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(54) **AN ARC EXTINGUISHING NOZZLE AND A LOAD SWITCH WITH THE ARC EXTINGUISHING NOZZLE**

LICHTBOGENLÖSCHDÜSE UND LASTSCHALTER MIT DER LICHTBOGENLÖSCHDÜSE

BUSE D'EXTINCTION D'ARC ET COMMUTATEUR DE CHARGE COMPORTANT LA BUSE D'EXTINCTION D'ARC

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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of electrical apparatuses, and in particular, to an arc extinguishing nozzle and a load switch having the same.

BACKGROUND

[0002] A load switch is a switching apparatus for turning on, carrying, and cutting off current under normal conductive loop conditions or specified overload conditions, and an arc extinguishing device is disposed therein. As an example, a rotary pressure-operated load switch generally includes an insulating housing filled with an arc extinguishing gas and a rotary piston rotatably connected to the insulating housing and provided with an arc extinguishing nozzle thereon. When rotating with respect to the insulating housing, the rotary piston compresses the arc extinguishing gas in the insulating housing to eject the compressed gas from the arc extinguishing nozzle, so as to extinguish an arc generated when the load switch is switched from an on state to an isolated state. The arc extinguishing nozzle in the prior art is usually simply designed as an opening formed by making a hole or a groove on the rotary piston, and a length dimension of the arc extinguishing nozzle is determined by a thickness dimension of the rotary piston. However, the rotary piston is generally designed as a thin-plate structure, and so the length of the arc extinguishing nozzle is small. As a result, the problem exists that the flow rate of the compressed arc extinguishing gas flow drops sharply after passing through the arc extinguishing nozzle and thus may be unable to extinguish the arc, thereby affecting the normal operation of the load switch and the load apparatus.

[0003] There is a need in the art for an arc extinguishing nozzle with a favorable arc extinguishing effect and high reliability.

EP 0 281 817 A1 discloses an arc-extinguishing device for circuit breakers which are arranged in encapsulated, medium-voltage switchgear filled with insulating gas and which interrupt the current by means of a gas jet directed through a nozzle.

JP 2008 071708 A discloses an arc-extinguishing equipment having a blade type movable contact.

[0004] Document EP0484747 discloses a device according to the preamble of claim 1.

[0005] DE 38 03 117A1 discloses a circuit breaker for encased switching stations filled with an insulating gas having a main switching element and an auxiliary switching element, between which a bellows for producing a gas stream which cools the electric arc is arranged.

SUMMARY

[0006] The invention is defined by the independent

claims. The dependent claims define advantageous embodiments. The present invention aims to provide an arc extinguishing nozzle capable of solving at least part of the aforementioned problems.

5 **[0007]** The present invention further aims to provide a load switch to which the improved arc extinguishing nozzle described above is applied.

[0008] According to one aspect of the present invention, a switching apparatus according to claim 1 is provided.

10 **[0009]** As compared with the prior art, the arc extinguishing nozzle in the present invention is provided with the arc confining portion and the opening portion that communicate with each other to form a nozzle channel, thereby greatly extending the length of the nozzle channel in the limited space of the load switch. Thus, when the load switch changes from an on state to an isolated state according to movement of the rotary blade and the cold arc extinguishing gas compressed by the rotary blade in the insulating housing is ejected along the nozzle channel, the flow rate of the arc extinguishing gas flow passing through the nozzle channel is ensured within at least a certain length of the nozzle channel greater than the thickness of the rotary blade, thereby improving the arc extinguishing effect of the arc extinguishing nozzle in this embodiment and the reliability thereof. In addition, the arc extinguishing nozzle in the present invention is simple in structure and easy to manufacture and produce.

20 **[0010]** Preferably, the opening portion is configured as a four-sided closed opening formed on the rotary blade and extending in the direction tangential to the rotary blade.

25 **[0011]** Preferably, the opening portion is configured as a top-side-open opening formed on the rotary blade and extending in the direction tangential to the rotary blade, and a top end of the rotary blade abuts against an inner side wall of the insulating housing such that the opening portion has a four-sided closed shape.

30 **[0012]** Preferably, the arc confining portion has a four-sided closed hollow shape.

[0013] Preferably, the arc confining portion has a top-side-open hollow shape.

35 **[0014]** Preferably, the opening portion and the arc confining portion are designed as separate structures.

40 **[0015]** Preferably, the opening portion and the arc confining portion are designed to be integrally formed.

[0016] As compared with the prior art, an arc is generated between the moving contact and the upper static contact when they are mechanically separated, and since the upper static contact moves along the nozzle channel away from the moving contact and the nozzle channel has a certain length, at least part of an arc column of the arc generated between the upper static contact and the moving contact is confined in the nozzle channel, and meanwhile, the cold arc extinguishing gas in the insulating housing can be ejected toward the upper static contact along the nozzle channel at a high flow rate, so as to facilitate cooling and de-ionization of the arc column

confined in the nozzle channel to extinguish the arc.

[0017] Preferably, the upper static contact is configured to extend along the nozzle channel from an outer side of the rotary blade so as to be conductively connected to the moving contact.

[0018] Preferably, the upper static contact is configured to extend downward from an upper side of the rotary blade so as to be conductively connected to the moving contact.

[0019] One part of other features and advantages of the present invention will be obvious after those skilled in the art read the present application, and the other part will be described in the following specific implementations with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Embodiments of the present invention are described in detail in the following with reference to the accompanying drawings, and the same reference numerals represent the same or similar components in the accompanying drawings, in which

FIG. 1 and FIG. 2 are respectively a perspective view and a side view of a load switch of an arc extinguishing nozzle according to a first embodiment of the present invention, when the load switch is in an on state;

FIG. 3 is a schematic view of the arc extinguishing nozzle and a rotary blade according to the first embodiment of the present invention;

FIG. 4 is an enlarged view of a region A in FIG. 3;

FIG. 5 and FIG. 6 are respectively a perspective view and a side view of the load switch of the arc extinguishing nozzle according to the first embodiment of the present invention, when the load switch is in an isolated state;

FIG. 7 and FIG. 8 are respectively a perspective view and a side view of the load switch of the arc extinguishing nozzle according to the first embodiment of the present invention, when the load switch is in a grounded state;

FIG. 9 and FIG. 10 are respectively a perspective view and a side view of a load switch of an arc extinguishing nozzle according to a second embodiment of the present invention, when the load switch is in an on state;

FIG. 11 is a schematic view of the arc extinguishing nozzle and a rotary blade according to the second embodiment of the present invention;

FIG. 12 is an enlarged view of a region B in FIG. 11;

FIG. 13 and FIG. 14 are respectively a perspective view and a side view of the load switch of the arc extinguishing nozzle according to the second embodiment of the present invention, when the load switch is in an isolated state; and

FIG. 15 and FIG. 16 are respectively a perspective view and a side view of the load switch of the arc extinguishing nozzle according to the second embodiment of the present invention, when the load switch is in a grounded state.

Description of the reference numerals:

[0021] 1-load switch; 11-insulating housing; 111-bottom plate; 112-arc-shaped cover plate; 113-rear fan-shaped side plate; 12-rotary blade; 13-moving contact; 14-upper static contact; 15-grounding contact; 16-insulating spindle; 17-first chamber; 18-second chamber; 19-connecting arm; 20-lower static contact; 10-arc extinguishing nozzle; 101-opening portion; 102-arc confining portion.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] A schematic scheme of the device disclosed in the present invention is described in detail with reference to the accompanying drawings. Although providing the accompanying drawings is to present some implementations of the present invention, the accompanying drawings do not need to be drawn according to the size of specific implementation schemes, and certain features can be enlarged, removed, or locally exploded to better illustrate and explain the disclosure of the present invention. Part of members in the accompanying drawings can be positionally adjusted according to actual requirements without affecting the technical effect. In the description, the term "in the accompanying drawings" or similar terms do not necessary refer to all of the accompanying drawings or examples.

[0023] Some directional terms used in the following to describe the accompanying drawings, such as "in", "out", "upper", and "lower," and other directional terms are construed as having normal meanings thereof and refer to those directions involved when the accompanying drawings are viewed normally. Unless otherwise specified, the directional terms in the description are substantially in accord with conventional directions understood by those skilled in the art.

[0024] The terms "first", "first one," "second", "second one" and similar terms used in the present invention do not indicate any sequence, number, or importance in the present invention, and are used only to distinguish one component from other components.

[0025] The terms "join" and "connect" and similar terms used in the present invention refer to two components being indirectly connected to each other by an intermediate layer (such as an adhesive or a solder) or an inter-

mediate member (such as a connection member or a transition member), and also refer to two components being directly connected to each other without any intermediate layer (such as an adhesive or a solder) or any intermediate member (such as a connection member or a transition member).

[0026] FIG. 1 to FIG. 16 illustrate, by way of example, an arc extinguishing nozzle 10 in the present invention and a rotary pressure-operated load switch 1 to which the arc extinguishing nozzle 10 is applied. The load switch 1 is generally used for breaking a load current or a certain overload current. The arc extinguishing nozzle 10 is used for providing an ejection path of an arc extinguishing gas in the load switch 1, so as to extinguish an arc generated when the load switch 1 changes from an on state to an isolated state. In this embodiment, the load switch 1 may include an insulating housing 11, a rotary blade 12, a moving contact 13, an upper static contact 14, a grounding contact 15, an insulating spindle 16, and a lower static contact 20.

