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

(11) **EP 3 843 117 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.06.2021 Bulletin 2021/26

(51) Int Cl.:
H01H 33/12 *(2006.01)* ***H01H 33/02*** *(2006.01)*

(21) Application number: **19020727.4**

(22) Date of filing: **24.12.2019**

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

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(54) LOAD-BREAK SWITCH WITHOUT SF6 GAS HAVING A VACUUM CIRCUIT INTERRUPTER FOR MEDIUM-VOLTAGE SWITCHING SYSTEMS

(57) The present invention relates to a load-break switch (1) having a vacuum circuit interrupter (4) for medium-voltage switching systems. The load-break switch (1) comprises an inner elongated insulating housing (9) enclosing a vacuum interrupter (4) comprising a vacuum chamber (13) containing a fixed contact (20) electrically interconnected with a second conductive bar (16) and a movable contact (21) electrically connected to a flexible conductor (14) and a first switch contact (17), a second switch contact (18) electrically connected with a first conductive bar (15), a pair of parallelly arranged rotable blades (26), wherein the pair of rotable blades (26) is movable by a drive shaft (27) between a main current path in electrical communication with the fixed contact (20) and an isolation path when the movable contact (21) is spaced apart from the fixed contact (20), said pair of rotable blades (26) being connected to a pair of parallelly arranged cam plates (25) enabling formation of the isolation path in the event of an extinguished arc or the main current path, said drive shaft (27) in combination with said cam plates (25) on one side, causes said pair of rotable blades (26) to acquire said main current path and, on another side, to acquire the isolation path. One end of each of the rotable blades (26) is in electrical contact with the first switch contact (17) and an opposite end of each rotable blades (26) is in electrical contact with the second switch contact (18), wherein the main current path is formed in a first position of the pair of rotatable blades (26) and an isolation path is formed in a second position of the pair of rotatable blades (26), the pair of rotatable blades (26) is embodied as rotatable by 90° around the drive shaft (27).

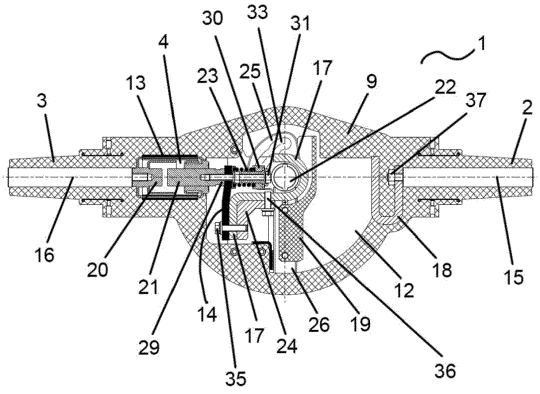

FIG. 8

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Description

Field of the Invention

[0001] The present invention relates to electrical switching devices, and more particularly, relates to the development and operation of a load-break switch which includes a vacuum circuit interrupter allowing the safe interruption of the arc resulting when switching nominal load currents.

Background of the Invention

[0002] Generally, vacuum interrupters used for electrical switching devices, particularly in the 6 to 35 kV voltage range, are known in the prior art. Vacuum interrupters can be used for circuit-breakers, and for load-break switches and contactors.

[0003] Depending on the area of application and the voltage to be switched, load switches are at least in the range of the middle voltage level (up to about 52 kV) often operated in a protective gas atmosphere of SF_6, which quickly extinguishes the gas resulting from the switching arc switching arc and thus prevents destruction of the switch. The use of sulfur hexafluoride (SF_6) gas in the electrical industry as a gaseous dielectric medium for high-voltage circuit breakers, switchgear, and other electrical equipment is known. However, SF_6 gas insulated switches are no longer preferred due to the greenhouse gas effect of SF_6 (approximately 23,900 times that of CO_2). In addition, SF_6 is involved in the degradation and destruction of the ozone layer. Furthermore, it has not yet been conclusively explored which possible decomposition products are formed in the SF_6 atmosphere when a switching arc is extinguished, which in turn may have harmful effects. In addition, switches incorporating SF_6 gas require sealing and such sealed switches generally attract higher maintenance costs to ensure proper operation through the lifetime of the switch. A further issue is the recent introduction of reporting requirements associated with such switches, requiring that the switching apparatus is checked annually to determine any leakage, which must then be reported. This reporting places a significant burden on the operators of any such switch gear.

[0004] Vacuum interrupters have been widely employed in the art because they provide fast, low energy arc interruption with long contact life, low mechanical stress and a high degree of operating safety. In a vacuum interrupter the contacts are sealed in a vacuum chamber. One of the contacts is a moveable contact having an operating member extending through a vacuum seal in the chamber.

[0005] A known circuit breaker from EP-A-342 603, comprises two cartridges or vacuum bottles, arranged one above the other, within an elongate support, borne by a fixed insulating console 'a chassis. The aforementioned known circuit breaker is very large and bulky, and requires a large order of energy, almost double that of a single cartridge. The incorporation of such a circuit breaker in a cell poses serious problems plus the risk of overheating which are also double.

[0006] Furthermore, is also known from EP-A-0433 184 a medium voltage electrical circuit breaker having per pole a support for a cartridge which contains a pair of separable arc contacts one of which is movable, and a mechanism of control for opening and closing the contacts. The cartridge is rigidly secured inside a sealed enclosure filled with a high dielectric strength gas and has an insulating jacket whose creepage distance corresponds to the dielectric withstand of the housing in the high dielectric strength gas.

[0007] Furthermore, is also known from EP-B1- 0542 637 an electrical circuit breaker with two vacuum switch tubes connected in series by an electrical connection to increase the voltage withstand of the pole and which both comprise a movable contact, which two movable contacts are connected by a mechanical connection to open and close the two pairs of contacts simultaneously due to the action of an operating mechanism, a circuit breaker wherein the two cartridges are rigidly secured inside a sealed enclosure, filled with a high dielectric strength gas.

[0008] Finally, EP-B1- 2 789 000 discloses a switching device, more particularly a load interrupter switch, for medium-voltage switching systems comprising a moving contact which is rotatable by means of a rotary support arranged centrally between a first fixed contact and a second fixed contact, wherein a main current path is formed in a first position of the rotatable moving contact and an isolation path is formed in a second position of the rotatable moving contact, the rotatable moving contact is embodied as rotatable through 360°. A blow-out contact system comprises a vacuum interrupter having a contact system that is closable by means of a contact compression spring. A switch-disconnector is arranged in a housing which can be filled with an insulating gas or an insulating liquid.

