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(54) **AUTOMATIC TRANSFER SWITCH**

(57) The invention discloses an automatic transfer switch, including a drive disk (10); a first transmission rod (21) and a second transmission rod (22), which transmit the movement of the drive disk to a first movable contact (31) and a second movable contact (32); an indicator (40), driven by the first transmission rod and the second transmission rod and move linearly; a stopper (50), driven by the indicator to rotate, including a first stop portion (51) and a second stop portion (52); a manual operation

disk (60), coaxial with and rotating synchronously with the drive disk, including a first projection portion (61) and a second projection portion (62), wherein in case of contact fusion welding, the manual operation disk cannot move further towards a double-opening position due to the first stop portion abutting with the first projection portion or the second stop portion abutting with the second projection portion, thus guaranteeing the safety at the time of contact fusion welding.

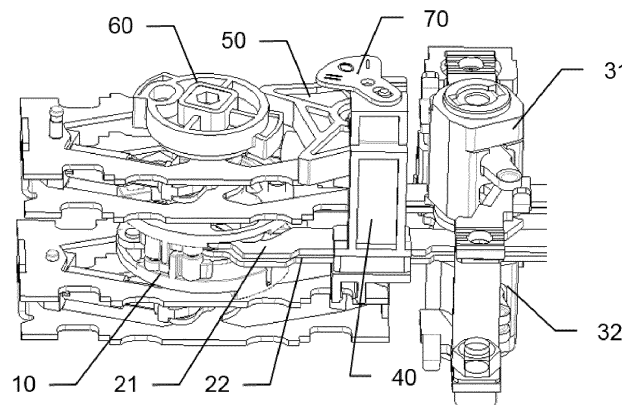


Figure 1

Description

TECHNICAL FIELD

[0001] The invention relates to an automatic transfer switch.

BACKGROUND

[0002] Automatic transfer switch (ATS) needs to switch between two different power sources in order to ensure the continuity of power supply to the load. There are three positions of ATS, namely the first power source closing position, the double-opening position (i.e. the OFF position, in which the load is not connected to the first or the second power source) and the second power source closing position. For an ATS with isolation functions, when the ATS product is in the double-opening position, the user can padlock and overhaul the related equipment. Therefore, the isolation function in the double-opening position becomes an important market demand.

[0003] Contact fusion welding refers to the fusion and adhesion of contacts, which may be caused by the current passing through the contacts of the electrical equipment exceeding the rated current of the contacts themselves, or the contacts heating caused by the increased resistance between the contacts due to aging of the electrical equipment.

[0004] ATS products usually have an indicator sheet to indicate the position status of the ATS product. When contact fusion welding happens, it is required that the indicator sheet should not indicate the double-opening position, or if the indicator sheet indicate the double-opening position while the ATS product is in fact in the first power source closing position or in the second power source closing position, it would be a great safety risk for the user or the maintenance personnel.

SUMMARY

[0005] In view of the above problems, according to the invention, an automatic transfer switch is proposed, which includes: a drive disk; a first transmission rod and a first transmission rod, transmitting the movement of the drive disk to a first movable contact and a second movable contact, respectively, so that when said drive disk moves to a first position, a middle position and a second position respectively, the first movable contact and the second movable contact are correspondingly driven, so that said automatic transfer switch is in a first power source closing position, a double-opening position and a second power source position, respectively; an indicator, fitted and connected to said first transmission rod and said second transmission rod, and configured to be able to move linearly on a first direction, wherein when said automatic transfer switch is respectively in the first power source closing position, the double-opening position and the second power source closing position, said indicator

is correspondingly driven to a first indication position, a middle indication position and a second indication position, and wherein, said indicator includes a groove; a stopper, able to rotate around a fixed axis, including a first stop portion and a second stop portion extending outward from the center of rotation, further including a projection that fits with said groove, so that the linear movement of the indicator drives the rotation of said stopper through the fitting of said groove and said projection, so that when said indicator is respectively in the first indication position, the middle indication position and the second indication position respectively, said stopper is at a first stop position, a middle stop position and a second stop position correspondingly; and a manual operation disk, coaxial with and rotating synchronously with said drive disk, including a disk body and a first projection portion and a second projection portion projecting radially outward from the disk body, wherein the shapes and positions of said first projection portion and second projection portion as well as said first stop portion and second stop portion are designed such that, in case of contact fusion welding when said automatic transfer switch is in the first power source closing position, on the way of the manual operation disk rotating towards the double-opening position, said first projection portion abuts against said first stop portion, so that the manual operation disk cannot move further; in case of contact fusion welding when said automatic transfer switch is in the second power source closing position, on the way of the manual operation disk rotating towards the double-opening position, said second projection portion abuts against said second stop portion, so that the manual operation disk cannot move further.

