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(54) ELECTRICAL SWITCH COMPRISING A FIRST ELECTRICAL CONTACT AND A MOBILE BODY MOVING AXIALLY AT DIFFERENT SPEED

(57) The invention concerns a first electrical connector (2) for a medium or a high voltage gas insulated electrical equipment (1). The first electrical connector (20) comprises a first electrical contact (20), a mobile body (22) and a fixed body (23). The mobile body (20) at least partially delimits with the fixed body (23) a compression chamber (29) to be filled with an arc extinguishing fluid. According to the invention, the first electrical connector (2) comprises an actuation mechanism (30) configured to move the first electrical contact (20) and the mobile body (22) axially with different speeds relative to the fixed body (23).

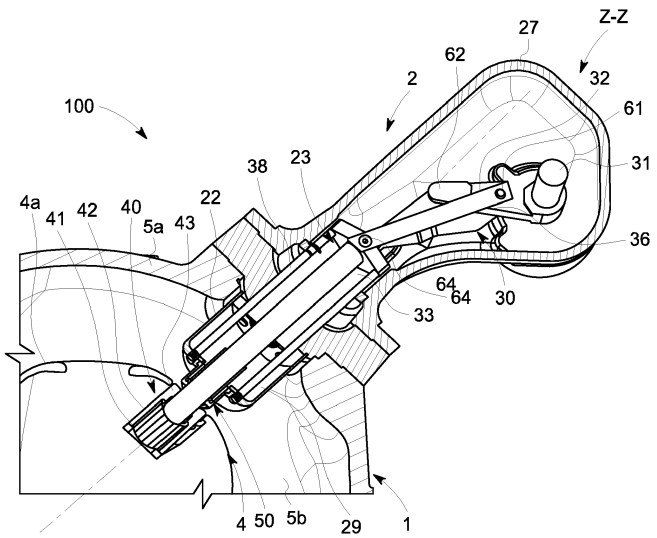

FIG. 2

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Description

TECHNICAL FIELD

[0001] This invention relates to an AC or DC equipment for medium or high voltage application, i.e. 72.5 kV or higher. Such equipment may comprise a circuit breaker, a disconnector or a grounding device.

[0002] In particular, the invention concerns an earthing switch or a disconnector of a gas insulated equipment.

BACKGROUD OF THE INVENTION

[0003] Figure 1 illustrates the general structure of a switch 2 for a gas insulated equipment 1.

[0004] According to known embodiments, each switch comprises a male arcing contact rod and a piston which are rigidly connected to each other to move in a single motion relative to a second electrical contact.

[0005] The piston expels pressurized arc extinguishing gas for blowing out an electric arc formed between the second electrical contact and the male electrical contact when the electrical male contact disengages the second electrical contact.

[0006] However, such a known switch is often heavy and cumbersome so that the switch can efficiently blow out the electrical arc. The switch may use an arc extinguishing gas with greenhouse effect such as SF_6.

PRESENTATION OF THE INVENTION

[0007] The invention concerns an electrical switch for a medium or a high voltage gas insulated electrical equipment. The electrical switch comprises a first electrical contact, a mobile body and a fixed body.

[0008] The first electrical contact is configured to move axially along a longitudinal direction of the first electrical contact to electrically engage a second electrical contact. The mobile body partially delimits a compression chamber to be filled with an arc extinguishing fluid. The mobile body comprises an upper wall of the compression chamber, wherein the upper wall is configured to be the nearest wall of the mobile body to the second electrical contact.

[0009] The fixed body comprising a bottom wall of the compression chamber. The bottom wall closes the compression chamber axially opposite to the upper wall of the mobile body.

[0010] The compression chamber comprises at least an opening through which the arc extinguishing fluid is configured to flow towards an electric arc formed between the first electrical contact and the second electrical contact when the first electrical contact electrically disengages the second electrical contact to blow out the electrical arc.

[0011] The mobile body and the fixed body surround the first electrical contact.

[0012] The mobile body acts as a piston expelling arc extinguishing gas out of the compression chamber when the mobile body moves axially opposite to the second electrical contact. The mobile body moves axially when the first electrical contact electrically disengages the second electrical contact by moving axially.

[0013] According to the invention, the electrical switch comprises an actuation mechanism configured to move the first electrical contact and the mobile body axially and in a same way with different speeds relative to the fixed body.

[0014] Thanks to the electrical switch according to the invention, an arc between the male contact and the female contact can be efficiently blown out with a smaller and lighter switch. Accordingly, the gas insulated equipment can also be smaller and lighter.