[0009] It is desirable in this respect to replace SF_6 encapsulated load switch or load switchgear by other switching means. In this case, for example, the vacuum interrupters already used in the higher power range can be used. In these components, two contact elements are arranged via a metallic bellows or similar device movable in an evacuated space, typically a ceramic tube, which form the electrical contact when moving towards each other. Due to the high vacuum with very low residual pressure, the formation of a switching arc is prevented here, or it breaks down again in the absence of ionizable gas immediately after a natural zero crossing.

[0010] There is now a need to further develop a medium-voltage load-break switch having a vacuum circuit interrupter in such a way that it unites a load switching element and a disconnecting switching element in a simple manner, so that an increased degree of freedom is given with regard to the design of the power switching element. In this case, the use of SF_6 or another formed

by an artificial atmosphere insulating medium in the region of the separating switching element can be omitted and in particular the formation of a switching arc can be suppressed particularly reliable.

[0011] There is a need for a load-break switch, without SF6 gas or any other insulating gas or an insulating liquid, which includes a vacuum circuit interrupter that is essentially tailored only to the breaking operation for a nominal load current.

[0012] The general objective of the present invention is to provide a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems, which is inexpensive to produce in a compact design.

[0013] A further objective of the present invention is to provide a compact load-break switch having a vacuum circuit interrupter for medium-voltage switching systems which is simplified in its parts with as few as possible of the same.

[0014] This object is achieved by a medium-voltage load-break switch having a vacuum circuit interrupter having the features of claim 1. Preferred embodiments of the invention are claimed in the dependent claims.

Summary of the Invention

[0015] The present invention relates to a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems. The load-break switch comprises an inner elongated insulating housing enclosing a vacuum interrupter comprising a vacuum chamber containing a fixed contact electrically interconnected with a first line terminal and a movable contact electrically connected to a flexible conductor and a first switch contact, a second switch contact electrically connected with a second load terminal, a pair of parallelly arranged rotable blades, wherein the pair of rotable blades is movable by a drive shaft between a main current path in electrical communication with the fixed contact and an isolation path when the movable contact is spaced apart from the fixed contact, said pair of rotable blades being connected to a pair of parallelly arranged cam plates enabling formation of the isolation path in the event of an extinguished arc or the main current path, said drive shaft in combination with said cam plates on one side, causes said pair of rotable blades to acquire said main current path and, on another side, to acquire the isolation path. One end of each of the rotable blades is in electrical contact with the first switch contact and an opposite end of each rotable blades is in electrical contact with the second switch contact, wherein the main current path is formed in a first position of the pair of rotatable blades and an isolation path is formed in a second position of the pair of rotatable blades, the pair of rotatable blades is embodied as rotatable by 90° around a perpendicular axis of the load-break switch.

[0016] The present invention further relates to a load-break switch for medium-voltage switching systems comprising at least one load-break switch.

Brief Description of the Drawings

[0017] A full understanding of the invention can be gained from the following description of the preferred embodiments when read in conjunction with the accompanying drawings in which:

Figure 1 is a block diagram of a three-pole load-break switch for medium-voltage switching systems;

Figure 2 is a schematic presentation of a three-pole load-break switch having a vacuum circuit interrupter for medium-voltage switching systems;

Figure 3 is a side view of a three-pole load-break switch having a vacuum circuit interrupter for medium-voltage switching systems;

Figure 4 is a cross-section view along line A-A of Figure 3 of a three-pole load-break switch having a vacuum circuit interrupter for medium-voltage switching systems;

Figure 5 is a back view of a three-pole load-break switch having a vacuum circuit interrupter for medium-voltage switching systems;

Figure 6 is a top view of a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems;

Figure 7 is a cross-sectional view of a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems in a closed-circuit position in accordance with the present invention;

Figure 8 is a cross-sectional view of a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems in an open-circuit position in accordance with the present invention;

Figure 9 is a cross-sectional view of a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems in accordance with the present invention;

Figure 10 is a cross-sectional view of a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems in accordance with the present invention; and

Figure 11 is an expanded view of an operating mechanism of a load-break switch having a vacuum circuit interrupter for medium-voltage switching systems in accordance with the present invention.

Detailed description of the Invention

[0018] In electricity transmission and distribution substations a load-break switch is necessary to connect or interrupt the supply when required. Typical reasons for interruption are to control a load, to respond to an overvoltage or to respond to an overload caused by a short circuit. The supply to be switched is generally a three-phase supply, requiring a conductor for each phase, and switching for the three phases.

[0019] The load-break switch 100 for medium-voltage switching systems may comprise at least one load-break switch 1. Referring to Figures 1 and 2, the usual arrangement of a load-break switch 100 for a three-phase circuit consists of a set of three load-break switches 1 each having a vacuum circuit interrupter 4 for medium-voltage switching systems, one for each phase, a motor controller for controlling operation of a driving motor 6, measuring and signaling devices to detect events requiring interruption, a control unit and communication equipment to cause the driving motor to act when required. Within a substation all the equipment is conventionally housed in an enclosure. The control unit comprises a power supply such as battery arrangement connected to power supply such as a solar battery charger including a solar panel, a motor controller connected to the drive motor 6 for operating a mechanical arrangement 28 coupled to a drive shaft 27 providing initiating simultaneous switching operation of each load-break switch 1, and the communication equipment enabling connection to an operator interface for monitoring of distribution network. The control unit is designed to be operated locally and remotely. Measuring devices to detect events requiring interruption may include voltage, current, or other sensors for example to operate relays in protection systems.

[0020] Referring to Figures 3 to 5, the load-break switch 100 for the three-phase circuit for medium-voltage switching systems shows an outer housing 7 in which a compact load-break switch 1 having the vacuum circuit interrupter 4 and centralized actuation according to the invention, is assembled. The outer housing 7 can alternatively provide in its interior an environment in dry air, such as to satisfy gas-pollution prevention requirements. In the example shown, three poles are provided, which are connected on the one hand to phases of a power supply and on the other to respective bars (not shown) of any user. The load-break switch 100 for medium-voltage switching systems may comprise at least one load-break switch 1. The outer housing 7 comprising at least one load-break switch 1 having environment in dry air, wherein an inner insulating housing 9 of each load-break switch 1 is made of a solid dielectric material.