[0006] The automatic transfer switch according to the invention may have one or more features below.

[0007] According to one embodiment, the automatic transfer switch further includes an indicator sheet, said indicator sheet is able to rotate around a fixed axis and includes a slot that fits with a pin of the indicator, so that the linear movement of said indicator drives the rotation of the indicator sheet, and when said indicator is respectively in the first indication position, the middle indication location and the second indication location, said indicator sheet indicates first closing, opening and second closing, respectively.

[0008] According to one embodiment, in case of contacts fusion welding, said stopper cannot rotate, so that the indicator sheet cannot indicate closing.

[0009] According to one embodiment, when said automatic transfer switch is working normally, said first projection portion does not abut against said first stop portion, and said second projection portion does not abut against said second stop portion.

[0010] According to one embodiment, when the automatic transfer switch is in the first power source closing position, the stopper rotates to a position in which the first stop portion is closest to the manual operation disk; when the automatic transfer switch is in the second power

source closing position, the stopper rotates to a position in which the second stop portion is closest to the manual operation disk.

[0011] According to one embodiment, said stopper comprises a V-shaped body open towards the manual operation disk, said first stop portion and said second stop portion forming two arms of the V-shape.

[0012] According to one embodiment, said body is connected at the root of the V-shape, forming a stiffener.

[0013] According to one embodiment, said projection projects upward from a plane of the body of said stopper and form a cylinder.

[0014] According to one embodiment, said groove forms a U-shaped groove, and its width is equal to or slightly larger than the diameter of said projection.

[0015] According to one embodiment, the shown first projection portion and the shown second projection portion form arcs centered on the center of the manual operation disk.

[0016] The automatic transfer switch according to the invention, in case of contacts fusion welding, could not indicate the double-opening position due to the interaction between the manual operation disk and the stopper, so as to guarantee the safety function. Furthermore, the safety of the automatic transfer switch in two operation positions (the first power source closing position and the second power source closing position) in contacts fusion welding is guaranteed through one stopper, the structure being simple and reliable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] In order to explain the technical solution of the embodiment of the invention more clearly, the attached figures of the embodiment of the invention will be briefly introduced below. The attached figures are only used to illustrate some embodiments of the invention, but not to limit all the embodiments of the invention to what illustrated below.

Figure 1 is a perspective view of a part of the automatic transfer switch according to the invention.

Figure 2 is a perspective view of a part of the automatic transfer switch according to the invention, viewed in a direction opposite from that in figure 1.

Figure 3 is a perspective view of a part of the automatic transfer switch according to the invention, showing the stopper and the manual operation disk more clearly.

Figure 4 is an enlarged view of the stopper of the automatic transfer switch according to the invention. Figure 5 is a view of the automatic transfer switch according to the invention in the first power source closing position.

Figure 6 is a view of the automatic transfer switch according to the invention in the first power source closing position in case of contacts fusion welding. Figure 7 is a view of the automatic transfer switch

according to the invention in the second power source closing position.

Figure 8 is a view of the automatic transfer switch according to the invention in the second power source closing position in case of contacts fusion welding.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0018] In order to make the aim of the technical solutions, the technical solutions as well as the advantages of the invention clearer, the technical solutions of the embodiments of the invention will be described clearly and completely below, in combination with the attached figures of the specific embodiments of the invention. In the figures, the same reference numbers represent the same parts. It should be noted that, the described embodiments are part of the embodiments of the invention, but not all of them. Based on the described embodiments of the invention, all other embodiments obtained by ordinary technicians in the field without creative work are within the scope of protection of the invention.

[0019] Unless otherwise defined, the technical terms or scientific terms used here should have the ordinary meaning understood by people with general skills in the field to which the invention belongs. The "first", "second" and similar words used in the specification and claims of the invention patent application do not indicate any order, quantity or importance, but are only used to distinguish different components. Likewise, similar words such as "one" do not necessarily mean quantitative restriction. Similar words such as "comprising" or "including" mean that the elements or objects appearing before this word cover the elements or objects listed after this word and their equivalents, without excluding other elements or objects. Words like "connected to" or "connected" are not limited to physical or mechanical connections, but can include electrical connections, whether direct or indirect. "Above", "below", "left" and "right" are only used to indicate the relative positional relationship. When the absolute position of the described object changes, the relative positional relationship may also change accordingly.

[0020] The invention will be described in detail below by way of example embodiments.