[0027] Specifically, the insulating housing 11 may include a bottom plate 111, a front fan-shaped side plate and a rear fan-shaped side plate 113 disposed opposite to each other on the bottom plate 111, and an arc-shaped cover plate 112 connecting the bottom plate 111, the front fan-shaped side plate and the rear fan-shaped side plate 113. An inner space formed by the bottom plate 111, the front fan-shaped side plate and the rear fan-shaped side plate 113, and the arc-shaped cover plate 112 is filled with an arc extinguishing gas, for example, including but not limited to, sulfur hexafluoride, carbon dioxide, air, and other mixed arc extinguishing media. Two ends of the insulating spindle 16 may be mounted on the front fan-shaped side plate and the rear fan-shaped side plate 113 of the insulating housing 11 so as to rotate, in combination with an external operating mechanism and in a controlled manner, with respect to the insulating housing 11. The rotary blade 12 may be mounted on the insulating spindle 16 and extend toward the arc-shaped cover plate 112 to abut against the inner side of the arc-shaped cover plate 112, so as to move with respect to the insulating housing 11 along with the insulating spindle 16. The moving contact 13 may be connected to the insulating spindle 16, and thus may be considered connected to the rotary blade 12 via the insulating spindle 16. Thus, when controlled by the external operating mechanism to rotate, the insulating spindle 16 drives the moving contact 13 and the rotary blade 12 to synchronously rotate with respect to the insulating housing 11. In addition, the upper static contact 14 cannot be connected to the arc-shaped cover plate 112 by moving relative to the arc-shaped cover plate 112; the upper static contact 14 may be directly and fixedly connected to the arc-shaped cover plate 112 by means of a fastener, for example, a bolt, or may be indirectly and fixedly connected to the arc-shaped cover plate 112 by connecting to another structure that is located on the outer side of the insulating housing 11 and has no relative movement with respect to the insulating

housing 11. The lower static contact 20 is rotatably connected to the moving contact 13 and extends through the insulating spindle 16 and the bottom plate 111. Thus, the lower static contact 20 does not move along with the insulating spindle 16 and is fixed with respect to the insulating housing 11. The grounding contact 15 may be disposed fixedly with respect to the arc-shaped cover plate 112 and pass through a side wall of the arc-shaped cover plate 112 to enter into the insulating housing 11. It can be understood that the manner of connection between the lower static contact 20 and the bottom plate 111, and that between the grounding contact 15 and the arc-shaped cover plate 112, may be similar to the manner of connection between the upper static contact 14 and the arc-shaped cover plate 112.

[0028] In actual use, the insulating spindle 16 moves in a controlled manner under the control of the external operating mechanism, so as to drive the rotary blade 12 and the moving contact 13 to rotate with respect to the insulating housing 11, that is, rotate with respect to the upper static contact 14 and the grounding contact 15. In this way, the moving contact 13 can switch in turn between an on state of being conductively connected to the upper static contact 14 shown in FIG. 1 and FIG. 2 or FIG. 9 and FIG. 10, an isolated state of being separated from both the upper static contact 14 and the grounding contact 15 shown in FIG. 5 and FIG. 6 or FIG. 13 and FIG. 14, and a grounded state of being conductively connected to the grounding contact 15 shown in FIG. 7 and FIG. 8 or FIG. 15 and FIG. 16, and vice versa. It can be understood that respective materials forming the insulating housing 11, the rotary blade 12, the moving contact 13, the upper static contact 14, the grounding contact 15, the operating mechanism, the insulating spindle 16, and the lower static contact 20 may be the same as materials forming rotary pressure-operated load switches in the prior art, and will not be described in detail herein again.

[0029] When the moving contact 13 and the upper static contact 14 change from a conductively connected state to a separated state, under the action of a high electric field, after the moving contact 13 and the upper static contact 14 are mechanically separated from each other, a medium around the moving contact 13 and the upper static contact 14 generates an arc between the moving contact 13 and the upper static contact 14 because of ionization, thermal ionization, impact ionization, and the like, so that a current path forms between the moving contact 13 and the upper static contact 14 and the connection therebetween cannot be broken.

[0030] To this end, the closed insulating housing 11 is filled with an arc extinguishing gas, and is divided into a first chamber 17 and a second chamber 18 with variable volumes by the insulating spindle 16 and the rotary blade 12 pivotally mounted on the insulating housing 11. Herein, the side of the rotary blade 12 facing the interior of the insulating housing 11 is referred to as the inner side, the first chamber 17 is the chamber that the inner side of the rotary blade 12 faces, and the second chamber 18

is the chamber that the outer side of the rotary blade 12 faces. When the insulating spindle 16 drives the rotary blade 12 and the moving contact 13 to rotate with respect to the insulating housing 11 so that the moving contact 13 and the upper static contact 14 change from the conductively connected state to the separated state, the volume of the first chamber 17 is reduced to compress the arc extinguishing gas in the first chamber 17, and the compressed arc extinguishing gas is ejected, through the arc extinguishing nozzle 10 on the rotary blade 12, toward the upper static contact 14 away from the moving contact 13, and enters the second chamber 18 to extinguish the arc between the moving contact 13 and the upper static contact 14. The arc extinguishing nozzle 10 includes an opening portion 101 and an arc confining portion 102.

[0031] The opening portion 101 is configured as an opening located at the top of the rotary blade 12 and passing through the thickness of the rotary blade 12 in a direction tangential to the rotary blade 12. The arc confining portion 102 is disposed on an inner surface and/or outer surface of the rotary blade 12 and designed as a hollow shape protruding inward and/or outward for a certain length, that is, disposed on a side surface of the rotary blade 12 facing the first chamber 17 and/or a side surface facing the second chamber 18 and protruding toward the first chamber 17 and/or the second chamber 18 for a certain length, so as to expand the application range thereof. In actual application, users can make selections according to actual needs.

[0032] A free end of the moving contact 13 may be located on the inner side of the nozzle channel or accommodated within the nozzle channel or partially accommodated within the nozzle channel. In an example, when the free end of the moving contact 13 is located on the inner side of the nozzle channel, namely, the inner side of the rotary blade 12, the arc confining portion 102 may be located on the inner surface and/or outer surface of the rotary blade 12. When an arc confining portion 102 located on the inner surface of the rotary blade 12 is present, the spacing between the moving contact 13 and the rotary blade 12 may be properly increased to satisfy the desired length of the arc confining portion 102 in the tangential direction. In another example, when the free end of the moving contact 13 is accommodated within the nozzle channel, the free end of the moving contact 13 occupies part of the nozzle channel, that is, the free end of the moving contact 13 is located within the opening portion 101 and/or within the arc confining portion 102. In the above two examples, since a nozzle channel of a certain length is always maintained between the outer side of the moving contact 13 and the inner side of the upper static contact 14 after the moving contact 13 is mechanically separated from the upper static contact 14, it is possible to advantageously confine, in the nozzle channel, both the complete arc column of the arc generated between the moving contact 13 and the upper static contact 14 when the upper static contact 14 has not left the nozzle channel, and part of the arc column between

the moving contact 13 and the upper static contact 14 when the upper static contact 14 has left the nozzle channel and the arc has not been extinguished; meanwhile, the compressed arc extinguishing gas is ejected toward the upper static contact 13 to cool and de-ionize the arc column confined in the nozzle channel as well as the arc column in the gas flow channel outside the nozzle channel, so as to extinguish the arc. In yet another example, the free end of the moving contact 13 may be partially accommodated within the nozzle channel and partially extend inward to the inner side of the nozzle channel. In short, the position of the moving contact 13 in the present invention with respect to the nozzle channel only needs to meet the requirement that, after the moving contact 13 mechanically separates from the upper static contact 14, the upper static contact 14 should travel through a length of the nozzle channel on the rotary blade 12 that is at least greater than the length of the opening portion 101. The shapes and configurations of the rotary blade 12, the moving contact 13, and the upper static contact 14 are not limited.

[0033] As an example, as shown in the figures, the arc confining portion 102 is formed on the side surface of the rotary blade 12 facing the second chamber 18 and protrudes toward the second chamber 18 for a certain length, and the moving contact 13 is located on the inner side of the nozzle channel, namely, the inner side of the rotary blade 12. The arc confining portion 102, the opening portion 101, and the free end of the moving contact 13 are located approximately in the same direction tangential to the rotary blade 12, so that the arc confining portion 102 and the moving contact 13 are respectively located on the outer side and the inner side of the rotary blade 12 and the arc confining portion 102 extends away from the moving contact 13, and the arc confining portion 102 and the opening portion 101 may form a tangential-direction communicating nozzle channel. The arc confining portion 102 may be designed to extend for at least the thickness of the rotary blade 12, so that the length of the nozzle channel, namely, the length of the nozzle channel in the tangential direction, may be designed to be at least twice the thickness of the rotary blade 12 to confine and extinguish the arc between the moving contact 13 and the upper static contact 14. In addition, the moving contact 13 is usually configured as a pair of axially opposed blades for elastically clamping the upper static contact 14 therebetween, and then the space between the pair of blades of the moving contact 13 can communicate with the nozzle channel to form a static contact moving path.

