfunction of the switching device.

CONTENT OF THE INVENTION

[0003] The object of the present invention is to provide a contact assembly of a switching device, so as to reduce the erosion of the contacts by the arc.

[0004] Another object of the present invention is to provide a switching device using the contact assembly above.

[0005] The present invention provides a contact assembly of a switching device, comprising a fixed contact member and a moveable contact component. The moveable contact component comprises a pair of first conductive members and a pair of second conductive members. The first conductive members have contact ends. The second conductive members are provided between the first conductive members. The fixed contact member may contact the contact ends or the second conductive members, and the arc erosion resistance performance of the first conductive members is poorer than that of the second conductive members, and when the second conductive members are out of contact with the fixed contact member, the contact ends may contact the fixed contact member.

[0006] In the contact assembly of the switching device, when the moveable contact component is separated from the fixed contact member, an arc is produced between the first conductive members and the fixed contact member, and the first conductive members have arc erosion resistance performance superior to that of the second conductive members; therefore, erosion of the contacts by the arc can be effectively reduced, and the service life of the switching device is extended.

[0007] In a further illustrative embodiment of the contact assembly of a switching device, the contact assembly further comprises a barrier member. The barrier member has a barrier end, and when the barrier end is inserted between the second conductive members, the fixed contact member may push the barrier end out of the second conductive members. By inserting the barrier end between the second conductive members, the spacing between the second conductive members can be ensured, such that the fixed contact member can be inserted between the second conductive members.

[0008] In another illustrative embodiment of the contact assembly of a switching device, the barrier member is further provided with a connecting end pivotably connected between the second conductive members, and the barrier member is capable of rotating relative to the second conductive members by taking the connecting end as an axis.

[0009] In yet another illustrative embodiment of the contact assembly of a switching device, the barrier end is provided with a contact projection that may contact the second conductive members. Compared to the case where the entire barrier end directly contacts the second conductive members, the contact area of the contact projection and the second conductive members is much smaller, thereby decreasing the frictional force produced by the barrier end rotating relative to the second conductive members.

[0010] In yet another illustrative embodiment of the contact assembly of a switching device, the moveable contact component is further provided with a pair of elastic pieces, the first conductive members being clamped between the elastic pieces, and an elastic force applied to the first conductive members by the elastic pieces tending to narrow the spacing between the first conductive members and the spacing between the second conductive members.

[0011] In yet another illustrative embodiment of the contact assembly of a switching device, the contact end is a clamping plate bending toward the second conductive members.

[0012] In yet another illustrative embodiment of the contact assembly of a switching device, the spacing between the contact ends is greater than that between the second conductive members.

[0013] In yet another illustrative embodiment of the contact assembly of a switching device, the first conductive members are prepared from permeable materials.

[0014] In yet another illustrative embodiment of the contact assembly of a switching device, the first conductive members are prepared from steel.

[0015] In yet another illustrative embodiment of the contact assembly of a switching device, the second conductive members are prepared from copper.

[0016] In yet another illustrative embodiment of the contact assembly of a switching device, the fixed contact member is provided with a first contact area that may

contact the contact ends, and a second contact area that may contact the second conductive members. The arc erosion resistance performance of the first contact area is superior to that of the second contact area. Since both the contact ends and the first contact area are made of materials having good arc erosion resistance performance, the erosion speed of the moveable contact component and the fixed contact member can be reduced.

[0017] In yet another illustrative embodiment of the contact assembly of a switching device, the first contact area is prepared from steel, and the second contact area is prepared from copper.

[0018] The present invention further provides a switching device, comprising a housing and the abovementioned contact assembly that is provided in the housing.

DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0019] The following figures are only for illustrative description and explanation of the present invention and are not to limit the scope of the present invention.

Fig. 1 is a structural schematic diagram used for illustrating an illustrative embodiment of a contact assembly of a switching device.

Figs. 2-7 are used for illustrating a separation process of a fixed contact member and a moveable contact component in a contact assembly of a switching device.

Fig. 8 is a structural schematic diagram used for illustrating another illustrative embodiment of a contact assembly of a switching device.

Figs. 9-14 are used for illustrating a contact process of a fixed contact member and a moveable contact component in a contact assembly of a switching device.

Fig. 15 is a structural schematic diagram used for illustrating an illustrative embodiment of a switching device.

Description of reference numerals

[0020]

10	Fixed contact member
12	First contact area
14	Second contact area
20	Moveable contact component
22	First conductive member
222	Contact end
24	Second conductive member
26	Barrier member
262	Barrier end
264	Connecting end
266	Contact projection
30	Elastic piece.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0021] For the sake of better understanding of the technical features, objects and effects of the present invention, particular embodiments of the present invention will now be described in detail by reference to the accompanying drawings, in which the same reference numerals refer to the same parts.

[0022] In this context, "illustrative" represents "serving as an example, instance or description", and any illustration and embodiment described in "illustrative" in this context should not be explained as a more preferred or more advantageous technical solution.

[0023] For more concise representation of the figures, only parts related to the present invention are illustratively shown in each of the figures, and they do not represent the practical structure of the product. In addition, to representing the figures concisely and making them easy to understand, in some figures, only one of the components with the same structure or function is schematically drawn or marked.

[0024] In this context, "a" or "an" represents not only "only one" but also "more than one".

[0025] In this context, two "first conductive members" use the same name and reference numeral, only representing that the parts, which are relevant to the present invention, in the two first conductive members have the same structure. Two "second conductive members" use the same name and reference numeral, only representing that the parts, which are relevant to the present invention, in the two second conductive members have the same structure.

[0026] Fig. 1 is a structural schematic diagram used for illustrating an illustrative embodiment of a contact assembly of a switching device. As shown in the figure, the contact assembly of a switching device comprises a fixed contact member 10 and a moveable contact component 20. The connection/breaking control of the switching device on the current flowing therethrough can be achieved by the contact and separation of the moveable contact component 20 and the fixed contact member 10.