[0021] An automatic transfer switch may switch between two different power sources, with a first power source closing position, a double-opening position, and a second power source closing position. As shown in figure 1, the automatic transfer switch according to the invention may comprise a drive disk 10, the drive disk 10 may be driven electrically or manually. The automatic transfer switch may also comprise a transmission mechanism to transmit the movement of the drive disk 10 to the movable contacts. Since the automatic transfer switch have a first movable contact 31 and a second movable contact 32, the transmission mechanism may comprise a first transmission rod 21 and a second transmission rod 22, in order to transmit the movement of the

drive disk 10 to the first movable contact 31 and the second movable contact 32, respectively. It is understood that, as shown in figure 1, the transmission mechanism may further comprise a third transmission rod and a fourth transmission rod to drive the movable contacts symmetrically. It is also understood that, the first movable contact 31 may comprise four first movable contacts corresponding to three first phase poles and one first neutral pole respectively; likewise, the second movable contact 32 may comprise four second movable contacts corresponding to three second phase poles and one second neutral pole. For clarity, only one first movable contact 31 and one second movable contact 32 are shown in figure 1. When the drive disk 10 moves to a first position, a middle position and a second position respectively, the first movable contact 31 and the second movable contact 32 are driven correspondingly, so that the automatic transfer switch is in a first power source closing position (the first movable contact 31 is in the closing position and the second movable contact 32 is in the opening position), a double-opening position and a second power source closing position (the second movable contact 32 is in the closing position and the first movable contact 31 is in the opening position).

[0022] The automatic transfer switch may also comprise an indicator 40. The indicator 40 is fitted and connected to the first transmission rod 21 and the second transmission rod 22, and is configured to be able to move linearly in a first direction (shown in figure 1 as the left-right direction). The fitting between the indicator 40 and the first transmission rod 21 and the second transmission rod 22 makes it possible that, when the automatic transfer switch is in the first power source closing position, the double-opening position, and the second power source closing position respectively, the indicator 40 may be driven to a first indication position, a middle indication position, and a second indication position respectively. For example, the middle indication position is between the first indication position and the second indication position. In figure 1, the second indication position is located to the left of the middle indication position, and the first indication position is located to the right of the middle indication position. In the embodiment in figure 1, the indicator 40 is shaped as a vertically extending long strip.

[0023] The automatic transfer switch may also comprise an indicator sheet 70, as shown in figure 1. The indicator sheet 70 is located above the indicator 40 and can rotate around a fixed axis. The indicator sheet 70 may be provided with a slot spaced apart from the fixed axis, the slot may fit with a pin on the indicator 40, so that the left-right linear movement of the indicator 40 drives the indicator sheet 70 to rotate around the fixed axis, and that the indicator sheet 70 indicates first closing, opening, and second closing respectively when the indicator 40 is in the first indication position, the middle indication position and the second indication position, respectively. For example, the slot is formed as a through-hole of runway shape, and the width of the through-hole is equal to or

slightly larger than the diameter of the pin. Marks "I", "O", "II" may be set on the indicator sheet 70 in order to indicate the status of the automatic transfer switch to the user. A house of the automatic transfer switch may be provided with a transparent indicator window to display the marks on the indicator sheet 70.

[0024] The automatic transfer switch may further comprise a stopper 50, which is able to rotate around a fixed axis. Figure 4 shows an enlarged view of the stopper 50. The stopper 50 may comprise a first stop portion 51 and a second stop portion 52 that extend outward from the center of rotation. Specifically, the stopper 50 may comprise a body of V-shape, with the first stop portion 51 and the second stop portion 52 forming two arms of the V-shape, the width of the two arms may increase with the distance from the center of rotation. Preferably, the body of the stopper 50 is connected at the root of the V-shape and forms a stiffener 54, so that the stopper 50 has enough stiffness. As shown in figure 4, the stopper 50 may also comprise projection 53, the projection 53 may fit with a groove 41 provided on the indicator 40. For example, the projection 53 may project from the plane of the body of the stopper 50 and form a cylinder, while the groove 41 of the indicator 40 may form as a U-shaped groove open towards the projection 53, and the width of the groove 41 being equal to or slightly larger than the diameter of said projection 53, the groove 41 of the indicator 40 may be seen from figure 2. The left-right linear movement of the indicator 40 drives the stopper 50 to rotate around its fixed axis by the fitting between the groove 41 and the projection 53, so that when the indicator 40 is in the first indication position, the middle indication position and the second indication position respectively, the stopper 50 correspondingly is in the first stop position, the middle stop position and the second stop position.