[0015] As the electrical arc between the male contact and the female contact is more efficiently blown out by the electrical switch, a less efficient arc extinguishing gas but with less global warming potential can be used, such as a mixture of fluoronitrile, carbon dioxide and dioxygen which is also known as g3 mixture.

[0016] The arc extinguishing gas tends to be expelled at a higher speed and/or with a greater pressure when the male contact is sufficiently away from the female contact so that the electrical arc can be efficiently blown out.

[0017] Preferably, the electrical switch comprises a nozzle inside the opening of the compression chamber. The nozzle comprises at least a hole for expelling arc extinguishing fluid out of the electrical switch.

[0018] The nozzle comprises preferably an annular hole forming a channel around the first electrical contact. The channel most preferably extends from the first electrical contact to a lateral wall of the nozzle surrounding the first electrical contact.

[0019] Preferably, the nozzle comprises through holes through an external lateral wall of the nozzle. The through holes are preferably equally angularly spaced around the first electrical contact.

[0020] In an embodiment, the channel has a diminishing width towards the outside of the electrical switch.

[0021] Alternatively, the channel has a constant width towards the outside of the electrical switch.

[0022] In an embodiment, the channel is tapered towards the outside of the electrical switch.

[0023] Alternatively, the channel is curved towards the outside of the electrical switch.

[0024] In an embodiment, the nozzle has a first channel extending from the first electrical contact to a lateral internal wall of the nozzle surrounding the first electrical contact. The nozzle has a second channel surrounding the first channel and extending from the internal wall to an external lateral wall of the nozzle.

[0025] Preferably, the actuation mechanism is configured to move the mobile body relative to the fixed body at a lower speed than the speed of the first electrical contact relative to the fixed body.

[0026] Preferably, the actuation mechanism comprises a disconnecting lever, at least a linking arm connecting the disconnecting lever to the mobile body by at least a

first link. The first electrical contact is connected to the disconnecting lever by at least a second link.

[0027] The first link and the second link are most preferably pivot link.

[0028] Preferably, the actuation mechanism comprises a rudder through which the first electrical contact is configured to extend and to move axially. An end of the linking arm is fixed to the rudder. The actuation mechanism comprises at least a traction rod extending from the rudder to the mobile body to move the mobile body axially relative to the first electrical contact.

[0029] Preferably, the actuation mechanism comprises a slave connecting rod connecting the first electrical contact to the disconnecting lever by at least a link. Most preferably, the slave connecting rod is connecting the first electrical contact to the disconnecting lever by a pivot link at each longitudinal end of the slave connecting rod.

[0030] Preferably, the fixed body comprises a sleeve surrounding the first electrical contact to guide the first electrical contact axially relative to the fixed body.

[0031] Preferably, the electrical switch comprises a housing surrounding at least part of the actuation mechanism. The fixed body is integral with or fixed to the housing.

[0032] Preferably, the first electrical contact comprises a male arcing contact rod. The mobile body is cylindrical around the longitudinal axis of the male arcing contact rod. The fixed body is annular around the longitudinal axis of the male arcing contact rod.

[0033] Most preferably, the nozzle has a generally cylindrical shape around the longitudinal axis of the male arcing contact rod. Most preferably, the nozzle extends radially between the male arcing contact and the mobile body.

[0034] The invention also relates to a medium or a high voltage gas insulated electrical equipment comprising a first electrical switch as described above, a second electrical connector and a gas insulated enclosure.

[0035] The second electrical connector is a female connector. The second electrical connector comprises a second electrical contact, preferably a tulip type electrical contact. The first electrical contact of the electrical switch is configured to electrically engage the second electrical contact.

[0036] The gas insulated enclosure surrounds the female electrical connector. The gas insulated enclosure at least partially delimits a cavity forming a gap between the second electrical contact and the first electrical contact when the gas insulated equipment is in an opened position. In the opened position of the gas insulated equipment, the male electrical switch is electrically disconnected from the female electrical connector.