[0034] When the upper static contact 14 and the moving contact 13 change from the conductively connected state to the separated state, the insulating spindle 16 rotates with respect to the insulating housing 11 so that the moving contact 13, the rotary blade 12, the opening portion 101, and the arc confining portion 102 all rotate with respect to the upper static contact 14. The upper static contact 14 is first mechanically separated from the moving contact 13, and then moves away from the mov-

ing contact 13 along the nozzle channel, namely, the opening portion 101 and the arc confining portion 102. Since the nozzle channel has a certain length, the arc generated after the upper static contact 14 and the moving contact 13 are mechanically separated is confined within the opening portion 101 and the arc confining portion 102. Meanwhile, due to the rotation of the rotary blade 12, the compressed arc extinguishing gas in the first chamber 17 is ejected toward the upper static contact 14 away from the moving contact 13 via the nozzle channel, thus facilitating extinguishing of the arc confined in the nozzle channel. The nozzle channel extends for a certain length, and thus can restrict the cross section of the ejected arc extinguishing gas flow within a certain length range. In this way, for the same arc extinguishing gas flow quantity, the flow rate of the arc extinguishing gas flow can be maintained at a high level to extinguish the arc within the certain length range, so as to improve the cut-off capability and reliability of the load switch 1 to which the nozzle channel is applied.

[0035] It can be understood that the size of an opening cross section of the nozzle channel of the rotary blade 12 should be larger than the size of a cross section of the upper static contact 14 coinciding with the opening cross section to facilitate entrance and exit of the upper static contact 14. Preferably, the minimum opening cross section of the nozzle channel may be designed to be smaller than three times the opening cross section of the upper static contact 14, so as to avoid decrease in flow rate of the arc extinguishing gas flow ejected along the nozzle channel while facilitating entrance and exit of the upper static contact 14.

[0036] FIG. 1 to FIG. 8 illustrate, by way of example, an arc extinguishing nozzle 10 a load switch 1 to which the arc extinguishing nozzle 10 is applied. As shown in the figures, the opening portion 101 may be configured as a four-sided closed rectangular opening formed on the top of the rotary blade 12 and extending through the thickness of the rotary blade 12 in a direction tangential to the rotary blade 12. The arc confining portion 102 has a four-sided closed hollow rectangular shape. The shape of the opening cross section of the opening portion 101 and/or the arc confining portion 102 may also be configured as a trapezoid, a parallelogram, a square, or another shape. Preferably, the opening cross sections of the opening portion 101 and the arc confining portion 102 may be configured to have the same shape and size to form a nozzle channel having a constant shape and size. Or, the opening cross sections of the opening portion 101 and the arc confining portion 102 may have different shapes and sizes and only need to be configured to communicate with each other to facilitate passage of the compressed arc extinguishing gas. Correspondingly, the shape of the opening cross section of the nozzle channel may be configured to be the same as or different from the shape of the cross section of the upper static contact 14. Such a design scheme can use a rotary blade 12 in the prior art and only the arc confining portion 102 needs

to be designed, so as to greatly reduce the manufacturing cost of the nozzle channel in this embodiment and improve production efficiency. As an example, the length of the upper static contact 14 in the direction tangential to the rotary blade 12 may be 40 millimeters, and the length of the nozzle channel through which the upper static contact 14 passes after being separated from the moving contact 13 may be designed as any value in the range from 6 millimeters to 70 millimeters.

[0037] Optionally, as shown in FIG. 1 to FIG. 4, the upper static contact 14 of the load switch 1 to which the arc extinguishing nozzle 10 is applied is configured, when in the conductively connected state with respect to the moving contact 13, to be connected to the top of the arc-shaped cover plate 112 via a connecting arm 19, and the upper static contact 14 is conductively connected to the moving contact 13 through the nozzle channel, namely, the arc confining portion 102 and the opening portion 101, from the outer side of the rotary blade 12, making it convenient for the upper static contact 14 to move when being separated from the moving contact 13 to avoid obstruction thereof.

[0038] Optionally, the rotary blade 12 and the arc confining portion 102 may be configured to be integrally formed; that is, the opening portion 101 and the arc confining portion 102 are integrally formed to increase the manufacturing speed of the load switch in this embodiment. In addition, the rotary blade 12 and the arc confining portion 102 may also be configured as separate structures. The manner of connection between the rotary blade 12 and the arc confining portion 102 may be designed, shown in FIG. 1 to FIG. 8, as a bolt connection or any other connection means capable of connecting the rotary blade 12 and the arc confining portion 102 without relative movement therebetween. The rotary blade 12 and the arc confining portion 102 may use different materials. For example, the arc confining portion 102 may use a non-metal material that is more ablation-resistant than the rotary blade 12. In a specific implementation scheme, the insulating spindle 16 and the rotary blade 12 may be configured to be integrally formed or may be configured as separate structures. The arc confining portion 102 may be integrally formed with the aforementioned structure or may be manufactured in a separated manner and connected by a bolt or be assembled to the aforementioned structure by any other means capable of connecting the arc confining portion 102 and the aforementioned structure without relative movement therebetween.

[0039] FIG. 9 to FIG. 16 illustrate an arc extinguishing nozzle 10 according to a second embodiment of the present invention and a load switch 1 to which the arc extinguishing nozzle 10 is applied. As compared with the arc extinguishing nozzle 10 and the load switch 1 to which the arc extinguishing nozzle 10 is applied in the embodiment shown in FIG. 1 to FIG. 8, the structures are basically the same except that the arc extinguishing nozzle 10 and the upper static contact 14 have different config-

urations.

[0040] As shown in the figures, the opening portion 101 may be configured as a top-side-open opening formed on the rotary blade 12 and extending through the thickness of the rotary blade 12 in a direction tangential to the rotary blade 12. A top end of the rotary blade 12 tightly abuts against the inner side of the arc-shaped cover plate 112 such that the opening has a four-sided closed shape. To ensure the ejection of the arc extinguishing gas, the rotary blade 12 may be configured to remain tightly abutted against an inner side wall of the insulating housing 11 in at least the first half of the movement from an on position to an isolated position. Optionally, the rotary blade 12 and the inner side wall of the insulating housing 11 may be designed to be hermetically connected, or such that a minimum gap between the rotary blade 12 and the inner side wall of the insulating housing 11 is less than a predetermined gap value, for example, 3 millimeters. In addition, the arc confining portion 102 has a top-side-open hollow shape.

[0041] The upper static contact 14 of the load switch 1 to which the arc extinguishing nozzle 10 is applied may be configured, when conductively connected to the moving contact 13, to extend downward from the upper side of the rotary blade 12 into the first chamber 17 so as to be conductively connected to the moving contact 13. When the upper static contact 14 and the moving contact 13 change from the conductively connected state to the separated state, the upper static contact 14 moves through the nozzle channel, namely, the opening portion 101 and the arc confining portion 102, and the compressed arc extinguishing gas extinguishes the arc between the upper static contact 14 and the moving contact 13 along the nozzle channel.

[0042] In other embodiments, the opening portion 101 has a four-sided closed shape or a top-side-open shape, which may arbitrary match the four-sided closed hollow shape or top-side-open hollow shape of the arc confining portion 102 according to needs. However, it should be noted that if one of the opening portion 101 or the arc confining portion 102 has the four-sided closed shape, the upper static contact 14 of the load switch 1 should correspondingly be arranged to extend through the arc confining portion 102 and/or the opening portion 101 from the second chamber 18 so as to be conductively connected to the moving contact 13. Moreover, the upper static contact 14 of the load switch 1 can be arranged to extend downward from the upper side of the rotary blade 12 so as to be conductively connected to the moving contact 13 only when the opening portion 101 and the arc confining portion 102 both have the top-side-open shape.

Claims

1. A load switch (1) comprising:

an insulating housing (11) filled with an arc extinguishing gas;
a rotary blade (12) pivotally mounted on the insulating housing (11) and against the inner side of the insulating housing (11), to divide the interior of the insulating housing (11) into two chambers (17, 18) of variable volumes, wherein, with a rotation of the rotary blade (12), the load switch (1) is capable of being in at least an on state and an isolated state;
an upper static contact (14) connected to the insulating housing (11) and not movable with respect to the insulating housing (11);
a moving contact (13) capable of moving along with the rotary blade (12) so as to be conductively connected to or separated from the upper static contact (14); and
an arc extinguishing nozzle (10) comprising:

an opening portion (101) configured as an opening formed on the rotary blade (12) and extending in a direction tangential to the rotary blade (12); and

an arc confining portion (102) disposed on an inner surface and/or outer surface of the rotary blade (12) and designed as a hollow shape protruding inward and/or outward for a certain length in the direction tangential to the rotary blade (12), wherein the arc confining portion (102) and the opening portion (101) are in communication to form a nozzle channel, such that the arc extinguishing gas compressed by the rotary blade (12) in one of the two chambers (17, 18) in the insulating housing (11) is ejected along the nozzle channel when the load switch (1) changes from the on state to the isolated state;

wherein the upper static contact (14) is configured to move away from the moving contact (13) in and along the nozzle channel when changing from a conductively connected state to a separated state with respect to the moving contact (13), **characterised in that** the moving contact is connected to the rotary blade (12).

2. The load switch (1) according to claim 1, wherein the opening portion (101) is configured as a four-sided closed opening formed on the rotary blade (12) and extending in the direction tangential to the rotary blade (12).
3. The load switch (1) according to claim 1, wherein the opening portion (101) is configured as a top-side-open opening formed on the rotary blade (12) and extending in the direction tangential to the rotary blade (12), and a top end of the rotary blade (12) abuts against an inner side wall of the insulating

housing (11) such that the opening portion (101) has a four-sided closed shape.