[0021] With reference to figures 6 to 11, the load-break switch 1 having the vacuum circuit interrupter 4 shows the inner insulating housing 9 consisting of a first cover 10 and a second cover 11, said covers 10; 11 composed of two mutually tightly connected half-shells made of a solid dielectric material such as epoxy resin, said half-shells forming an interior 12 of the load-break switch 1. An environment in the interior 12 of the inner insulating housing 9 is dry air. Furthermore, the inner insulating housing 9 in a longitudinal direction, along a longitudinal axis, is elongated and in a transverse direction has significantly smaller thickness than length. The inner insulating housing 9 is generally shell shaped elongated housing. The inner insulating housing 9 encloses the vacuum interrupter 4 comprising a vacuum chamber 13 containing a fixed contact 20 electrically interconnected with a second conductive bar 16 and a movable contact 21 electrically connected to a flexible conductor 14 and a first switch contact 17, and a second switch contact 18 electrically connected via a pair of parallelly arranged rotable blades 26 with a first conductive bar 15, wherein the pair of rotable blades 26 is rotated by means of a pair of parallelly arranged cam plates 25 being rotatably connected to the drive shaft 27 between a main current path in electrical communication with the fixed contact 20 and an isolation path when the movable contact 21 is spaced apart from the fixed contact 20; wherein said pair of rotable blades 26 being mechanically connected to the pair of parallelly arranged cam plates 25 which rotation, on one side, causes electrical connection of the fixed contact 20 and the movable contact 21 to acquire said main current path and, on another side, spacing apart the fixed contact 20 and the movable contact 21 to acquire the isolation path. The pair of parallelly arranged cam plates 25 is arranged in the longitudinal direction perpendicular to the drive shaft 27and the pair of rotable blades 26 is embodied as rotatable by 90° around the drive shaft 27. Further, the pair of parallelly arranged cam plates 25 and the pair of parallelly arranged rotable blades 26 are arranged parallel to each other.

[0022] Inside the inner insulating housing 9 in its interior 12 an environment in dry air is provided. The inner insulating housing 9 is connected to two insulated conical end covers 2 and 3, which define the first conductive bar 15 and the second conductive bar 16, respectively. Each of the first conductive bar 15 and the second conductive bar16 may include a termination structured to electrically connect to a line power cable or a load power cable, or a connector structured to electrically connect to a line power bus or a load power bus. The drive shaft 27 passes through a pass-through hole 22 and is made of an insulting material, supported at its ends and rotatable by means of an operating mechanical arrangement 28 and the driving motor 6, either by local operation or a remote operation. In addition, switching operation may be performed manually by means of an operating handle 8 coupled to the drive shaft 27, said operating handle 8 is arranged at a back side of the load-break switch 100 for the three-phase circuit for medium-voltage switching systems.

[0023] Figures 7 to 11 show an operating mechanism inside of the inner insulating housing 9 in the interior 12. The vacuum circuit interrupter 4 includes a vacuum envelope or sealed vacuum chamber 13 containing the

fixed contact 20 and the movable contact 21 movable along the longitudinal axis of the load-break switch 1 between a closed circuit position (as shown in Figure 7) in electrical communication with the fixed contact 20 and an open circuit position (as shown in Figure 8) spaced apart from the fixed contact 20. The fixed contact 20 is sealed within the vacuum chamber 13 and is connected to the second conductive bar 16 at one end thereof. The movable contact 21 is sealed within the vacuum chamber 13 and movable between a first position in electrical communication with the second conductive bar 16, and a second position, out of electrical communication with the second conductive bar 16. The movable contact 21 further includes a first movable electrical stem 29 electrically connected to the flexible conductor 14 at a first end thereof. The first movable electrical stem 29 sealable penetrates the vacuum chamber 13 and terminates at the first end of the flexible conductor 14. The flexible conductor 14 is in the longitudinal direction connected to a second movable stem 30 by fastening means 31. Between the first end of the flexible conductor 14 and the second movable stem 30 a spring 23 is positioned coaxial with the second movable stem 30. The second movable stem 30 at one end thereof includes a pair of sliding pins 32 extending from the second movable stem 30 in the transverse direction, said sliding pins 32 being integral part of the second movable stem 30. The spring 23 is subjected to stress as a result of the rotation of the drive shaft 27 which involves the rotation of the pair of cam plates 25 with the action of a cam grooves 33 on the pair of sliding pins 32, wherein each cam plate 25 comprises the cam groove 33.

[0024] In particular, it can be seen from the figures 7 to 11 according to the invention that rotation of the pair of cam plates 25 controls the load-break switch 1 between closed and open positions by means of the cam grooves 33 acting on the pair of sliding pins 32.

[0025] In particular, according to the invention, the pair of cam plates 25 is positioned in the longitudinal direction of the load-break switch and in parallel. Each of the cam plate 25, in fact, provides the cam groove 33 which movably houses each pin sliding 32 extending in the transverse direction.

[0026] Each cam plate 25, in its cam groove 33, provides two dead points of opposite ends for each sliding pin 32. The forced shifting of each sliding pin 32 in each cam groove 33 commands the movement of first and second movable electrical stems 29;30 of the movable contact 21 and therefore the same movable contact 21 with respect to the fixed contact 20. Each cam plate 25 includes the pass-through hole 22 coaxially arranged around and mechanically coupled to the drive shaft 27. Further, each cam plate 25 at one end thereof is mechanically connected to the pair of parallelly arranged rotable blades 26 by means of one of a pair of transverse fastening means 34. A first end of each of the rotable blades 26 is in electrical contact with the first switch contact 17 and the other an opposite end of each of the rotable blades 26 is in electrical contact with the second switch contact 18, wherein the main current path is formed in the first position of the pair of rotatable blades 26 and the isolation path is formed in the second position of the pair of rotatable blades 26, the pair of rotatable blades 26 is embodied as rotatable by 90° around the drive shaft 27. The first position of the pair of rotatable blades 26, forming the main current path, is when the pair of rotatable blades 26 is arranged in parallel with the longitudinal axis of the load-break switch 1, wherein the second switch contact 18, the pair of rotable blades 26, the first switch contact 17 and the flexible conductor 14 are in electrical contact, and due to the action of the spring 30, the movable contact 21 and fixed contact 20 are also in electrical contact. The second position of the pair of rotatable blades 26, forming the isolation current path when the movable contact 21 and fixed contact 20 are not in electrical contact, is when the pair of rotatable blades 26 is arranged perpendicular in respect to the longitudinal axis of the load-break switch 1, wherein the second switch contact 18 and the pair of rotable blades 26 are not in electrical contact, and therefore due to the action of the pair of cam plates 25 each comprising the cam groove 33 which movably houses each sliding pin 32 commanding the movement of the first and second movable electrical stems 29;30 of the movable contact 21 and therefore the same movable contact 21 with respect to the fixed contact 20.

[0027] The fixed contact 20, the movable contact 21, the flexible conductor 14, the first switch contact 17 and the second switch contact 18 are arranged along the longitudinal axis of the load-break switch 1.