[0025] The automatic transfer switch may also comprise a manual operation disk 60. The manual operation disk 60 may be coaxial with and rotating synchronously with the drive disk 10. As shown in figure 3, the manual operation disk 60 may comprise a disk body 63 and a first projection portion 61 and a second projection portion 62 projecting radially outward from the disk body 63, the first projection portion 61 and the second projection portion 62 may be arcs centered on the center of the manual operation disk 60. The V-shaped body of the stopper opens towards the manual operation disk 60.

[0026] How the automatic transfer switch according to the invention realize the protection function in case of contact fusion welding will be described in detail below with reference to figure 5 to 8.

[0027] First, refer to figure 5, in which the automatic transfer switch is in the first power source closing position. As can be seen, the first movable contact 31 is closed, and the second movable contact 32 is opened. Meanwhile, the indicator 40 is in the first indication position, the indicator sheet 70 indicates first closing, the stopper 50 is in the first stop position, i.e. the position of ro-

tation in which the first stop portion 51 is closest to the manual operation disk 60, as shown in figure 5. At this time, if contact fusion welding happens, i.e. the first movable contact 31 is in fusion and adhesion with the first stationary contact and the user tries to switch the automatic transfer switch to the double-opening position, the manual operation disk 60 move clockwise from the position in figure 5 to the position in figure 6, the first projection portion 61 of the manual operation disk 60 abuts against the first stop portion 51 of the stopper 50, so that the manual operation disk 60 cannot move further, so the stopper 50 cannot rotate either, so that the indicator sheet 70 cannot indicate the opening. Therefore, the user would not obtain information of opening from the indicator sheet 70, and safety is guaranteed.

[0028] Similarly, refer to figure 7, in which the automatic transfer switch is in the second power source closing position. As can be seen, the second movable contact 32 is closed, and the first movable contact 31 is opened. Meanwhile, the indicator 40 is in the second indication position, the indicator sheet 70 indicates second closing, the stopper 50 is in the second stop position, i.e. the position of rotation in which the second stop portion 52 is closest to the manual operation disk 60, as shown in figure 7. At this time, if contact fusion welding happens, i.e. the second movable contact 32 is in fusion and adhesion with the second stationary contact and the user tries to switch the automatic transfer switch to the double-opening position, the manual operation disk 60 move counter-clockwise from the position in figure 7 to the position in figure 8, the second projection portion 62 of the manual operation disk 60 abuts against the second stop portion 52 of the stopper 50, so that the manual operation disk 60 cannot move further, so the stopper 50 cannot rotate either, so that the indicator sheet 70 cannot indicate the opening. Therefore, the user would not obtain information of opening from the indicator sheet 70, and safety is guaranteed.

[0029] The exemplary implementation of the automatic transfer switch proposed by this invention is described in detail above with reference to the preferred embodiments, however, it can be understood by those skilled in the art, that without deviating from the concept of this invention, many variations and modifications can be made to the above specific embodiments, and various technical features and structures proposed by this invention can be combined without exceeding the scope of protection of this invention.

List of reference numbers

[0030]

10 drive disk
21 first transmission rod
22 second transmission rod
31 first movable contact
32 second movable contact

40 indicator
41 groove
50 stopper
51 first stop portion
52 second stop portion
53 projection
54 stiffener
60 manual operation disk
61 first projection portion
62 second projection portion
63 disk body
70 indicator sheet

15 Claims

1. An automatic transfer switch, **characterized in that** the automatic transfer switch comprises:

a drive disk;
a first transmission rod and a second transmission rod, transmitting the movement of the drive disk to a first movable contact and a second movable contact respectively, so that when said drive disk moves to a first position, a middle position and a second position respectively, the first movable contact and the second movable contact are driven correspondingly so that said automatic transfer switch is in a first power source closing position, a double-opening position and a second power source closing position; an indicator, fitted and connected to said first transmission rod and said second transmission rod, and configured to be able to move linearly on a first direction, wherein when said automatic transfer switch is respectively in the first power source closing position, the double-opening position and the second power source closing position, said indicator is correspondingly driven to a first indication position, a middle indication position and a second indication position, and wherein, said indicator includes a groove;
a stopper, able to rotate around a fixed axis, the stopper comprising a first stop portion and a second stop portion extending outward from the center of rotation, and further comprising a projection that fits with said groove, so that the linear movement of said indicator drives the rotation of said stopper through the fitting of said groove and said projection, so that when said indicator is in the first indication position, the middle indication position and the second indication position respectively, said stopper is correspondingly in a first stop position, a middle stop position and a second stop position; and
a manual operation disk, coaxial with and rotating synchronously with said drive disk, the manual operation disk comprises a disk body and a