4. The load switch (1) according to any one of claims 1 to 3, wherein the arc confining portion (102) has a four-sided closed hollow shape. 5
5. The load switch (1) according to any one of claims 1 to 3, wherein the arc confining portion (102) has a top-side-open hollow shape. 10
6. The arc load switch (1) according to claim 1, wherein the opening portion (101) and the arc confining portion (102) are designed as separate structures. 15
7. The load switch (1) according to claim 1, wherein the opening portion (101) and the arc confining portion (102) are designed to be integrally formed. 20
8. The load switch (1) according to claim 1, wherein the upper static contact (14) is configured to extend along the nozzle channel from an outer side of the rotary blade (12) so as to be conductively connected to the moving contact (13). 25
9. The load switch (1) according to claim 1, wherein the upper static contact (14) is configured to extend downward from an upper side of the rotary blade (12) so as to be conductively connected to the moving contact (13). 30

Patentansprüche

1. Lastschalter (1), umfassend: 35
 - ein Isoliergehäuse (11), das mit einem Lichtbogenlöschgas gefüllt ist;
 - einen Drehflügel (12), der schwenkbar an dem Isoliergehäuse (11) und gegen die Innenseite des Isoliergehäuses (11) montiert ist, um das Innere des Isoliergehäuses (11) in zwei Kammern (17, 18) variabler Volumina zu unterteilen, wobei der Lastschalter (1) bei einer Drehung des Drehflügels (12) in der Lage ist, sich in mindestens einem eingeschalteten Zustand und einem isolierten Zustand zu befinden;
 - einen oberen statischen Kontakt (14), der mit dem Isoliergehäuse (11) verbunden ist und in Bezug auf das Isoliergehäuse (11) nicht bewegbar ist;
 - einen beweglichen Kontakt (13), der in der Lage ist, sich zusammen mit dem Drehflügel (12) zu bewegen, um leitfähig mit dem oberen statischen Kontakt (14) verbunden oder von diesem getrennt zu sein; und
 - eine Lichtbogenlöschdüse (10), umfassend: 40

einen Öffnungsabschnitt (101), der als eine Öffnung konfiguriert ist, die an dem Drehflügel (12) ausgebildet ist und sich in einer Richtung tangential zu dem Drehflügel (12) erstreckt; und
einen Lichtbogenbegrenzungsabschnitt (102), der auf einer Innenoberfläche und/oder Außenoberfläche des Drehflügels (12) angeordnet und als eine Hohlform konzipiert ist, die für eine bestimmte Länge in der Richtung tangential zu dem Drehflügel (12) nach innen und/oder nach außen vorsteht, wobei der Lichtbogenbegrenzungsabschnitt (102) und der Öffnungsabschnitt (101) in Verbindung stehen, um derart einen Düsenkanal auszubilden, dass das durch den Drehflügel (12) in einer der zwei Kammern (17, 18) in dem Isoliergehäuse (11) komprimierte Lichtbogenlöschgas entlang des Düsenkanals ausgestoßen wird, wenn der Lastschalter (1) von dem eingeschalteten Zustand in den isolierten Zustand wechselt;
wobei der obere statische Kontakt (14) konfiguriert ist, sich bei dem Wechsel von einem leitfähig verbundenen Zustand in einen getrennten Zustand in Bezug auf den beweglichen Kontakt (13) von dem beweglichen Kontakt (13) in dem und entlang des Düsenkanals weg zu bewegen, **dadurch gekennzeichnet, dass** der bewegliche Kontakt mit dem Drehflügel (12) verbunden ist.

2. Lastschalter (1) nach Anspruch 1, wobei der Öffnungsabschnitt (101) als eine vierseitige geschlossene Öffnung konfiguriert ist, die an dem Drehflügel (12) ausgebildet ist und sich in der Richtung tangential zu dem Drehflügel (12) erstreckt. 45
3. Lastschalter (1) nach Anspruch 1, wobei der Öffnungsabschnitt (101) als eine oben offene Öffnung konfiguriert ist, die an dem Drehflügel (12) ausgebildet ist und sich in der Richtung tangential zu dem Drehflügel (12) erstreckt, und ein oberes Ende des Drehflügels (12) an einer inneren Seitenwand des Isoliergehäuses (11) derart anliegt, dass der Öffnungsabschnitt (101) eine vierseitige geschlossene Form aufweist. 50
4. Lastschalter (1) nach einem der Ansprüche 1 bis 3, wobei der Lichtbogenbegrenzungsabschnitt (102) eine vierseitige geschlossene Hohlform aufweist. 55
5. Lastschalter (1) nach einem der Ansprüche 1 bis 3, wobei der Lichtbogenbegrenzungsabschnitt (102) eine oben offene Hohlform aufweist.

6. Lichtbogenlastschalter (1) nach Anspruch 1, wobei der Öffnungsabschnitt (101) und der Lichtbogenbegrenzungsabschnitt (102) als separate Strukturen konzipiert sind. 5
7. Lastschalter (1) nach Anspruch 1, wobei der Öffnungsabschnitt (101) und der Lichtbogenbegrenzungsabschnitt (102) konzipiert sind, um einstückig ausgebildet zu sein. 10
8. Lastschalter (1) nach Anspruch 1, wobei der obere statische Kontakt (14) konfiguriert ist, um sich entlang des Düsenkanals von einer Außenseite des Drehflügels (12) zu erstrecken, um leitfähig mit dem beweglichen Kontakt (13) verbunden zu sein. 15
9. Lastschalter (1) nach Anspruch 1, wobei der obere statische Kontakt (14) konfiguriert ist, um sich von einer Oberseite des Drehflügels (12) nach unten zu erstrecken, um leitfähig mit dem beweglichen Kontakt (13) verbunden zu sein. 20

Revendications

1. Commutateur de charge (1) comprenant :

un boîtier isolant (11) rempli d'un gaz d'extinction d'arc ;
 une lame tournante (12) montée pivotante sur le boîtier isolant (11) et contre la face interne du boîtier isolant (11), pour diviser l'intérieur du boîtier isolant (11) en deux chambres (17, 18) de volumes variables, dans lequel, avec une rotation de la lame tournante (12), le commutateur de charge (1) est apte à être au moins dans un état de marche et un état isolé ;
 un contact statique supérieur (14) relié au boîtier isolant (11) et non mobile par rapport au boîtier isolant (11) ;
 un contact mobile (13) apte à se déplacer avec la lame tournante (12) de manière à être relié de manière conductrice au contact statique supérieur (14) ou à en être séparé ; et
 une buse d'extinction d'arc (10) comprenant :

une partie d'ouverture (101) conçue comme une ouverture formée sur la lame tournante (12) et s'étendant dans une direction tangentielle à la lame tournante (12) ; et
 une partie de confinement d'arc (102) disposée sur une surface intérieure et/ou une surface extérieure de la lame tournante (12) et conçue comme une forme creuse faisant saillie vers l'intérieur et/ou vers l'extérieur sur une certaine longueur dans la direction tangentielle à la lame tournante (12), dans lequel la partie de confinement d'arc (102)

et la partie d'ouverture (101) sont en communication pour former un canal de buse, de sorte que le gaz d'extinction d'arc comprimé par la lame tournante (12) dans l'une des deux chambres (17, 18) dans le boîtier isolant (11) est éjecté le long du canal de buse lorsque le commutateur de charge (1) passe de l'état de marche à l'état isolé ; dans lequel le contact statique supérieur (14) est conçu pour s'éloigner du contact mobile (13) dans et le long du canal de buse lorsqu'il passe d'un état relié de manière conductrice à un état séparé par rapport au contact mobile (13), **caractérisé en ce que** le contact mobile est connecté à la lame tournante (12).

2. Commutateur de charge (1) selon la revendication 1, dans lequel la partie d'ouverture (101) est conçue comme une ouverture fermée à quatre côtés formée sur la lame tournante (12) et s'étendant dans la direction tangentielle à la lame tournante (12).
3. Commutateur de charge (1) selon la revendication 1, dans lequel la partie d'ouverture (101) est conçue comme une ouverture ouverte sur le côté supérieur formée sur la lame tournante (12) et s'étendant dans la direction tangentielle à la lame tournante (12), et une extrémité supérieure de la lame tournante (12) vient buter contre une paroi latérale intérieure du boîtier isolant (11) de sorte que la partie d'ouverture (101) a une forme fermée à quatre côtés.
4. Commutateur de charge (1) selon l'une quelconque des revendications 1 à 3, dans lequel la partie de confinement d'arc (102) a une forme creuse fermée à quatre côtés.
5. Commutateur de charge (1) selon l'une quelconque des revendications 1 à 3, dans lequel la partie de confinement d'arc (102) a une forme creuse ouverte sur le côté supérieur.
6. Commutateur de charge d'arc (1) selon la revendication 1, dans lequel la partie d'ouverture (101) et la partie de confinement d'arc (102) sont conçues comme des structures séparées.
7. Commutateur de charge (1) selon la revendication 1, dans lequel la partie d'ouverture (101) et la partie de confinement d'arc (102) sont conçues pour être formées d'un seul tenant.
8. Commutateur de charge (1) selon la revendication 1, dans lequel le contact statique supérieur (14) est conçu pour s'étendre le long du canal de buse depuis un côté extérieur de la lame tournante (12) de manière à être relié de manière conductrice au contact

mobile (13).