[0028] The second switch contact 18 has a generally U shape arranged perpendicular to the longitudinal axis of the load-break switch 1, wherein a first surface of the second switch contact 18 is positioned towards the interior 12 of the load-break switch 1, wherein a second surface of the second switch contact 18 is in electrical contact with the first conductive bar 15. The opposite end of pair of rotable blades 26, when rotating from the first position to the second position slide along the first surface of the second switch contact 18.

[0029] An upper side of the pair of the rotatable blades 26 is enclosed by a voltage protective screen 19 which voltage protective screen 19 is fixed to the pair of the rotatable blades 26 and rotates together with the pair of the rotatable blades 26 by 90°.

[0030] The flexible conductor 14 (e.g., a braided conductor; a laminated conductor) electrically connects the movable contact 21 and the first switch contact 17 in a linear or longitudinal direction between the closed-circuit position and the open-circuit position. A second opposite end of the flexible conductor 14 is by means of a fastening means 35 fixed to a first end of the first switch contact 17 and to a first end of a support 24 of the first switch contact 17 ensuring correct electrical contact. The support 24 of the first switch contact 17 has an L-profile and is made of an insulating material. A second opposite end

of the support 24 of the first switch contact 17 also secures a middle part of the first switch contact 17, wherein the middle part of the first switch contact 17 is fixed to the second end of the support 24 by means of a fastening means 36. A second opposite end of the first switch contact 17 is arranged around the pass-through hole 22, wherein the second opposite end of the first switch contact 17 is in electrical contact with the pair parallelly arranged spaced apart rotable blades 26.

[0031] The second end of flexible conductor 14, the first end of the first switch contact 17 and the first end of the support 24 are aligned next to each other in the longitudinal direction perpendicularly to the longitudinal axis. The first switch contact 17 has a curved shape and its first end is extending from the second opposite end of the flexible conductor 14 alongside a part of the flexible conductor 14 and the support 24 towards the pass-through hole 22, wherein the second opposite end of the first switch contact 17 is semicircular and semi-circularly encircles the pass-through hole 22. To ensure correct electrical contact between the flexible conductor 14 and the first switch contact 17 and the pair of blades 26 with the second switch contact 18, a width of the flexible conductor 14 is substantially the same a width of the first switch contact 17, and a width of the second switch contact 18 is such as to ensure correct electrical contact with the pair of parallelly arranged spaced apart rotable blades 26.

[0032] Referring to Figures 10 and 11, the operating mechanism housed inside the inner insulating housing 9 is arranged between a pair of parallelly arranged protective plates 37. Said plates 37 are connected to the support 24 by a pair of transverse fastening means 38. Further, each of said plates 37 comprises the pas-through hole 22 positioned to enable passing through the drive shaft 27.

[0033] Fastening means 34, 35, 36 and 38 are a screw fastening means or any suitable fastening means. The operative mechanism of the load-break switch 1 has additional fastening means (not shown in detail) that ensure connection of the pair of parallelly arranged protective plates 37.

[0034] What has been said and illustrated above shows how a load-break switch according to the invention is particularly compact, eliminating all the connecting lever mechanisms inside of the load-break switch. This is possible thanks to the fact that a single shaft is provided, which controls operation of the load-break switch.

[0035] The single shaft allows there to be a central control which makes the whole assembly particularly simple. It should also be pointed out that the presence of a single control shaft gives great security to the assembly.

[0036] The forms of the structure for producing a compact load-break switch for medium-voltage switching systems and with centralized actuation of the invention, as also the materials and assembly modes, can obviously differ from those shown for illustrative and non-limiting purposes in the drawings.

Claims

1. A load-break switch (1) for medium-voltage switching systems comprising:
   an inner elongated insulating housing (9) enclosing:

   a vacuum interrupter (4) comprising a vacuum chamber (13) containing a fixed contact (20) electrically interconnected with a second conductive bar (16) and a movable contact (21) electrically connected to a flexible conductor (14) and a first switch contact (17);
   a second switch contact (18) electrically connected via a pair of parallelly arranged spaced apart rotable blades (26) with a first conductive bar (15);
   a pair of parallelly arranged spaced apart cam plates (25) being rotatably connected to a drive shaft (27), wherein said pair of rotable blades (26) being mechanically connected to one end of the pair of parallelly arranged spaced apart cam plates (25);
   wherein said pair of rotable blades (26) is movable by means of the drive shaft (27) between a main current path in electrical communication with the fixed contact (20) and an isolation path when the movable contact (21) is spaced apart from the fixed contact (20), said drive shaft (27), on one side, causes said pair of rotable blades (26) to acquire said main current path and, on another side, to acquire the isolation path,
   characterized in that one end of each of the rotable blades (26) is in electrical contact with the first switch contact (17) and an opposite end of each of the rotable blades (26) is in electrical contact with the second switch contact (18), wherein the main current path is formed in a first position of the pair of rotatable blades (26) and an isolation path is formed in a second position of the pair of rotatable blades (26), the pair of rotatable blades (26) is embodied as rotatable by 90° around the drive shaft (27).

2. The load-break switch (1) according to claim 1, wherein each of parallelly arranged cam plates (25) includes a cam groove (33) formed in each plate (25), wherein a pair of sliding pins (32) engaged in each cam groove (33) are being integral part of a second movable stem (30), said sliding pins (32) are extending in a transverse direction perpendicular to a longitudinal axis of the load-break switch (1), where the second movable stem (30) is being mechanically coupled to the movable contact (21) of said vacuum chamber (13).

3. The load-break switch (1) according to claims 1 and 2, wherein the movable contact (21) further includes a first movable electrical stem (29) electrically con-

nected to the flexible conductor (14) at a first end thereof, wherein the other side of the first end of the flexible conductor (14) in a longitudinal direction is connected to the second movable stem (30) by fastening means (31), wherein between the first end of the flexible conductor (14) and the second movable stem (30) a spring (23) is positioned coaxial around the second movable stem (30).

4. The load-break switch (1) according to claims 1 to 3, wherein each of the cam plates (25) includes a pass-through hole (22) coaxially arranged around and mechanically coupled to the drive shaft 27, wherein the drive shaft (27) provides the rotation of the pair of cam plates (25) and forced shifting of each sliding pin (32) in each cam groove (33) that commands the movement of the first and second movable electrical stems (29;30) of the movable contact (21) and therefore the movable contact (21) with respect to the fixed contact (20).