- first projection portion and a second projection portion projecting radially outward from the disk body, wherein the shapes and positions of said first projection portion and second projection portion as well as said first stop portion and second stop portion are designed such that, in case of contact fusion welding when said automatic transfer switch is in the first power source closing position, in the way of the manual operation disk rotating towards the double-opening position, said first projection portion abuts against said first stop portion so that the manual operation disk cannot move further; in case of contact fusion welding when said automatic transfer switch is in the second power source closing position, in the way of the manual operation disk rotating towards the double-opening position, said second projection portion abuts against said second stop portion so that the manual operation disk cannot move further.
2. The automatic transfer switch as claimed in claim 1, **characterized in that**, the automatic transfer switch further comprises an indicator sheet, said indicator sheet is able to rotate around a fixed axis, the automatic transfer switch comprises a slot that fits with a pin of the indicator, so that the linear movement of said indicator drives the rotation of the indicator sheet, and when said indicator is in the first indication position, the middle indication position and the second indication position respectively, said indicator sheet indicates first closing, opening, and second closing respectively.
3. The automatic transfer switch as claimed in claim 2, **characterized in that**, in case of contact fusion welding, said stopper cannot rotate, so that the indicator sheet cannot indicate opening.
4. The automatic transfer switch as claimed in claim 1, **characterized in that**, when said automatic transfer switch is working normally, said first projection portion does not abut against said first stop portion, and said second projection portion does not abut against said second stop portion.
5. The automatic transfer switch as claimed in any one of claims 1 to 4, **characterized in that**, when the automatic transfer switch is in the first power source closing position, the stopper rotates to a position in which the first stop portion is closest to the manual operation disk; when the automatic transfer switch is in the second power source closing position, the stopper rotates to a position in which the second stop portion is closest to the manual operation disk.
6. The automatic transfer switch as claimed in any one of claims 1 to 4, **characterized in that**, said stopper comprises a V-shaped body that is open towards the manual operation disk, said first stop portion and said second stop portion forming two arms of the V-shape.
7. The automatic transfer switch as claimed in claim 6, **characterized in that**, said body is connected at the root of the V-shape and forms a stiffener.
8. The automatic transfer switch as claimed in claim 6, **characterized in that**, said projection projects from a plane of the body of said stopper and forms a cylinder.
9. The automatic transfer switch as claimed in claim 8, **characterized in that**, said groove forms a U-shaped groove, and the width of said groove is equal to or slightly larger than the diameter of said projection.
10. The automatic transfer switch as claimed in any one of claims 1 to 4, **characterized in that**, said first projection portion and said second projection portion form arcs centered on the center of the manual operation disk.