9. Commutateur de charge (1) selon la revendication 1, dans lequel le contact statique supérieur (14) est conçu pour s'étendre vers le bas à partir d'un côté supérieur de la lame tournante (12) de manière à être relié de manière conductrice au contact mobile (13).

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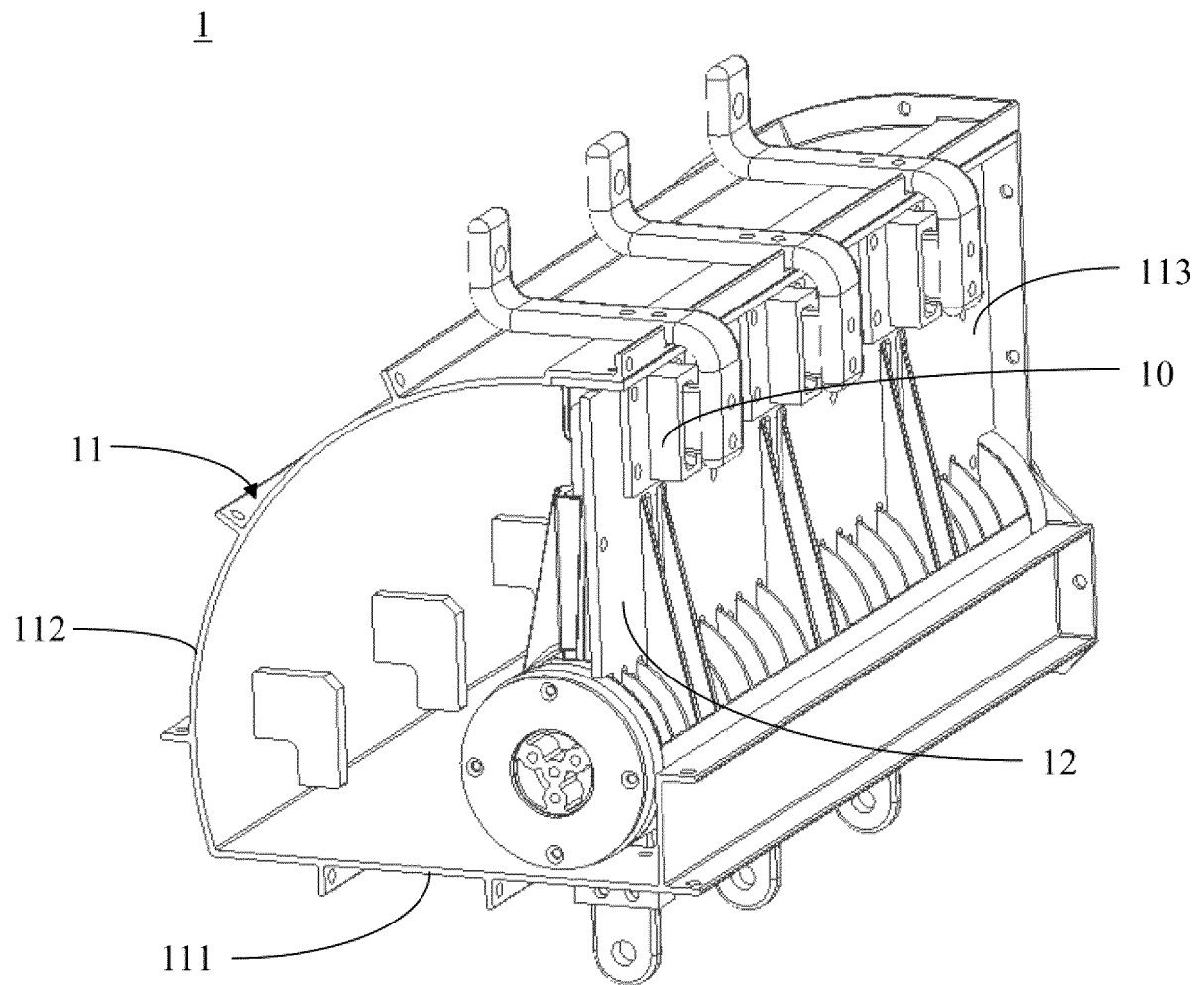