5. The load-break switch (1) according to claim 1, wherein the fixed contact (20), the movable contact (21), the flexible conductor (14), the first switch contact (17) and the second switch contact (18) are arranged in series along the longitudinal axis of the load-break switch (1).

6. The load-break switch (1) according to claims 1 and 5, wherein the second switch contact (18) has a generally U shape and is arranged perpendicular to the longitudinal axis of the load-break switch (1), wherein a first surface of the second switch contact (18) is positioned towards an interior (12) of the inner elongated insulating housing (9) and a second surface of the second switch contact (18) is in electrical contact with the first conductive bar (15), wherein the opposite end of each of rotable blades (26) when rotating from the first position to the second position slide along the first surface of the second switch contact (18).

7. The load-break switch (1) according to claims 1 and 5, wherein the first switch contact (17) has a curved shape and is extending from a second opposite end of the flexible conductor (14) alongside a part of the flexible conductor (14) towards the pass-through hole (22), wherein a second opposite end of the first switch contact (17) is semicircular and semi-circularly encircles the pass-through hole (22).

8. The load-break switch (1) according to claim 8, wherein between the second opposite end of the flexible conductor (14) and the first switch contact (17) a support (24) is arranged, the second opposite end of the flexible conductor (14) is by fastening means (35) fixed to one end of the first switch contact (17) and to a first end of the support (24), a middle part of the first switch contact (17) is fixed to a second end of the support (24) by fastening means (36), wherein the support (24) has an L-profile shape.

9. The load-break switch (1) according to preceding claims, wherein the flexible conductor (14) and the first switch contact (17) have substantially the same width, and a width of the second switch contact (18) is such as to ensure correct electrical contact with the pair of spaced apart rotable blades (26).

10. The load-break switch (1) according to any of preceding claims, wherein the inner insulating housing (9) includes a first cover (10) and a second cover 11, said covers (10; 11) composed of two mutually tightly connected half-shells made of a solid dielectric material, the inner insulating housing (9) having environment in dry air.

11. The load-break switch (1) according to any of preceding claims, wherein the inner insulating housing (9) is connected to two insulated conical end covers (2; 3), which define the first conductive bar (15) and the second conductive bar (16), respectively, said end covers (2;3) are made of the solid dielectric material.

12. The load-break switch (1) according to any of preceding claims, wherein an upper side of the pair of rotatable blades (26) is enclosed by a voltage protective screen (19), the voltage protective screen (19) is fixed to the pair of the rotatable blades (26) and rotates together with the pair of the rotatable blades (26) by 90°.

13. A load-break switch (100) for medium-voltage switching systems comprising at least one load-break switch (1) according to one of the preceding Claims 1 to 12.

14. The load-break switch (100) according to claim 13, wherein further comprises a motor controller for controlling operation of a driving motor (6), measuring and signaling devices to detect events requiring interruption, a control unit and communication equipment enabling connection to an operator interface for monitoring of distribution network and to cause the driving motor (6) to act when required, the motor controller connected to the drive motor (6) for operating a mechanical arrangement (28) coupled to the drive shaft (27) providing initiating simultaneous switching operation of each load-break switch (1), the control unit is designed to be operated locally and remotely.

15. The load-break switch (100) according to claim 13, wherein further comprises an outer housing 7 comprising at least one load-break switch (1), an interior

of the outer housing (7) having environment in dry air, the inner insulating housing (9) of each load-break switch (1) having environment in dry air is made of a solid dielectric material.

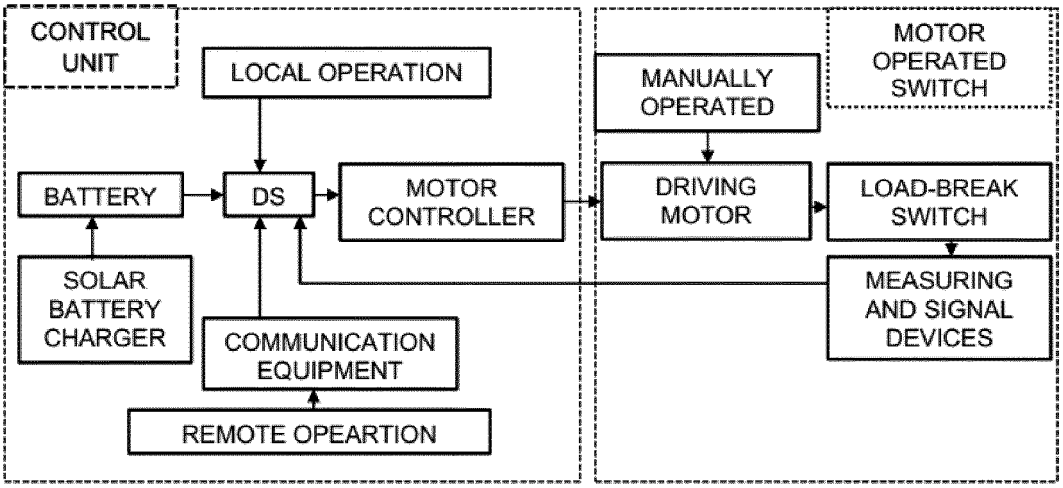
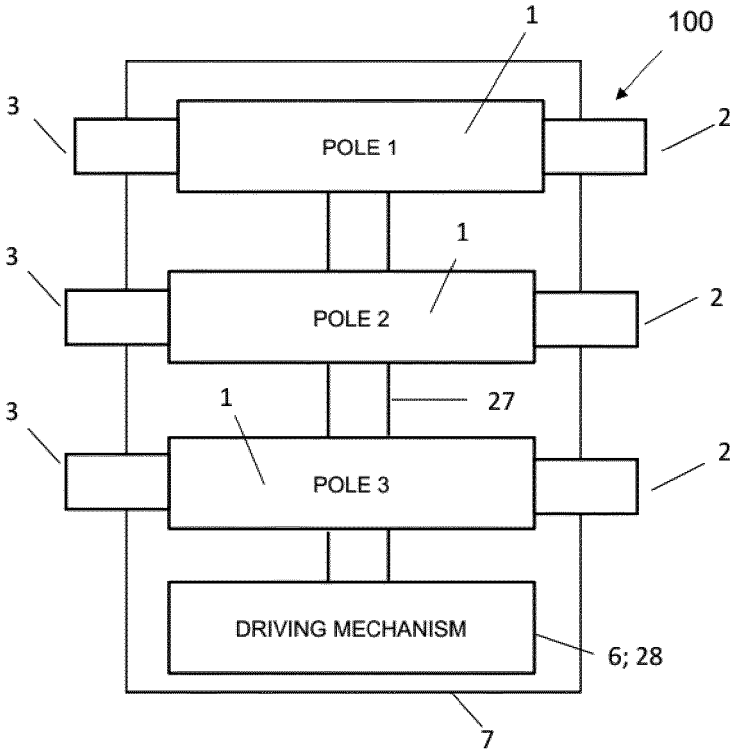