[0027] The fixed contact member 10 is provided in the switching device, and when the switching device carries out connection and breaking actions, the fixed contact member 10 stays still relative to the moveable contact component. In an illustrative embodiment of the contact assembly of a switching device, the fixed contact member 10 is prepared from metal copper, so that it has a good conductive capability.

[0028] The moveable contact component 20 is provided in the switching device, and when the switching device carries out connection and breaking actions, the moveable contact component 20 moves relative to the fixed contact member 10. The moveable contact component comprises a pair of first conductive members 22 and a pair of second conductive members 24. The second conductive members 24 are provided between the first conductive members 22. The first conductive members 22

have contact ends 222. The fixed contact member 10 may contact two second conductive members 24, or contact two contact ends 222. In an illustrative embodiment of the contact assembly of a switching device, the contact end 222 is a clamping plate bending toward the second conductive members 24 and upward the first conductive members 22. In addition, in the embodiment as shown in Fig. 1, although the two first conductive members are mutually independent, they may also be mutually connected as one piece at opposite ends of the contact ends; and although the two second conductive members are mutually independent, they may also be mutually connected as one piece at opposite ends of the contact ends.

[0029] The arc erosion resistance performance of the first conductive members 22 is poorer than that of the second conductive members 24. In an illustrative embodiment of the contact assembly of a switching device, the first conductive members 22 are prepared from steel materials having a permeability capability, while the second conductive members 24 are prepared from metal copper having a good conductive capability.

[0030] Figs. 2-7 are used for illustrating a separation process of a fixed contact member and a moveable contact component in a contact assembly of a switching device. Referring to Figs. 2 and 3, Fig. 3 is an A-direction view of Fig. 2, and at this moment, the fixed contact member 10 is inserted into the second conductive members 24 which are provided in pairs. Since the spacing between the contact ends 222 which are provided in pairs is greater than that between the second conductive members 24 which are provided in pairs, the fixed contact member 10 that contacts the second conductive members 24 does not contact the contact ends 222. Since both the fixed contact member 10 and the second conductive members 24 are prepared from metal copper, an energized line made up of the fixed contact member 10 and the second conductive members 24 can have a very low on-resistance, thereby ensuring that the switching device has good conductive characteristics in a conducting state.

[0031] When the switching device switches from a closed state to a breaking state, the moveable contact component 20 starts to detach from the fixed contact member 10. The contact area of the fixed contact member 10 and the second conductive members 24 which are provided in pairs is gradually decreased. Referring to Figs. 4 and 5, Fig. 5 is an A-direction view of Fig. 4. When the fixed contact member 10 is out of contact with the second conductive contact members 24, the spacing between the first conductive members 22 which are provided in pairs decreases, thereby enabling the two contact ends 222 to clamp the fixed contact member 10. For example, when the fixed contact member 10 is inserted between the second conductive members 24, the spacing between the first conductive members 22 becomes greater, thereby enabling the first conductive members 22 to produce elastic deformation, and when the fixed contact member 10 moves out of the second conductive members 24, the first conductive members 22 are driven by an elastic restoring force to narrow the spacing between the two second conductive members 22. In addition, in an illustrative embodiment of the contact assembly of a switching device as shown in Fig. 8, the contact assembly 20 is provided with a pair of elastic pieces 30, and the first conductive members 22 are provided between the elastic pieces 30. The elastic force produced by the elastic pieces 30 tends to narrow the spacing between the first conductive members 22 and the spacing between the second conductive members 24.

[0032] Referring to Figs. 6 and 7, Fig. 7 is an A-direction view of Fig. 6. At the moment when the fixed contact member 10 detaches from the contact ends 222, an arc is produced therebetween. Since the contact ends 222 are prepared from steel materials, the speed of arc erosion thereof is lower than that of metal copper, and the second conductive members made of metal copper are prevented from arc erosion, thereby increasing the service life of the switching device. In addition, compared to metal copper, the resistance of steel materials is much greater, thereby decreasing the energy of the arc produced between the contact ends and the fixed contact member.

[0033] In the contact assembly of the switching device, when the moveable contact component is separated from the fixed contact member, an arc is produced between the first conductive members and the fixed contact member, and the first conductive members have arc erosion resistance performance superior to that of the second conductive members; therefore, erosion of the contacts by the arc can be effectively reduced, and the service life of the switching device is extended.

[0034] Fig. 8 is a structural schematic diagram used for illustrating another illustrative embodiment of a contact assembly of a switching device. As shown in the figure, the contact assembly of a switching device comprises a barrier member 26. The barrier member 26 has a barrier end 262 and a connecting end 264.

[0035] The barrier end 262 can be inserted between the second conductive members 24, so as to ensure that the spacing between the second conductive members 24 enables the fixed contact member 10 to be inserted between the second conductive members 24. The connecting end 264 is pivotably connected between the two second conductive members 24, and the barrier end 262 is capable of rotating relative to the second conductive members 24 by taking the connecting end 264 as an axis. As shown in Fig. 8, the barrier end 262 is provided with a contact projection 266, and the barrier end 262 contacts the second conductive members 24 by virtue of the contact projection 266. Compared to the case where the entire barrier end 262 directly contacts the second conductive members 24, the contact area of the contact projection 266 and the second conductive members 24 is much smaller, thereby decreasing the frictional force produced by the barrier end 262 rotating relative to the second conductive members 24.