FIG. 1

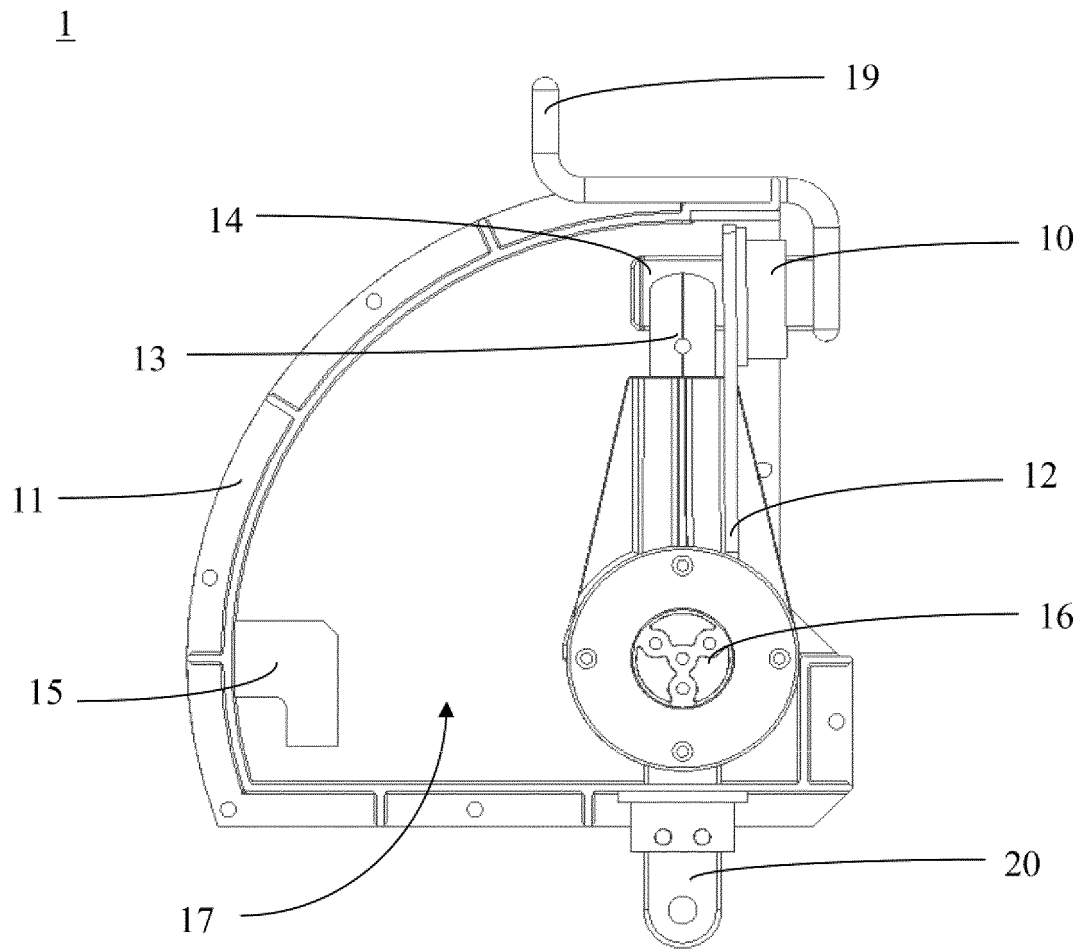


FIG. 2

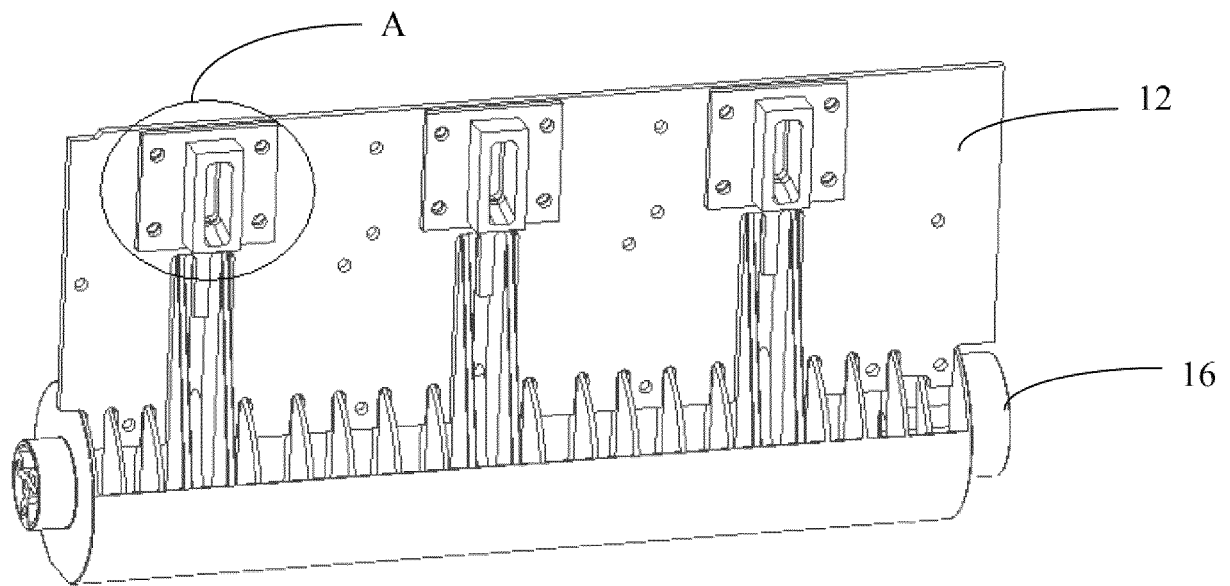


FIG. 3

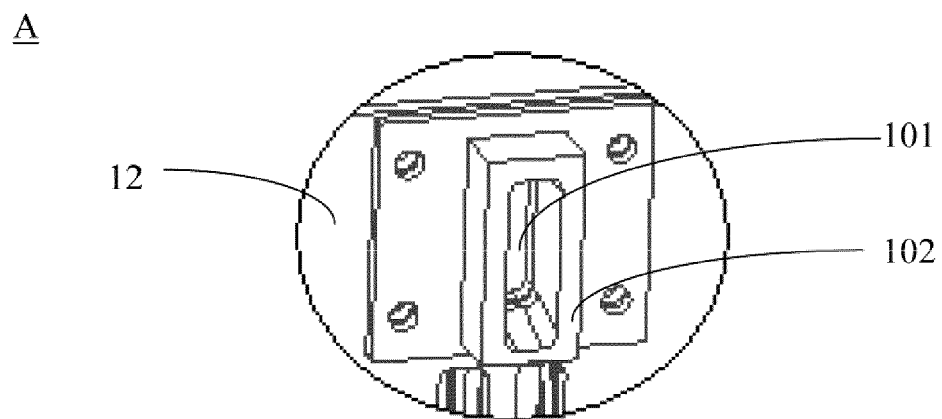


FIG. 4

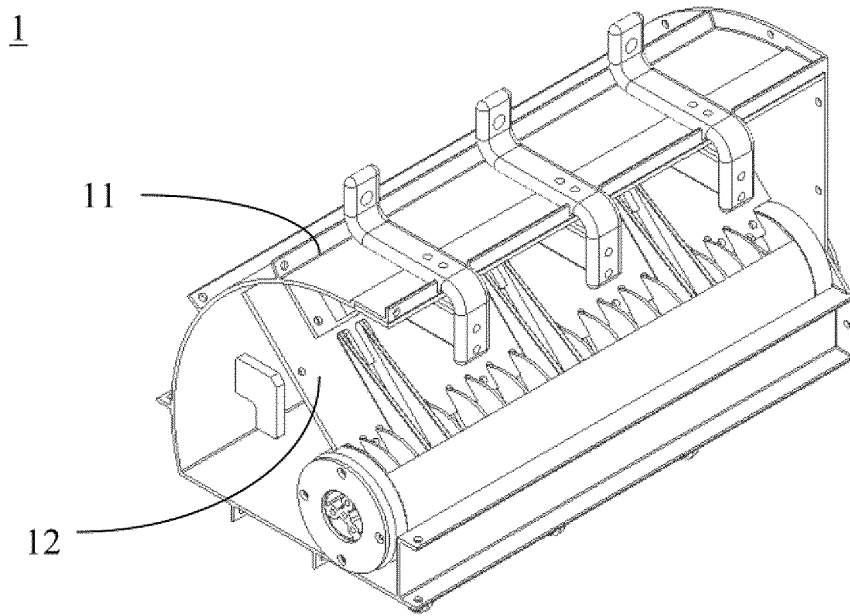


FIG. 5

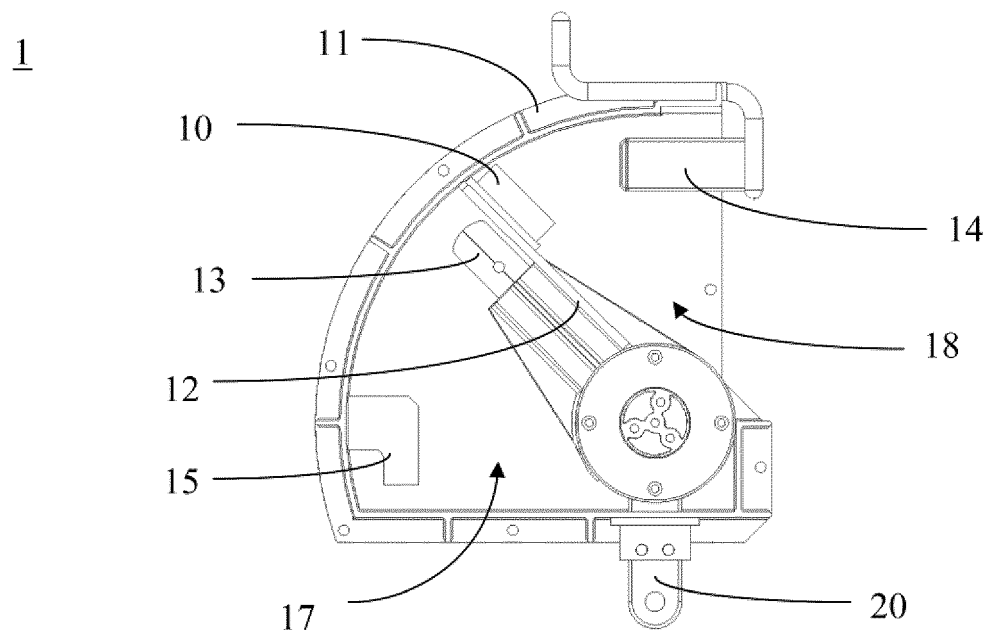


FIG. 6

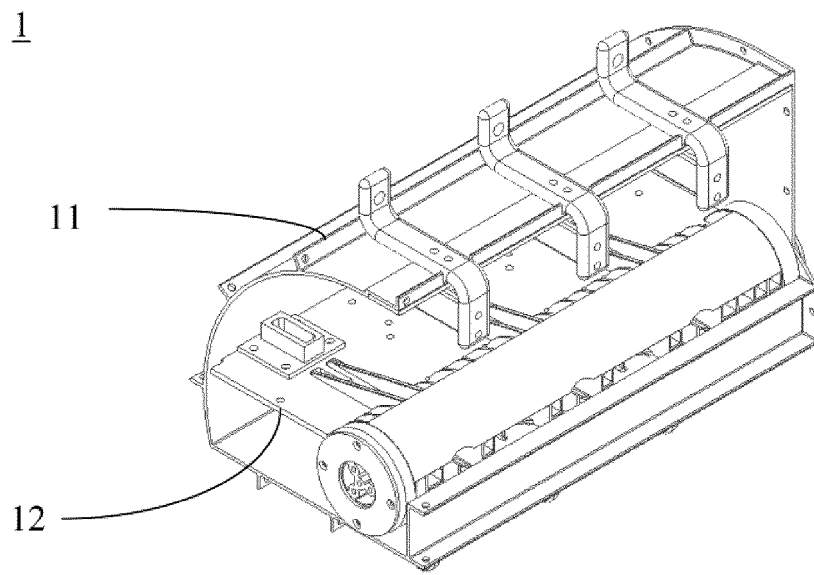