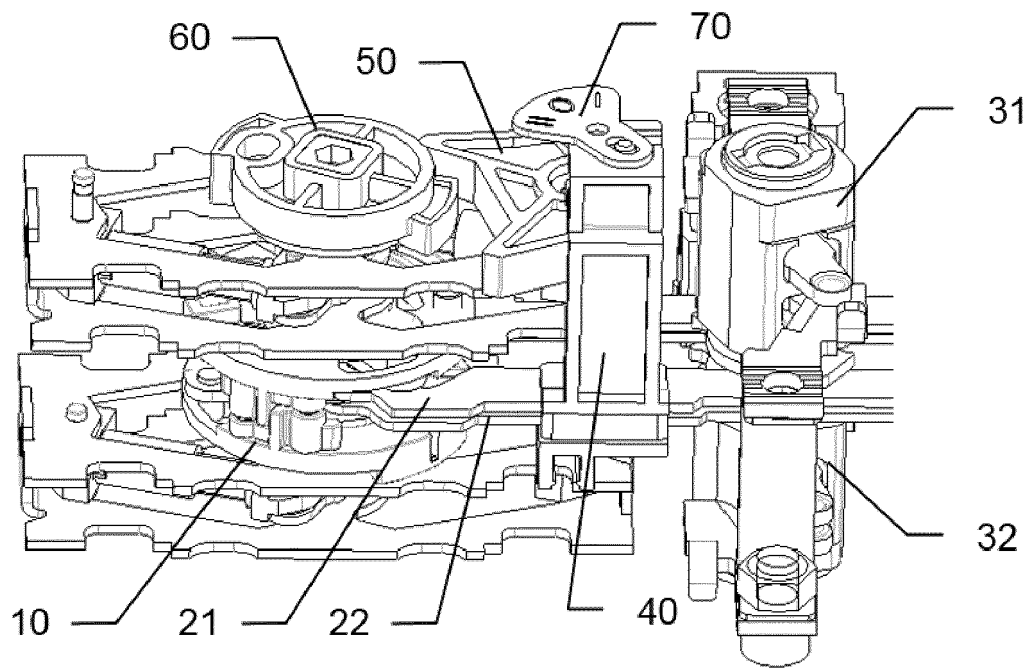


Figure 1

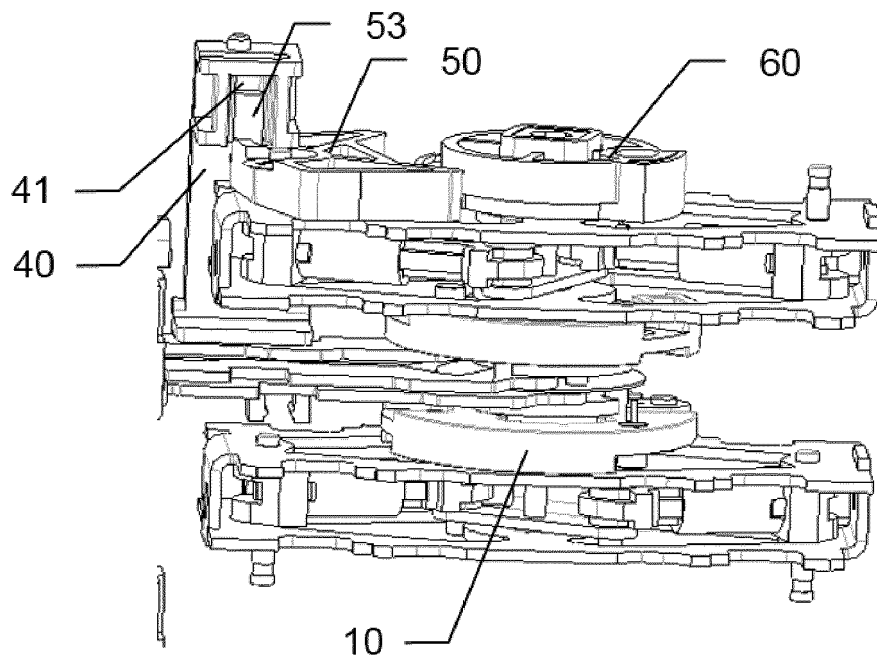


Figure 2

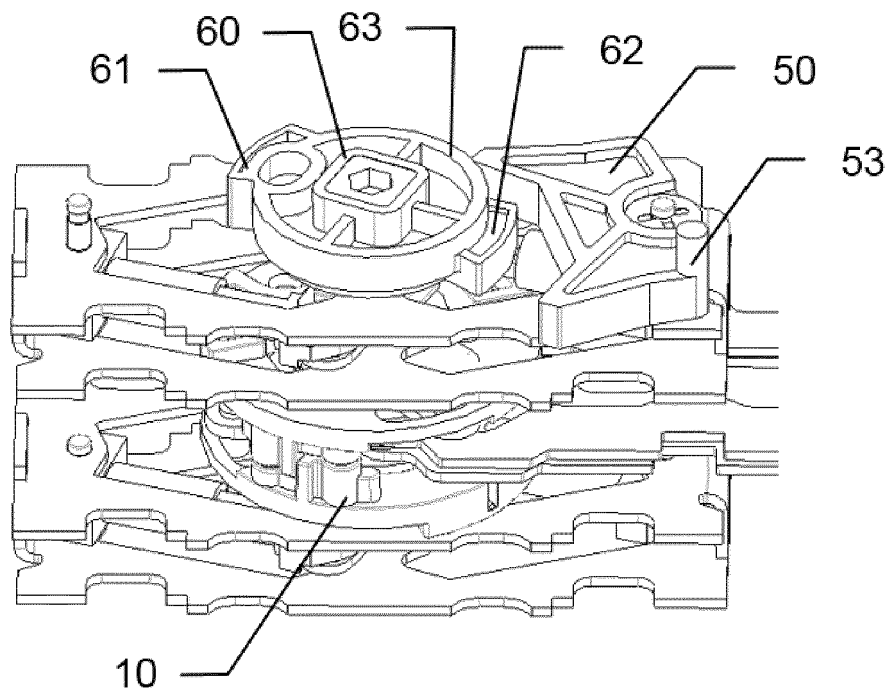


Figure 3

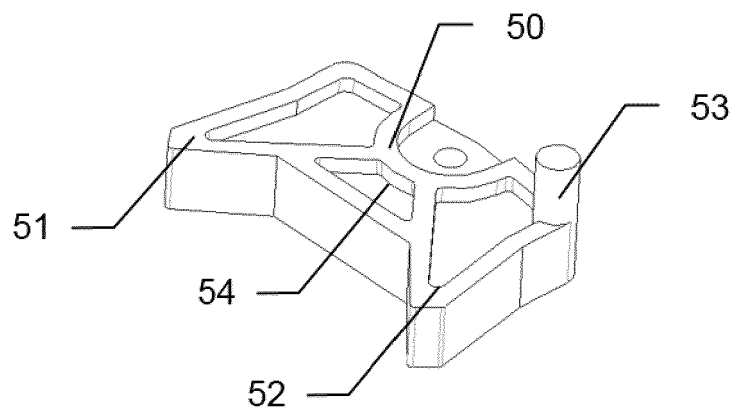


Figure 4

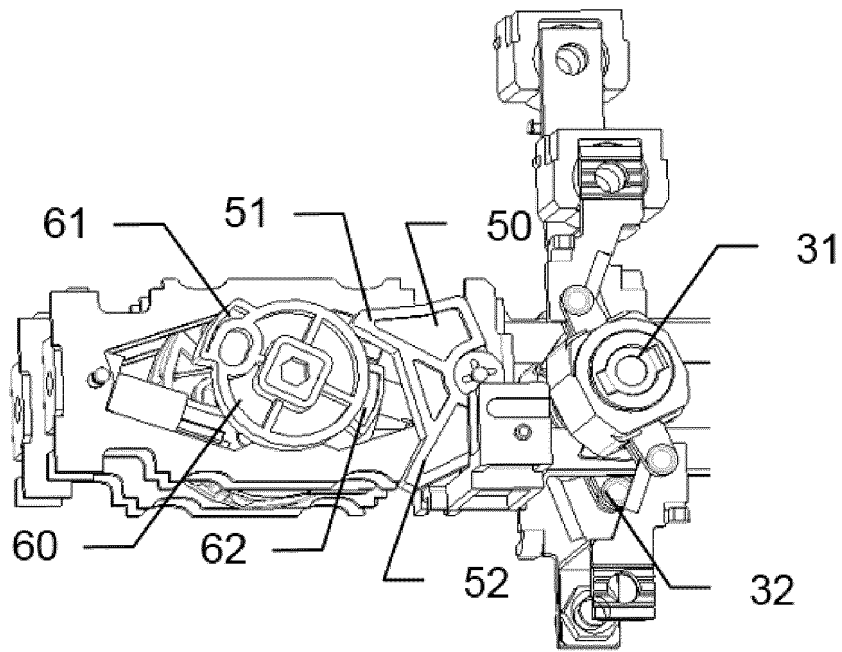


Figure 5

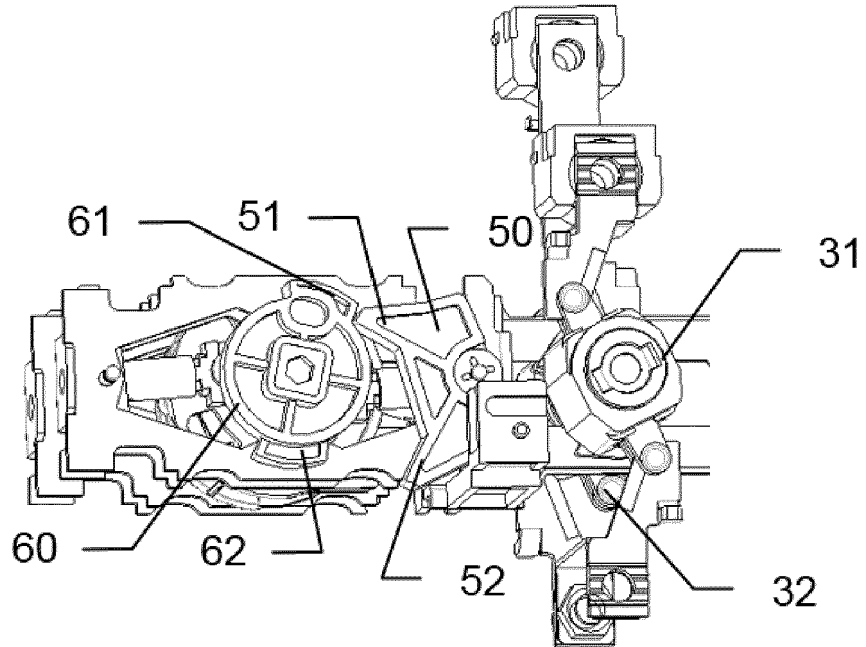


Figure 6

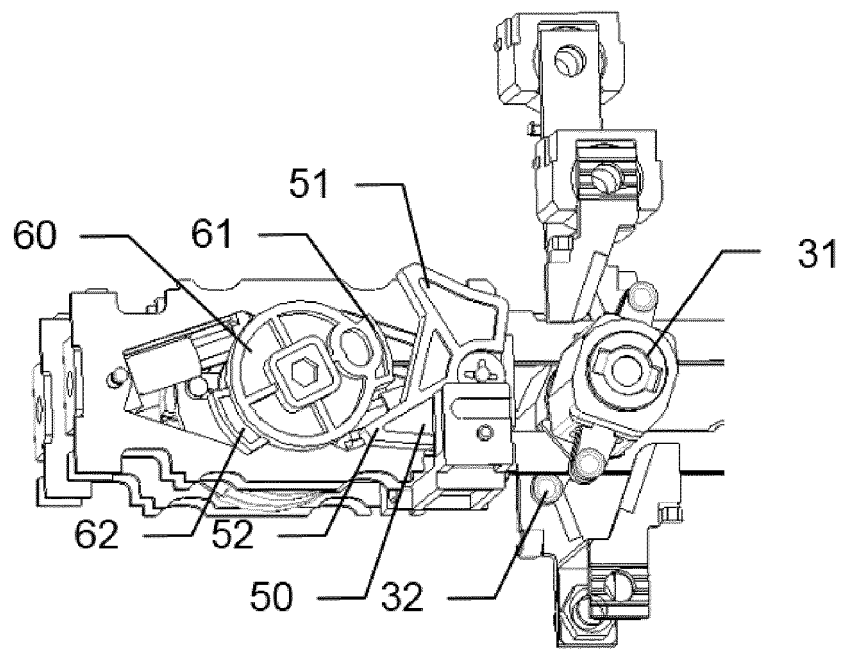


Figure 7

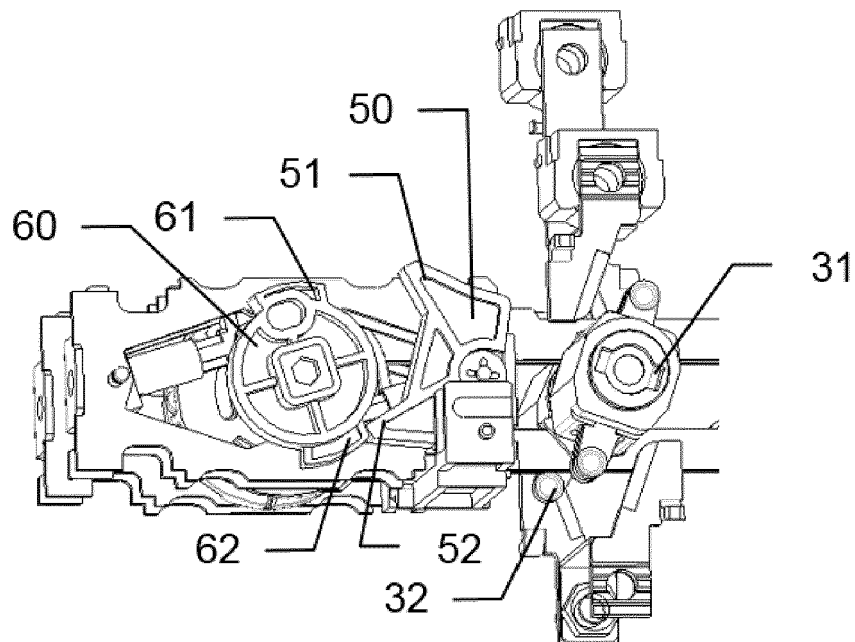


Figure 8



EUROPEAN SEARCH REPORT

Application Number

EP 21 30 6769

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 209 544 198 U (SCHNEIDER ELECTRIC IND SAS) 25 October 2019 (2019-10-25) * paragraphs [0030] - [0047]; figures 1-5 *	1-10	INV. H01H9/16 ADD. H01H19/03 H01H19/46
A	CN 211 578 602 U (SCHNEIDER WINGOAL TIANJIN ELECTRIC EQUIPMENT CO LTD) 25 September 2020 (2020-09-25) * paragraphs [0002], [0042] - [0073]; figures 1-5 *	1-10	
A	DE 44 45 339 A1 (KOPP HEINRICH AG [DE]) 20 June 1996 (1996-06-20) * column 1, lines 3-47 * * column 3, line 32 - column 6, line 16; figures 1-7 *	1-10	

TECHNICAL FIELDS
SEARCHED (IPC)

H01H

The present search report has been drawn up for all claims

1

Place of search

Munich

Date of completion of the search

26 April 2022

Examiner

Meyer, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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 O : non-written disclosure
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 30 6769

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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26-04-2022

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