[0036] Referring to Fig. 8 and Figs. 2 to 7, in an illustrative embodiment of a contact assembly of a switching device, the fixed contact member 10 is provided with a first contact area 12 and a second contact area 14. The first contact area 12 is prepared from steel materials and the second contact area 14 is prepared from metal copper. The first contact area 12 is inlaid in the second contact area 14. The first contact area 12 may contact the contact ends 222 and the second contact area 14 may contact the second conductive members 24. In the process where the fixed contact member 10 detaches from the moveable contact component 20, when the fixed contact member 10 is out of contact with the second conductive members 24, i.e., the second contact area 14 is out of contact with the second conductive members 24, the contact ends 222 start to contact the first contact area 12, and at the moment when the fixed contact member 10 detaches from the moveable contact component 20, an arc is produced between the contact ends 222 and the first contact area 12.

[0037] Since both the contact ends 222 and the first contact area 12 are prepared from permeable steel materials with an erosion rate less than that of metal copper, the erosion speed of the moveable contact component and the fixed contact member can be reduced. In addition, compared to metal copper, the resistance of the contact ends 222 and the first contact area 12 is greater, which may further decrease the energy of the arc.

[0038] Figs. 9-14 are used for illustrating a contact process of a fixed contact member and a moveable contact component in a contact assembly of a switching device. Referring to Figs. 9 and 10, Fig. 10 is an A-direction view of Fig. 9, and at this moment, the fixed contact member 10 has not contacted the moveable contact component 20 yet. The barrier end 262 is inserted between the two second conductive members 22. The elastic restoring force produced by the elastic pieces 30 tends to enable the spacing between the two first conductive members 22 and the spacing between the two second conductive members 24 to be decreased.

[0039] The moveable contact component 20 rotates toward the fixed contact member 10. Referring to Figs. 11 and 12, Fig. 12 is an A-direction view of Fig. 11. Due to the existence of the barrier member 26, the spacing between the second conductive members 24 is available for the insertion of the fixed contact member 10, and the fixed contact member 10 inserted between the second conductive members 24 contacts the second conductive members 24, thereby enabling the switching device to be in a conducting state. The fixed contact member 10 inserted between the second conductive members 24 also pushes the barrier end 262 which is likewise located between the second conductive members 24 out of the second conductive members 24. Since the spacing between the contact ends 222 is greater than that between the second conductive members 24, when the fixed contact member 10 is inserted between the second conductive members 24, the spacing between the second conductive members 24 is fixed, and in the entire process where the fixed contact member 10 is being inserted between the second conductive members 24, the fixed contact member 10 will not contact the contact ends 222.

[0040] The fixed contact member 10 continues to be inserted between the second conductive members 24, and increases the contact area therebetween, and meanwhile, the fixed contact member 10 continues to push the barrier end 262 out of the second conductive members 24. Referring to Figs. 13 and 14, Fig. 14 is an A-direction view of Fig. 13. At this moment, the fixed contact member 10 is inserted between the second conductive members 24, and the contact area therebetween reaches the maximum. The fixed contact member 10 completely pushes the barrier end 262 out of the second conductive members 24, and the barrier end 262 detaches from contact with the second conductive member 24.

[0041] Fig. 15 is a structural schematic diagram used for illustrating an illustrative embodiment of a switching device. As shown in Fig. 15, the switching device comprises a housing 40 and a contact assembly of a switching device above. The contact assembly is provided in the housing 40.

[0042] It should be understood that, although the description is given according to each of the embodiments, each embodiment does not comprise an independent technical solution on its own, this narration manner of the description is only for clarity, and for those skilled in the art, the description shall be regarded as a whole, and the technical solution in each of the embodiments may also be properly combined to form other implementations that may be understood by those skilled in the art.

[0043] The series of detailed descriptions set forth above are only specific descriptions directed to the embodiments of the present invention which can be realized, and are not intended to limit the scope of protection of the present invention; and all the equivalent implementations or modifications made without departing from the technical spirit of the present invention, such as combination, segmentation or repetition of features, shall be included in the scope of protection of the present invention.

Claims

1. A contact assembly of a switching device, comprising:

a fixed contact member (10); and
a moveable contact component (20), comprising:

a pair of first conductive members (22), each having a contact end (222), and
a pair of second conductive members (24) provided between the first conductive members (22), wherein the fixed contact member

(10) may contact the contact ends (222) or the second conductive members (24), and the arc erosion resistance performance of the first conductive members (22) is poorer than that of the second conductive members (24), and when the second conductive members (24) are out of contact with the fixed contact member (10), the contact ends (222) may contact the fixed contact member (10).

2. The assembly of claim 1, **characterized in that** the contact assembly further comprises a barrier member (26) having a barrier end (262), and when the barrier end (262) is inserted between the second conductive members (24), the fixed contact member (10) may push the barrier end (262) out of the second conductive members (24).

3. The assembly according to any of the preceding claims, **characterized in that** the barrier member (26) is further provided with a connecting end (264) pivotably connected between the second conductive members (24), and the barrier member (26) is capable of rotating relative to the second conductive members (24) by taking the connecting end (264) as an axis.

4. The assembly according to any of the preceding claims, **characterized in that** the barrier end (262) is provided with a contact projection (266) that may contact the second conductive members (24).

5. The assembly according to any of the preceding claims, **characterized in that** the moveable contact component (20) is further provided with a pair of elastic pieces (30), the first conductive members (22) being clamped between the elastic pieces (30), and an elastic force applied to the first conductive members (22) by the elastic pieces (30) tending to narrow the spacing between the first conductive members (22) and the spacing between the second conductive members (24).

6. The assembly according to any of the preceding claims, **characterized in that** the contact end (222) is a clamping plate bending toward the second conductive members (24).

7. The assembly according to any of the preceding claims, **characterized in that** the spacing between the contact ends (222) is greater than that between the second conductive members (24).

8. The assembly according to any of the preceding claims, **characterized in that** the first conductive members (22) are prepared from permeable materials.