FIG. 7

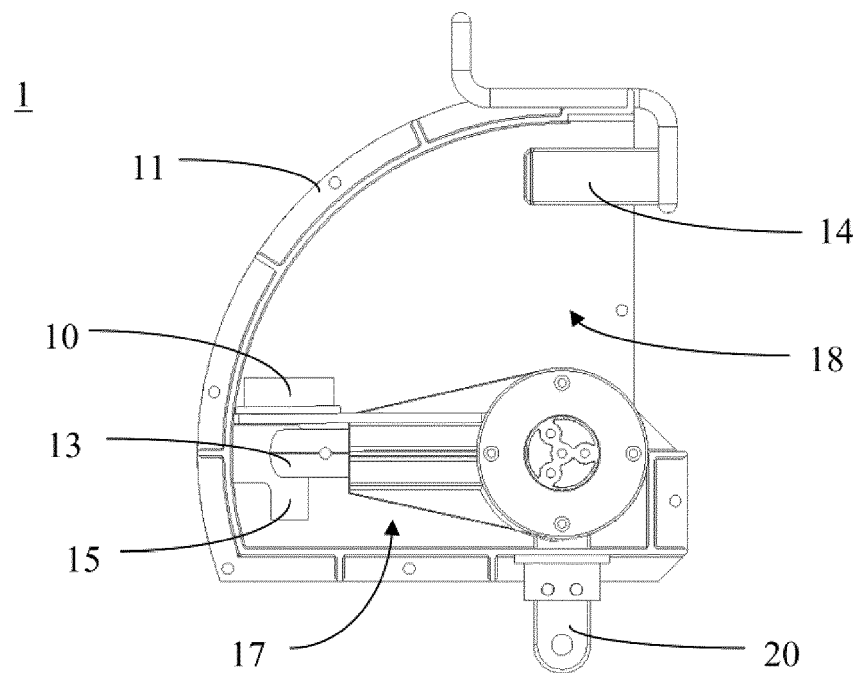


FIG. 8

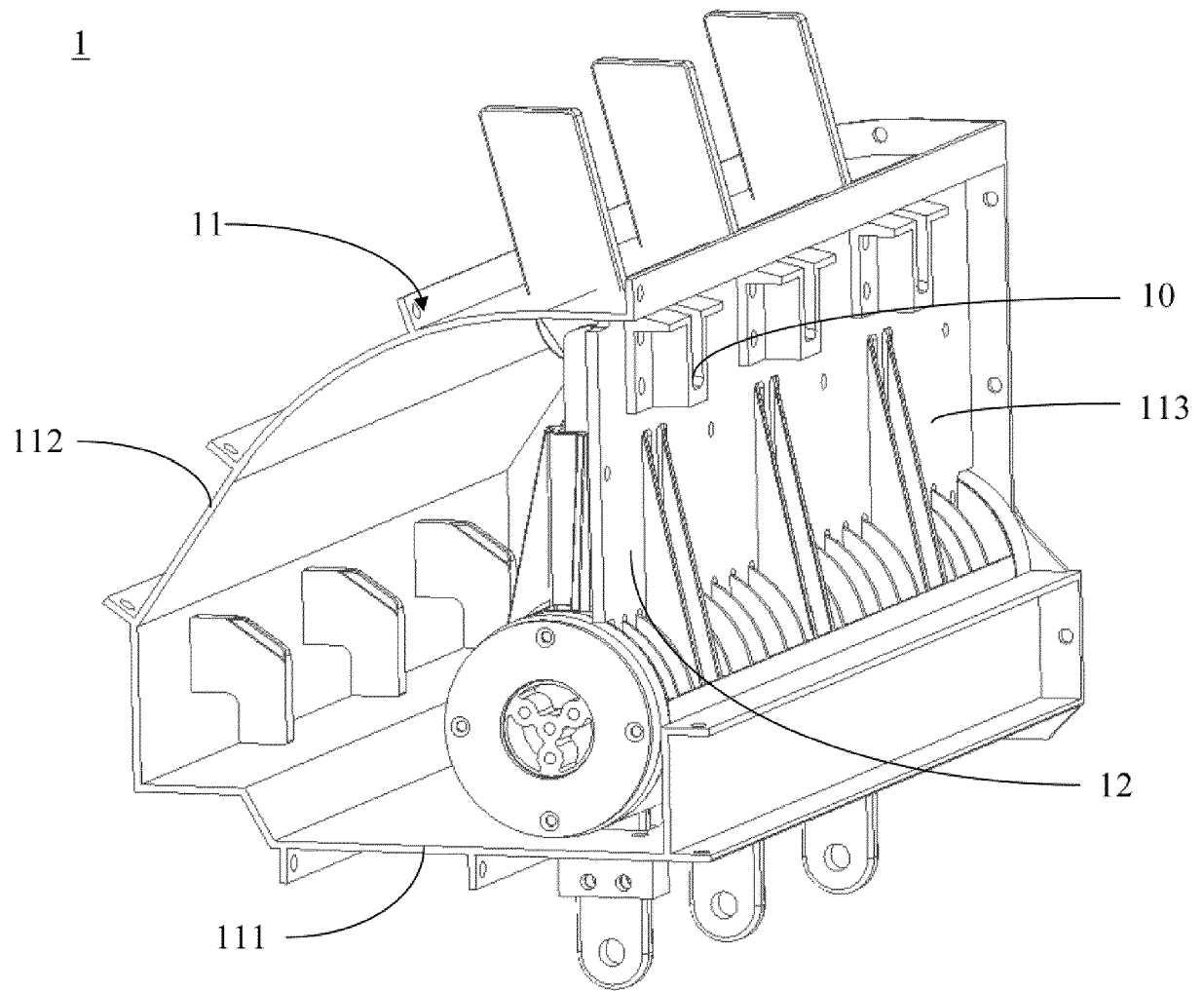


FIG. 9

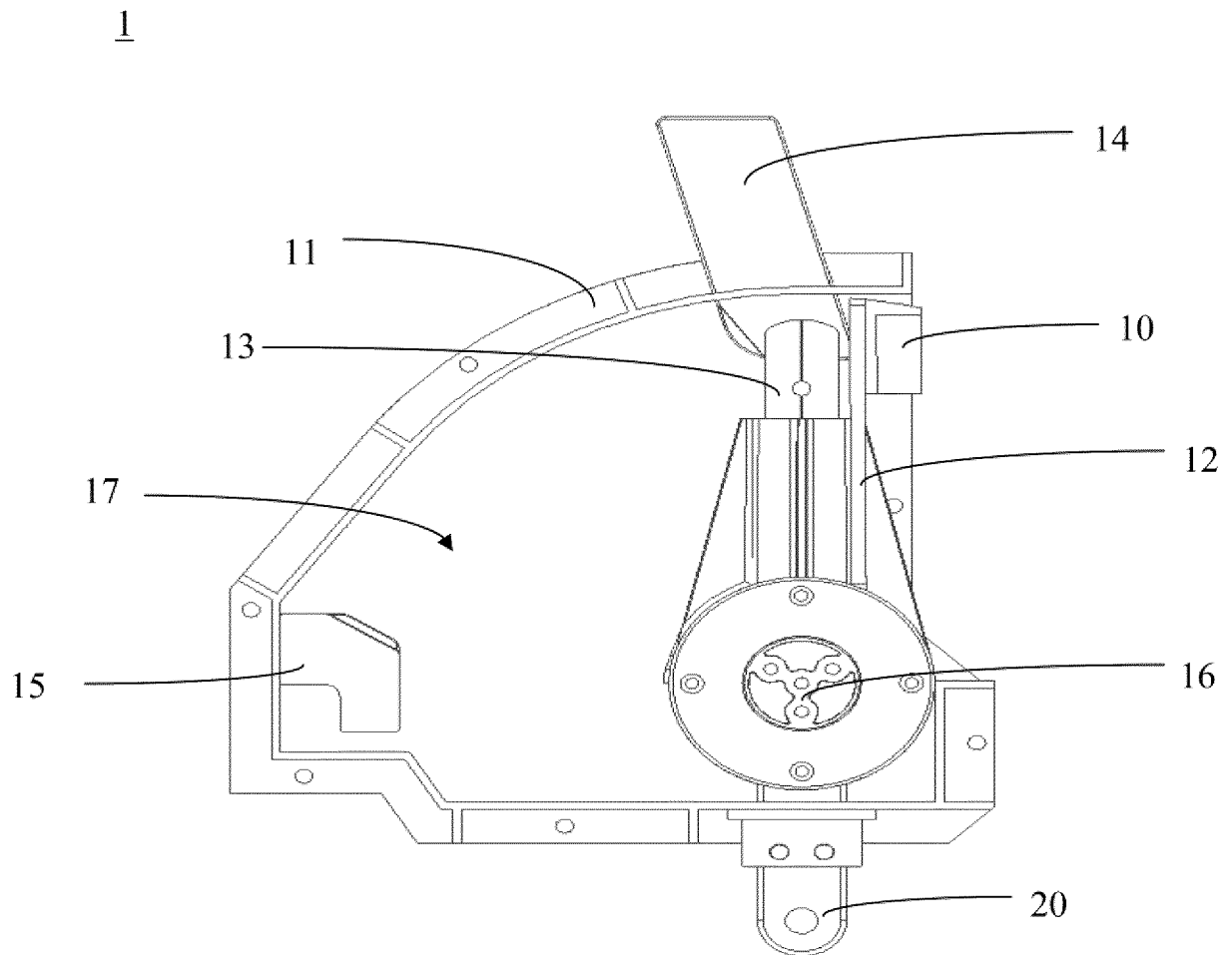


FIG. 10

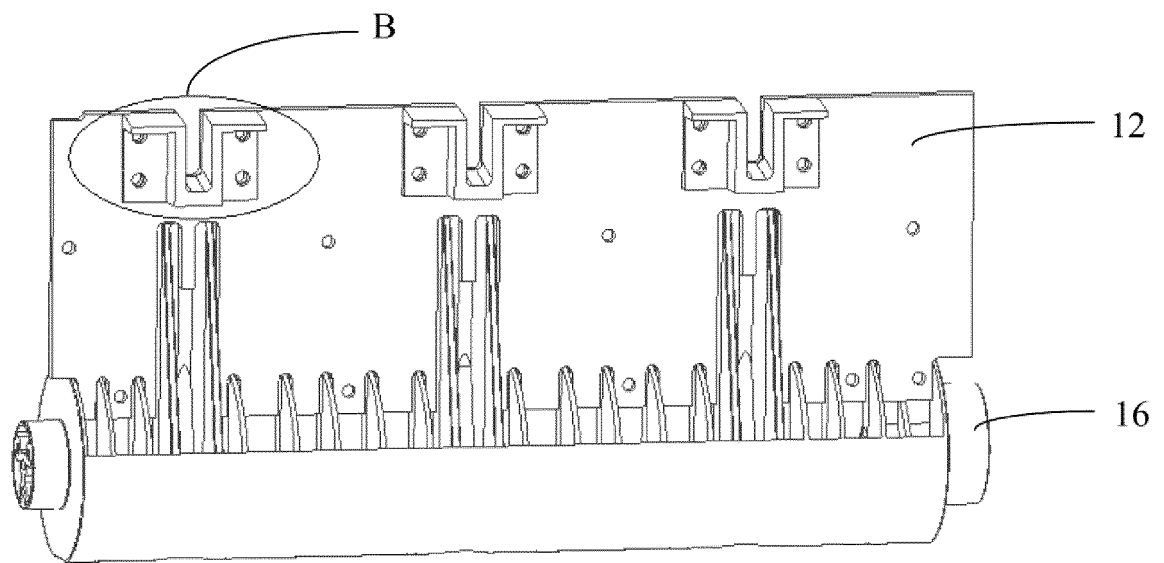


FIG. 11

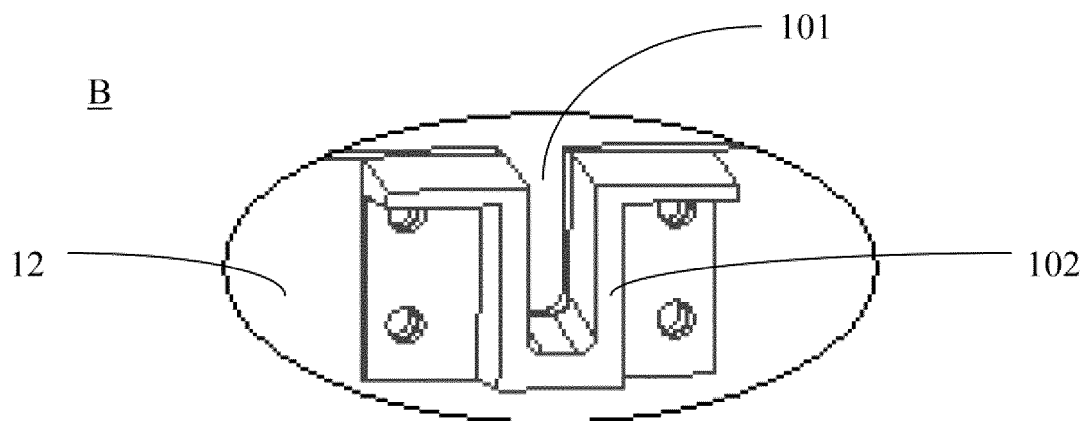


FIG. 12