CONTROL UNIT
LOCAL OPERATION
BATTERY
DS
MOTOR CONTROLLER
SOLAR BATTERY CHARGER
COMMUNICATION EQUIPMENT
REMOTE OPEARTION
MANUALLY OPERATED
MOTOR OPERATED SWITCH
DRIVING MOTOR
LOAD-BREAK SWITCH
MEASURING AND SIGNAL DEVICES

FIG. 1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POLE 1
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3
POLE 2
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1
27
3
POLE 3
2
DRIVING MECHANISM
6; 28
7

FIG. 2

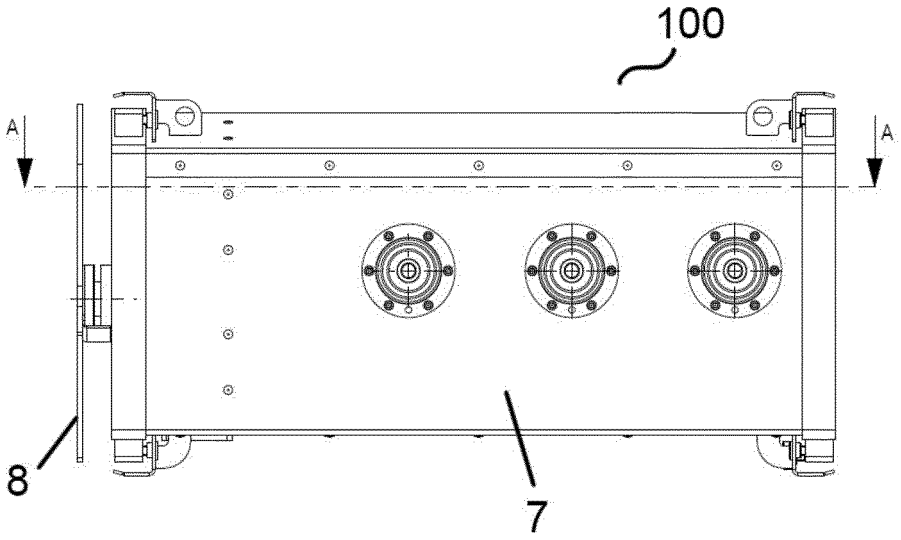

FIG. 3

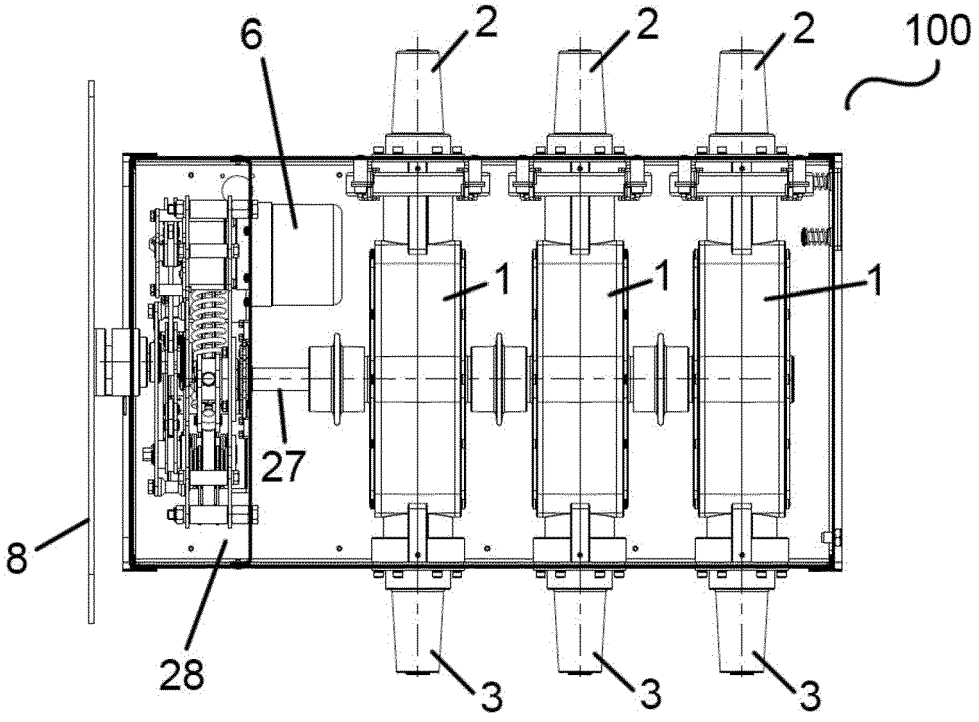

FIG. 4

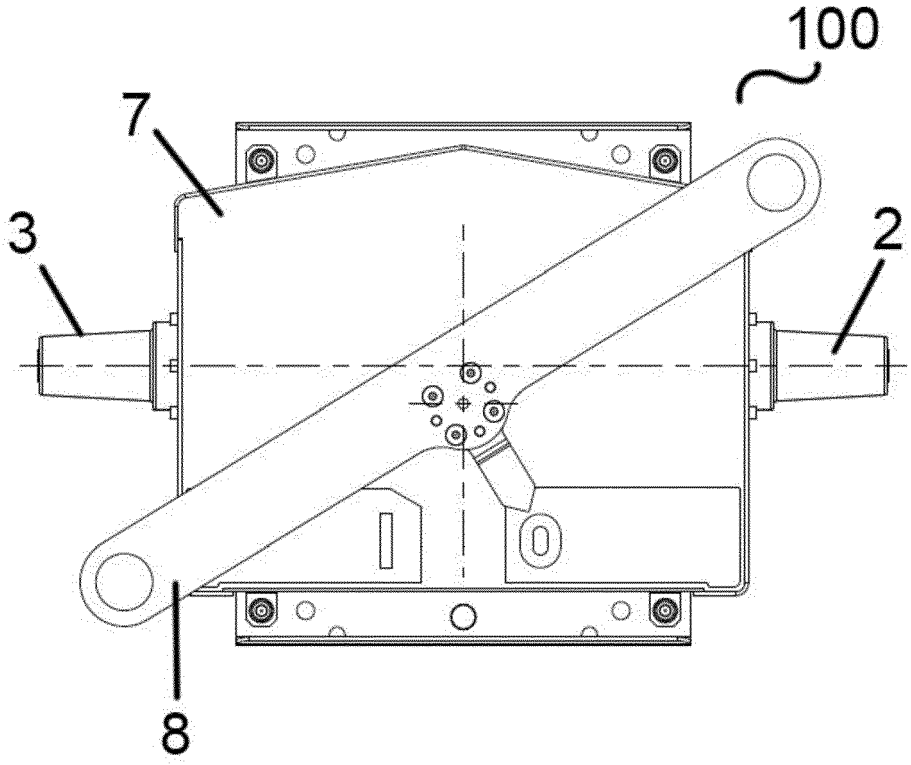

FIG. 5

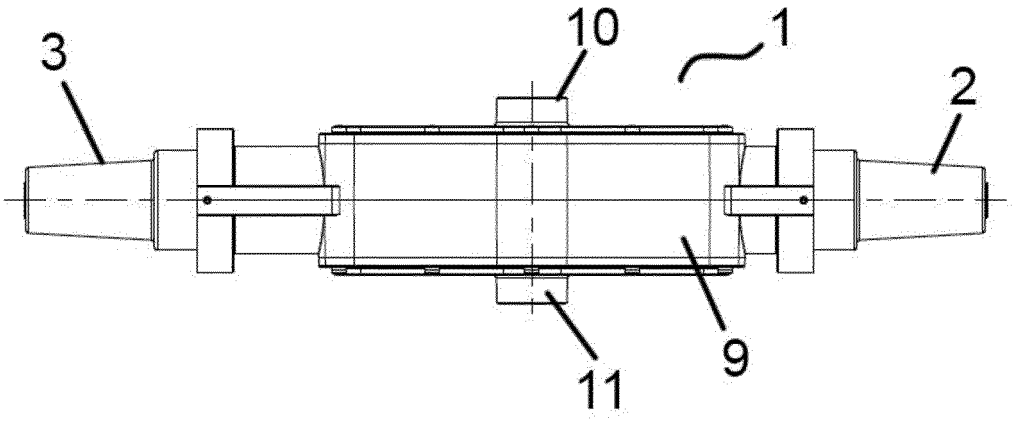

FIG. 6

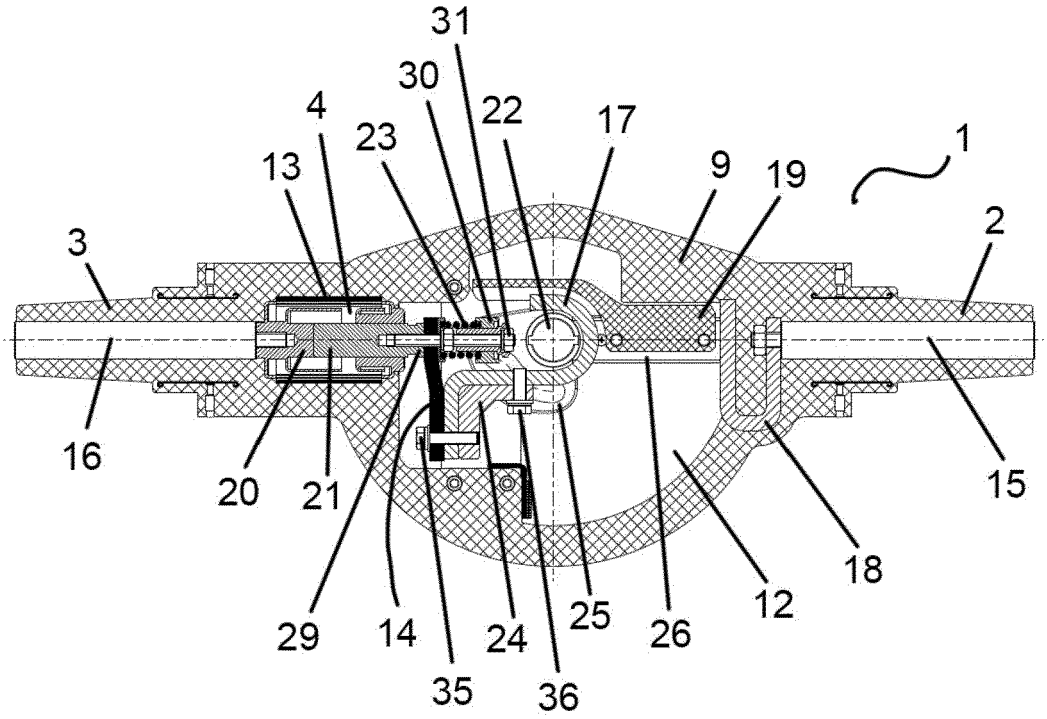
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FIG. 7

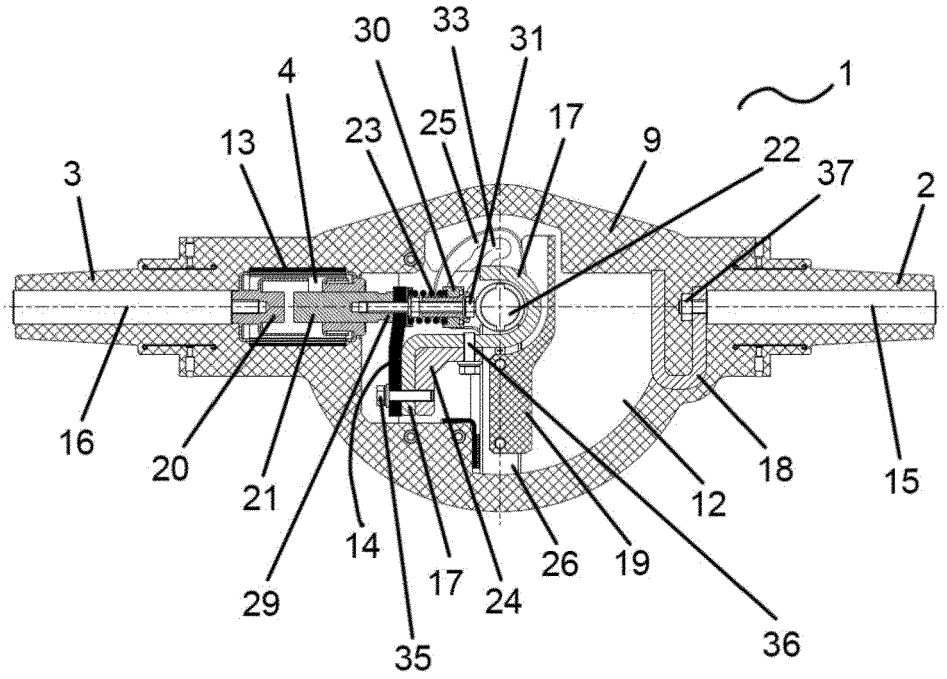
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FIG. 8