9. The assembly according to any of the preceding claims, **characterized in that** the first conductive members (22) are prepared from steel.

10. The assembly according to any of the preceding claims, **characterized in that** the second conductive members (24) are prepared from copper.

11. The assembly according to any of the preceding claims, **characterized in that** the fixed contact member (10) is provided with a first contact area (12) that may contact the contact ends (222), and a second contact area (14) that may contact the second conductive members (24), and
the arc erosion resistance performance of the first contact area (12) is superior to that of the second contact area (14).

12. The assembly of claim 11, **characterized in that** the first contact area (12) is prepared from steel, and the second contact area (14) is prepared from copper.

13. A switching device, comprising:

a housing (40); and
a contact assembly as claimed in any one of claims 1 to 12, which is provided in the housing (40).

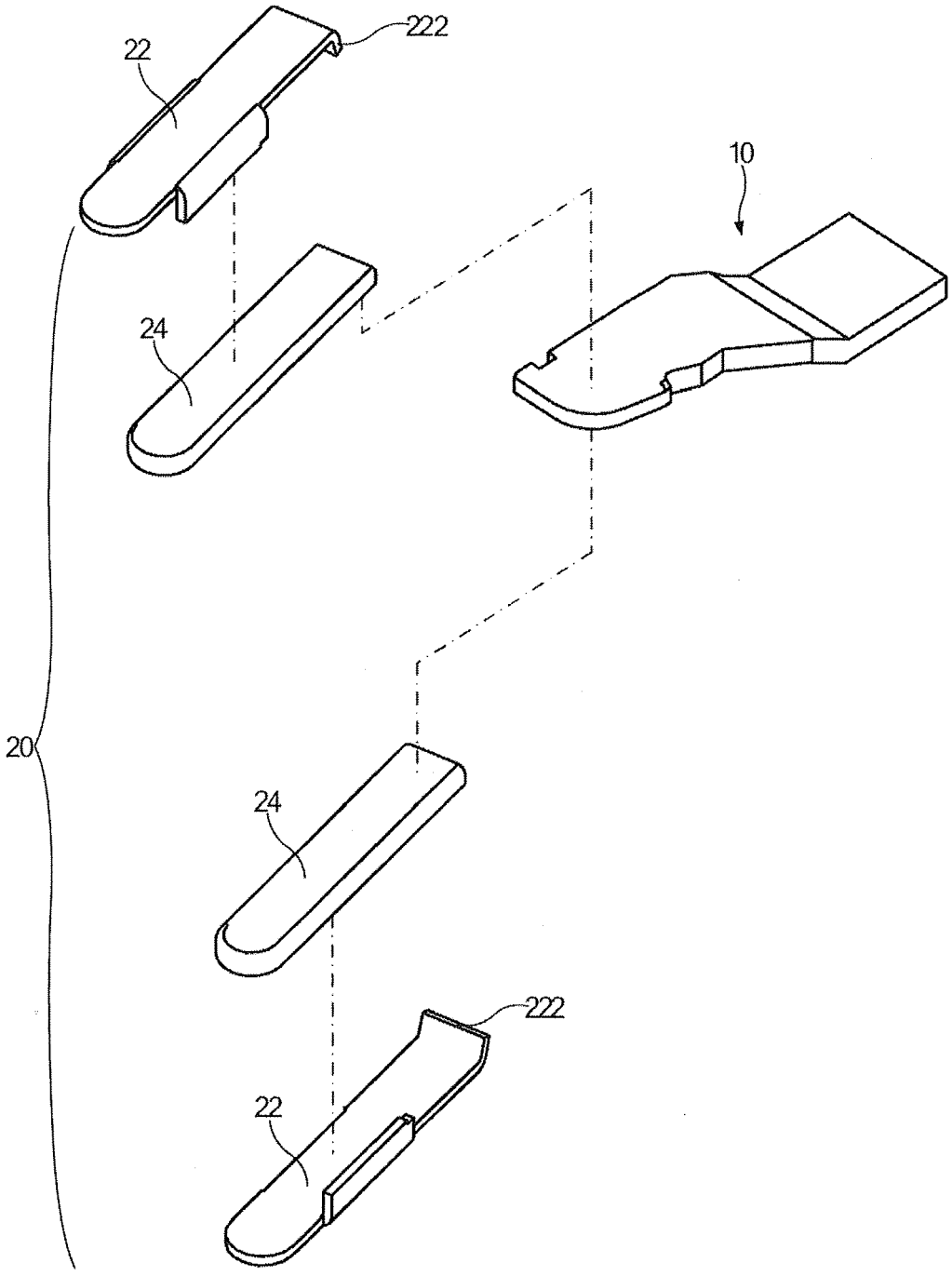

Fig. 1

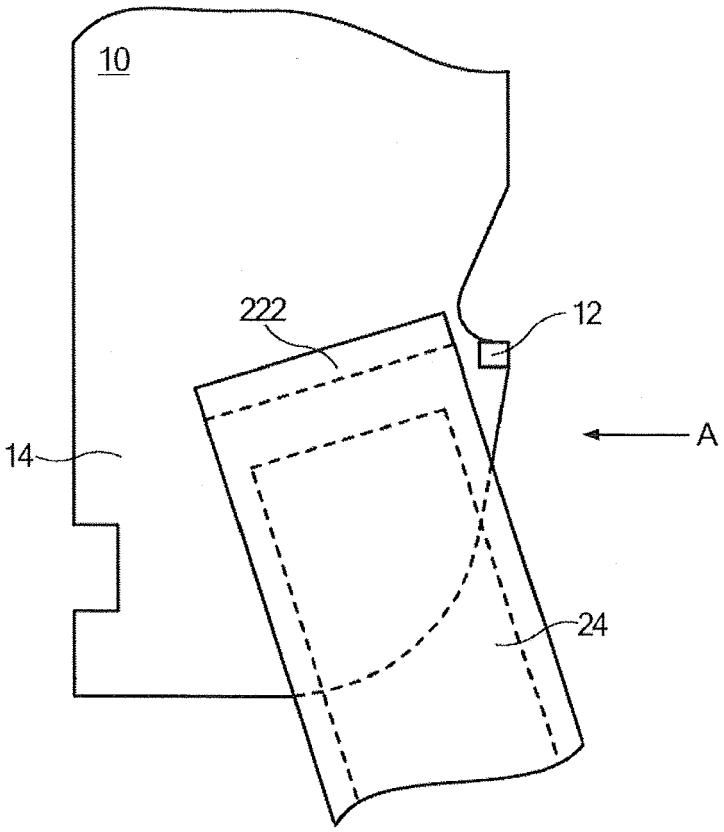

Fig. 2

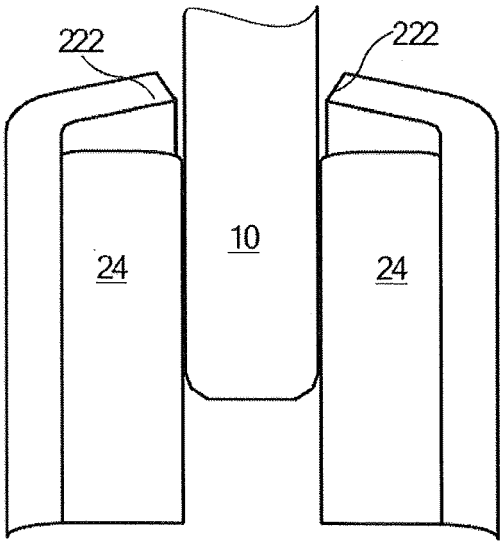

Fig. 3

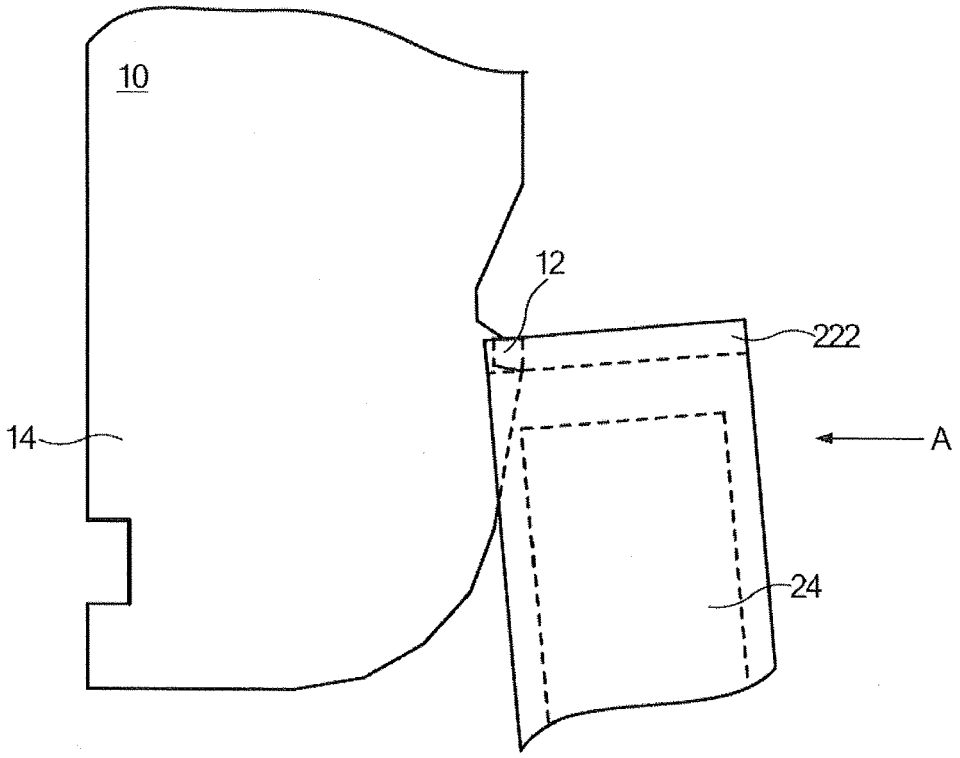

Fig. 4

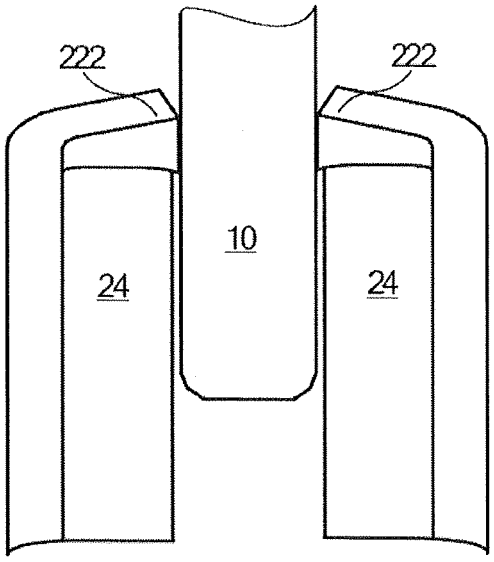

Fig. 5

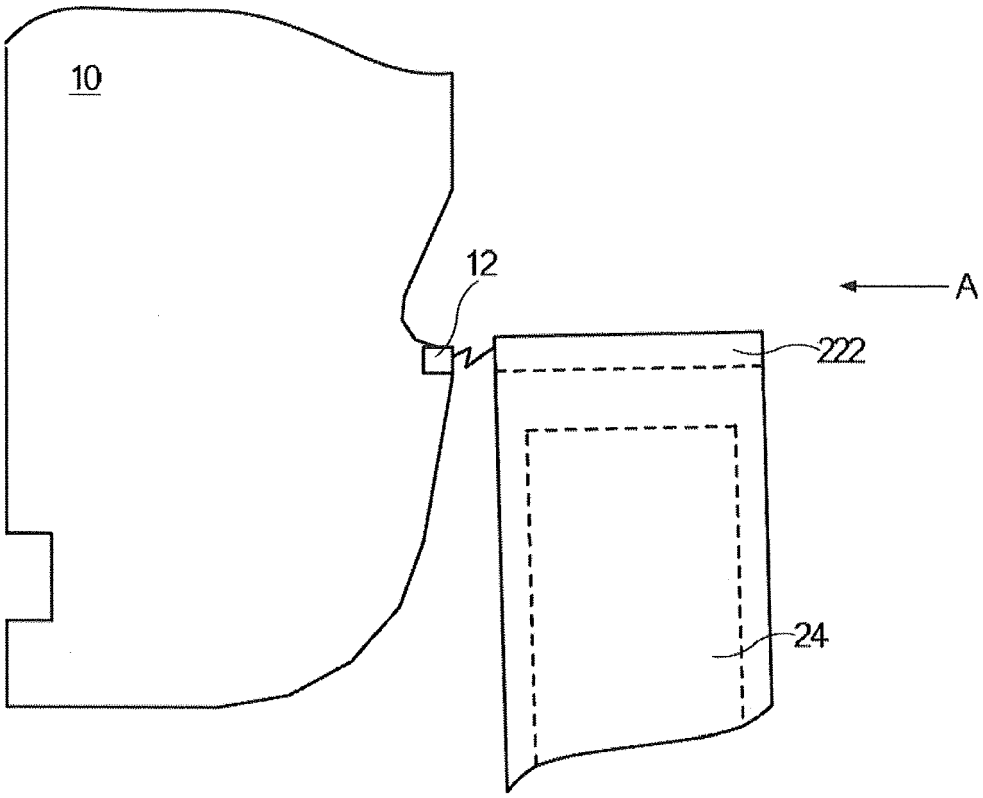

Fig. 6

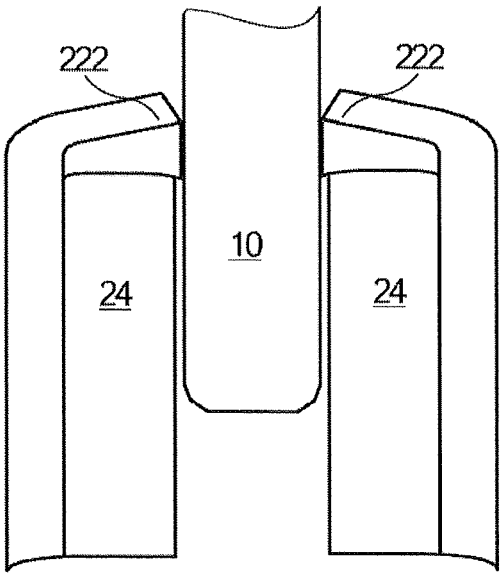

Fig. 7

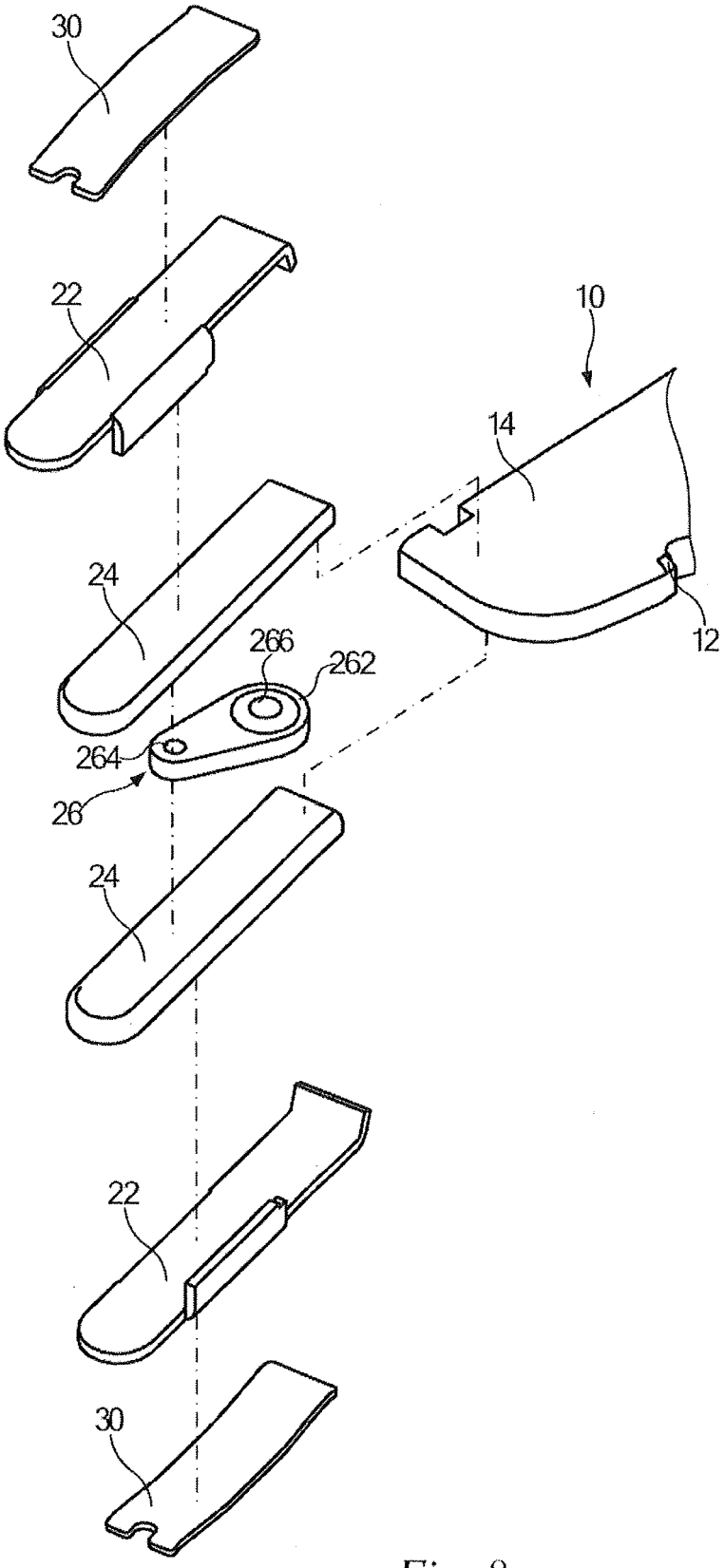

Fig. 8