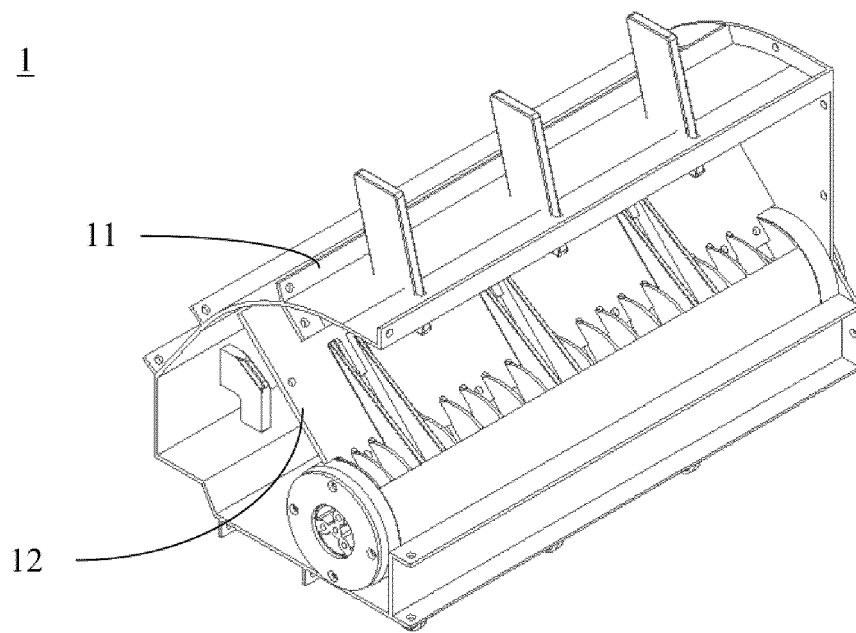


FIG. 13

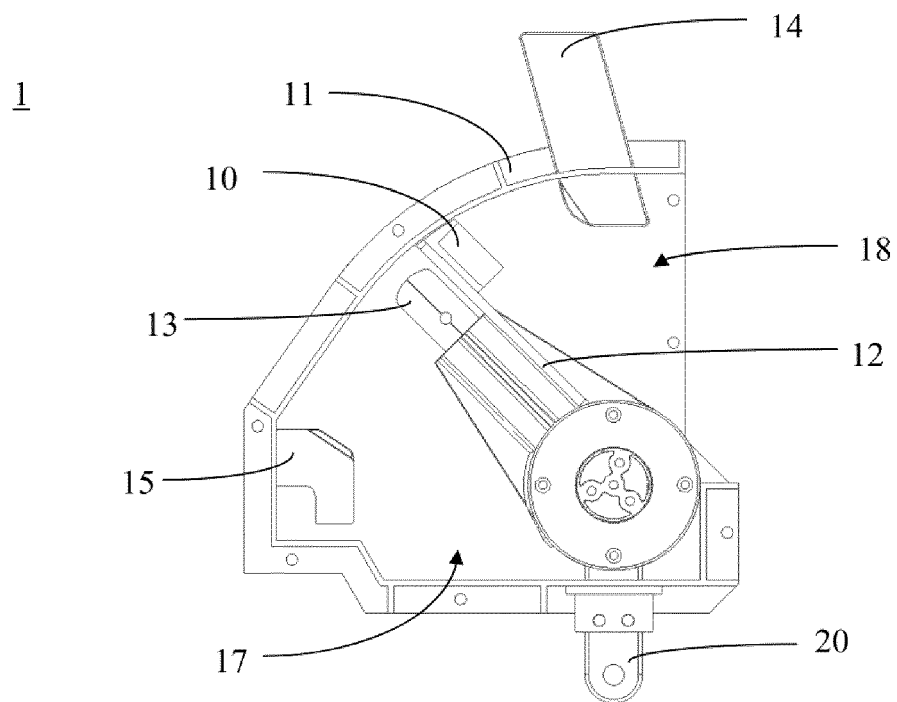


FIG. 14

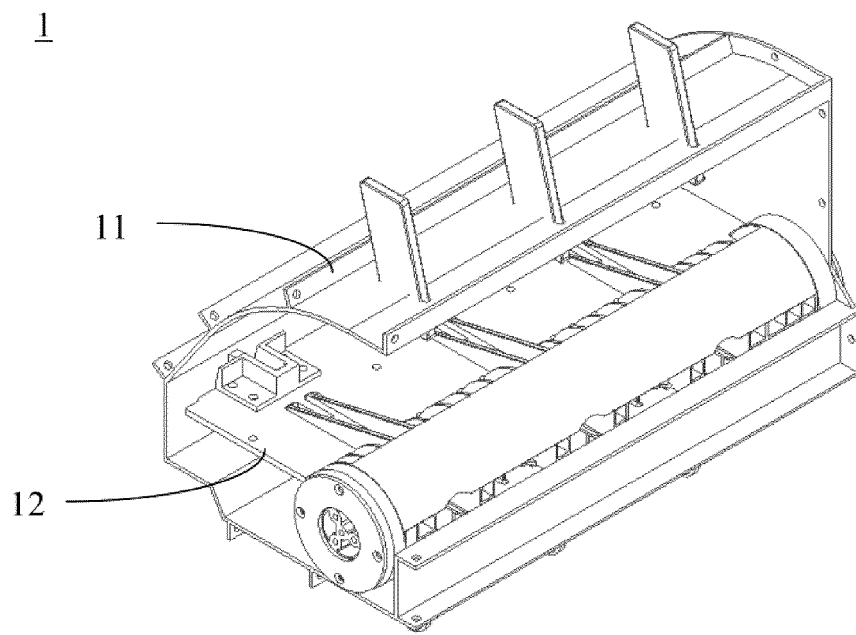


FIG. 15

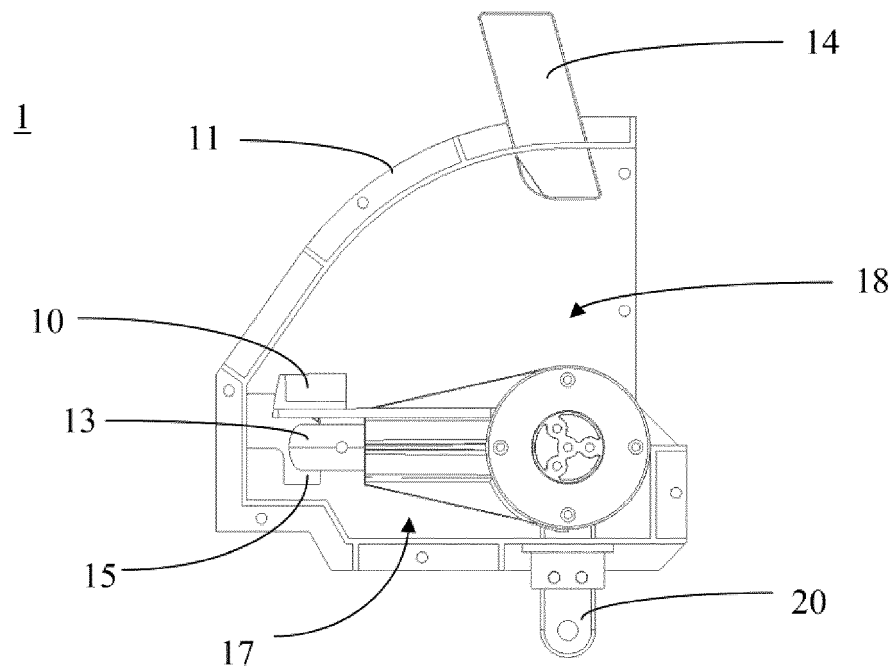


FIG. 16

REFERENCES CITED IN THE DESCRIPTION

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