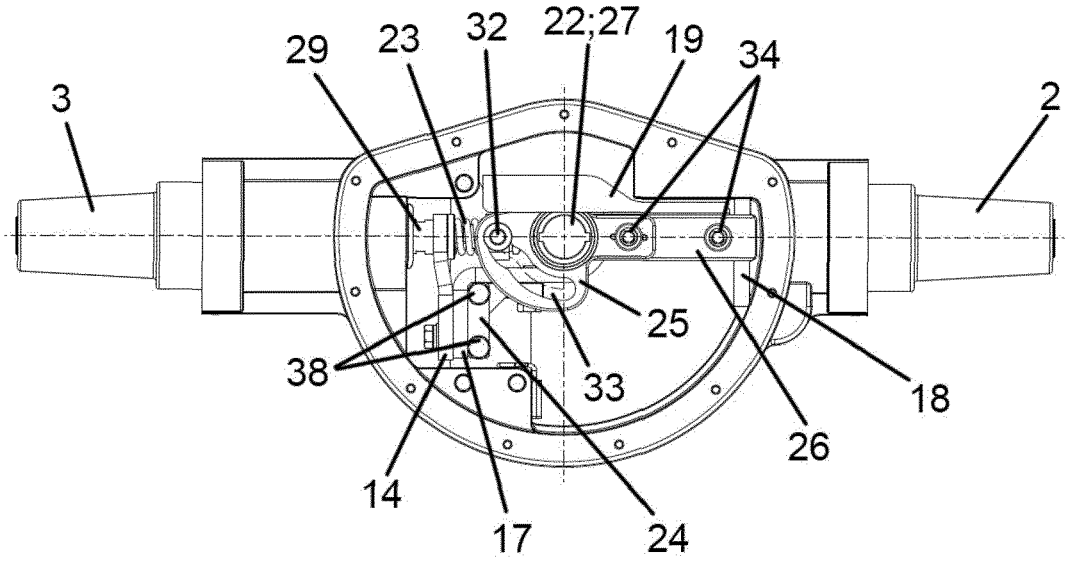
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FIG. 9

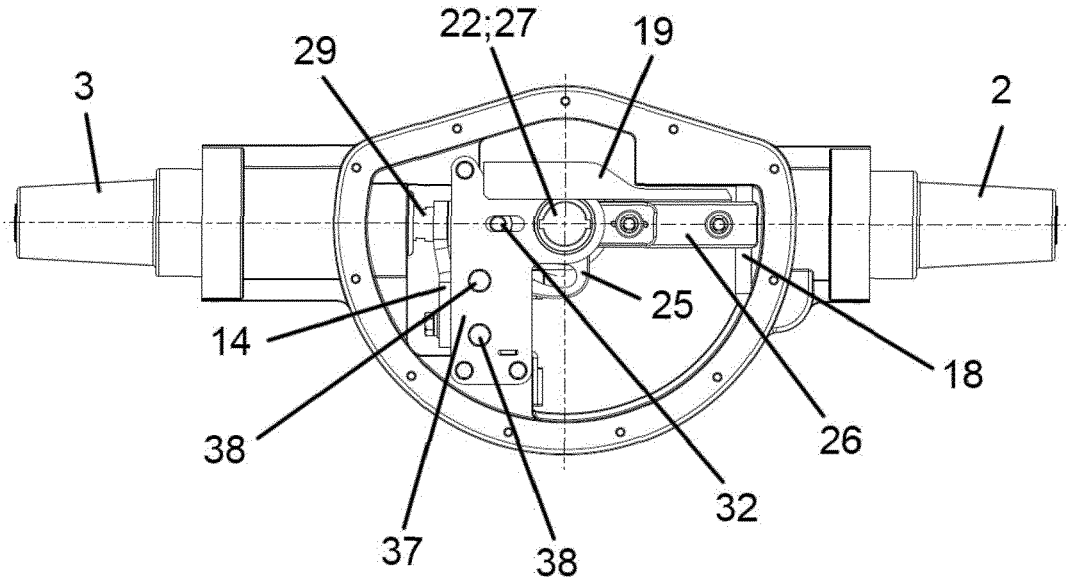
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FIG. 10

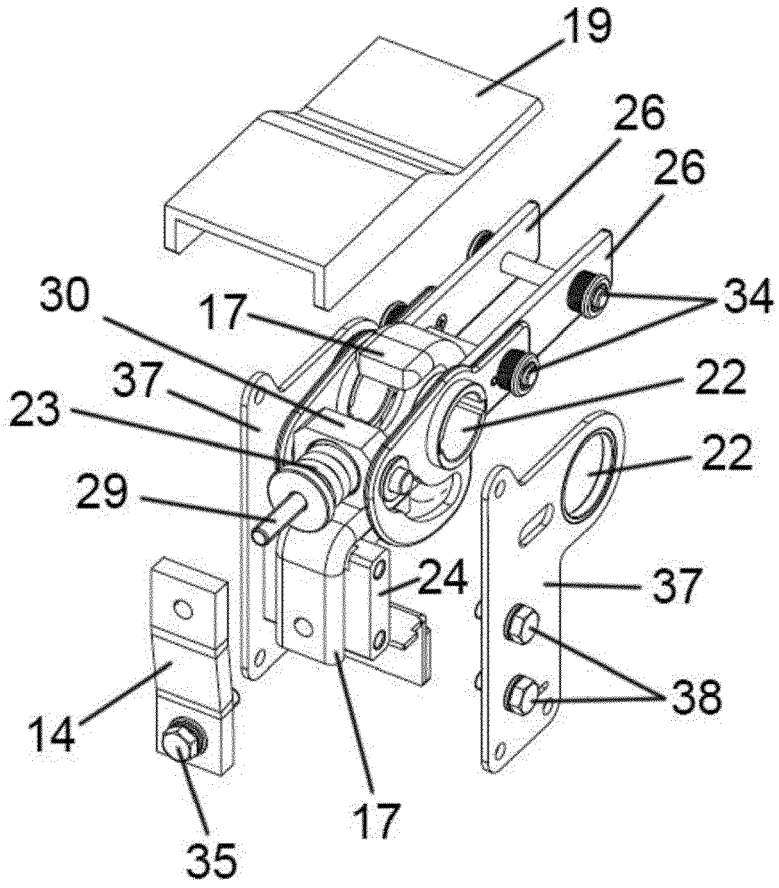

FIG. 11

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 19 02 0727

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 May 2020	Ramírez Fueyo, M

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