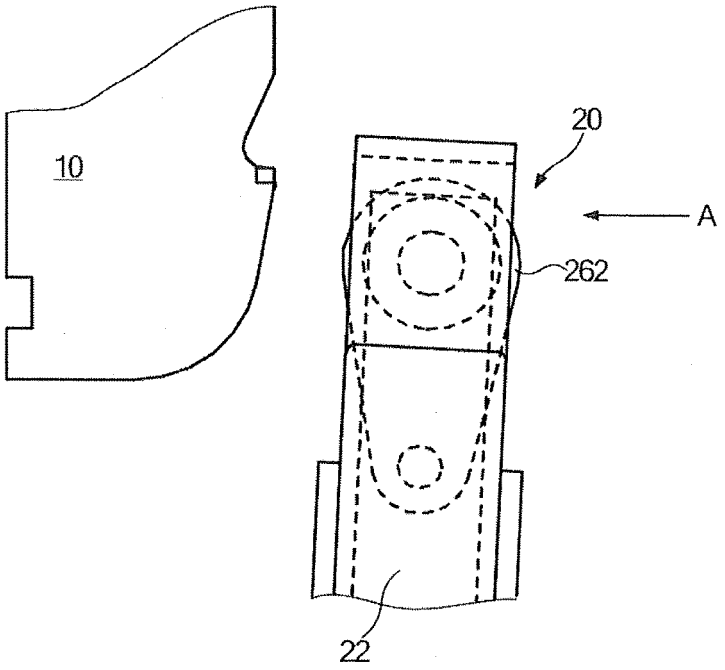

Fig. 9

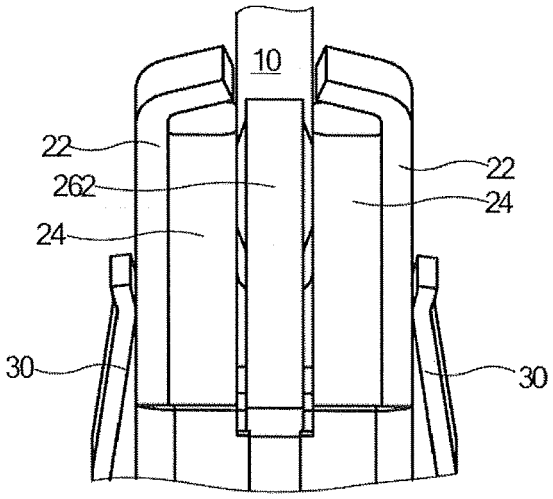

Fig. 10

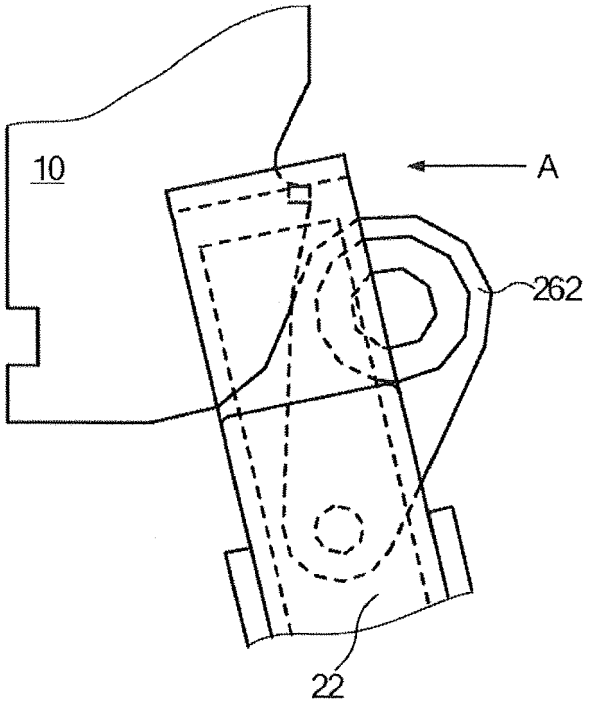

Fig. 11

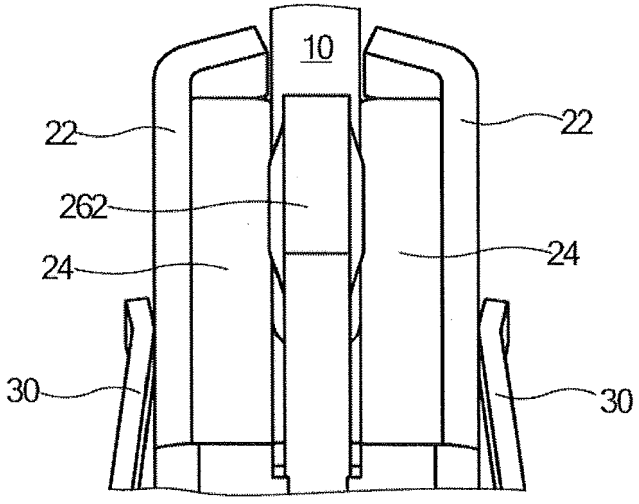

Fig. 12

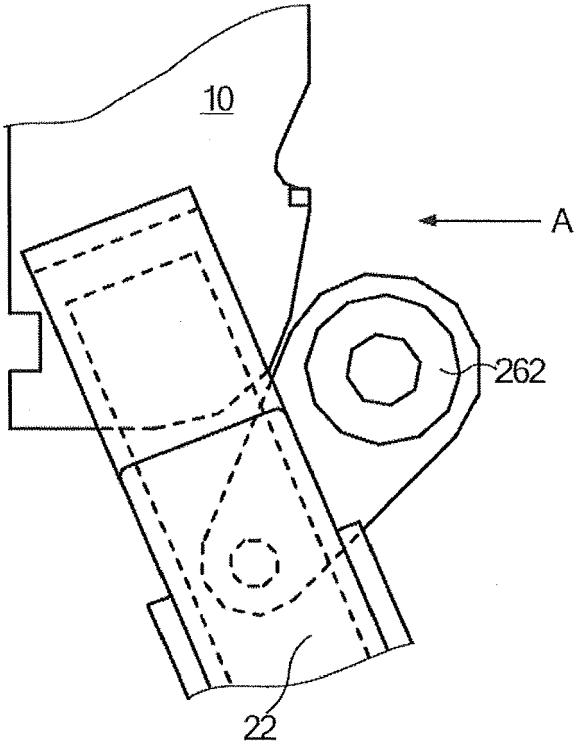

Fig. 13

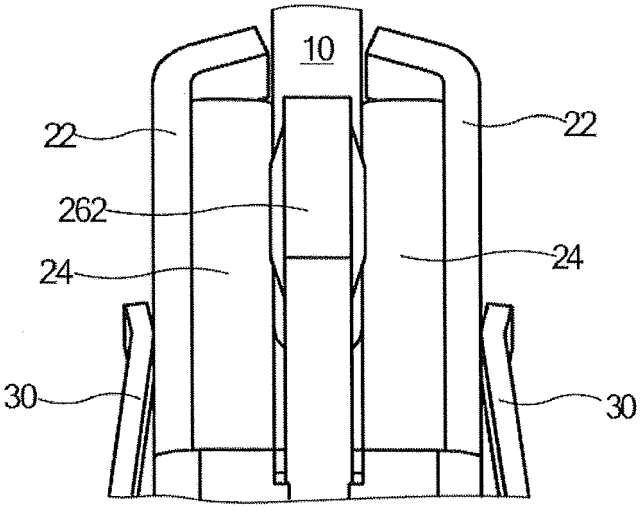

Fig. 14

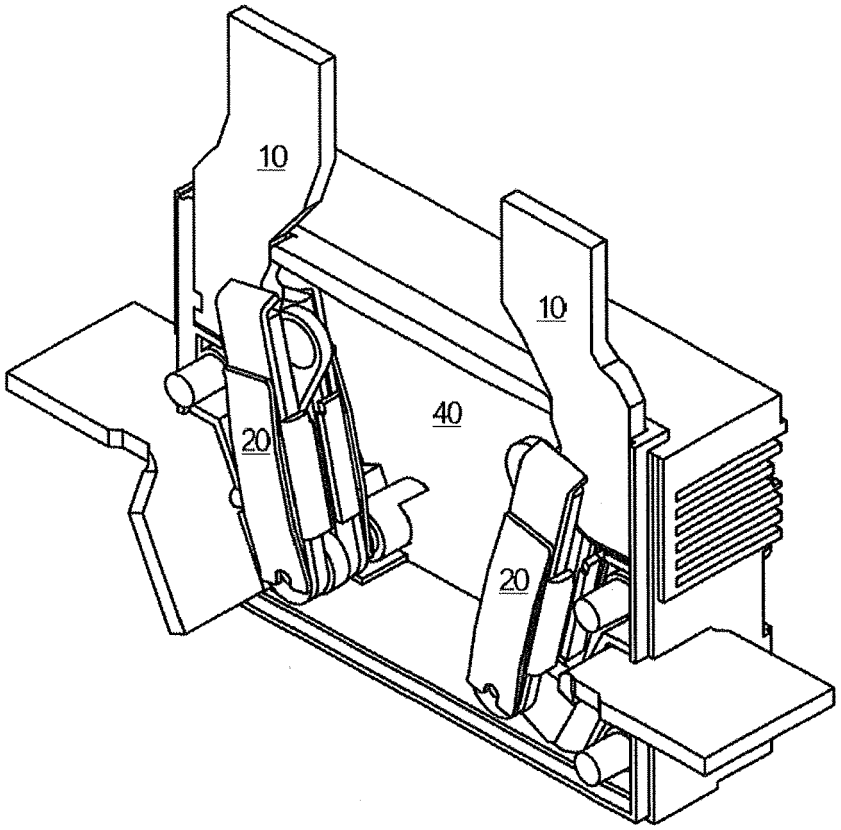

Fig. 15

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 19 8159

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	GB 882 691 A (OTTERMILL SWITCHGEAR LTD) 15 November 1961 (1961-11-15)	1,5-13	INV. H01H1/42
A	* page 3, lines 5-51; figure 1 *	2-4	ADD. H01H1/025 H01H1/04 H01H9/38
Y	US 2011/198203 A1 (MUELLER ROBERT W [US] ET AL) 18 August 2011 (2011-08-18) * paragraphs [0017], [0049] - [0053] *	1,5-13	

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	21 July 2015	Simonini, Stefano

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

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