[0037] Preferably, the gas insulated electrical equipment wherein the electrical switch is a disconnecting switch or earthing switch for a gas insulated equipment. Most preferably, the gas insulated electrical equipment comprises an electrical switch and an electrical female connector for each phase of an AC electric line.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] This invention will be better understood after reading the following description of example embodiments that are in no way limitative, wherein:

- Figure 1 shows a portion of gas insulated equipment including a grounding switch according to the first embodiment of the invention;
- Figure 2 schematically shows a portion of the gas insulated equipment including a switch according to the first embodiment, wherein the switch is in fully closed position;
- Figure 3 schematically shows a portion of the gas insulated equipment including a switch according to the first embodiment, wherein the grounding switch is in an intermediate closed position;
- Figure 4 schematically shows a portion of the gas insulated equipment including a switch according to the first embodiment, wherein the grounding switch is in a first intermediate opened position;
- Figure 5 schematically shows a portion of the gas insulated equipment including a switch according to the first embodiment, wherein the grounding switch is in a second intermediate opened position;
- Figure 6 schematically shows a portion of the gas insulated equipment including a switch according to the first embodiment, wherein the grounding switch is in a fully opened position;
- Figure 7 illustrates gas flow in a circuit breaker including a switch according to the first embodiment, wherein the grounding switch is in the first intermediate opened position;
- Figure 8 illustrates gas flow in a circuit breaker including a switch according to a second embodiment, wherein the grounding switch is in a first intermediate opened position;
- Figure 9 illustrates gas flow in a circuit breaker including a switch according to a third embodiment, wherein the grounding switch is in a first intermediate opened position;
- Figure 10 illustrates gas flow in a circuit breaker including a switch according to a fourth embodiment, wherein the grounding switch is in a first intermediate opened position;

[0039] Identical, similar or equivalent parts of the different figures are marked with the same numbers for facilitating comparisons between the different figures.

DETAILED PRESENTATION OF PARTICULAR EMBODIMENTS

[0040] Figure 1 shows a portion of an AC gas insulated equipment. The gas insulated equipment 1 comprises enclosures 5 for each phase of the gas insulated equipment 1 and a switch 2 at least partially inside each enclosure 5. Each enclosure 5 is gas insulated. Each en-

closure 5 is to be filled with an arc extinguishing gas such as mixture of fluoronitrile, fluoroketones, carbon dioxide and /or dioxygen.

[0041] The gas insulated equipment 1 is supported on the ground by a supporting frame 6 having legs.

[0042] A drive mechanism 3 commonly actuates each switch 2 at the same time for switching off current of the three phases. The drive mechanism 3 comprises a driver 7 and a drive rod 9 which is driven by the driver 7.

[0043] With reference to Figure 2 to Figure 7, the gas insulated equipment 1 comprises a first male electrical connector 2 and a second high voltage female electrical connector 4 for each phase of the equipment 1. The first male electrical connector 2 is a switch.

[0044] Each female connector 4 is entirely located inside a cavity 5b of an enclosure 5 of the equipment 1. There is a gap between the female electrical connector 4 and a wall 5a of the enclosure towards the male electrical connector 2. The female connector 4 is fixed to the enclosure 5 of the equipment 1.

[0045] The female connector 4 comprises a second female electrical contact 40 and a support structure 4a for holding the female electrical contact 40 inside the enclosure 5.

[0046] The female electrical contact 40 is a tulip type electrical contact comprising a plurality of electrical contact fingers 42 and a base 41 holding the electrical contact fingers 42.

[0047] The female electrical contact 40 is configured to electrically engage a male electrical contact 20 when the earthing switch 2 is in a closed position. In particular, the electrical contact fingers 42 are configured to grasp a conductive head 20b of the male electrical contact 20 when the earthing switch 2 is in a closed position.

[0048] The earthing switch 2 comprises a male electrical contact 20, a mobile body 22, a fixed body 23, a housing 27, a nozzle 50, and an actuation mechanism 30. The male electrical connector 2 is for example an earthing switch of a phase of the AC equipment 1.

[0049] The housing 27 surrounds most of the actuating mechanism 30. It protrudes at least partially from the enclosure 5 to which it is fixed by a flange.

[0050] The male electrical contact 20, the mobile body 22, the fixed body 23, the nozzle 50 and the actuation mechanism 30 are configured to be located at least partially inside the enclosure 5 and inside the housing 27. The fixed body 23 may be fixed or integral with the housing 27.

[0051] The male electrical contact 20, the nozzle 50, the mobile body 22 and the fixed body 23 are each annular along a longitudinal direction X-X of the male electrical contact 20. The nozzle 50, the mobile body 22 and the fixed body 23 each surround the male electrical contact 20.

[0052] The male electrical contact 20 is a male arcing contact rod in the disclosed embodiments. The male arcing rod 20 comprises a shank 20a and a head 20b which is at an end of the shank 20a along a longitudinal direction X-X of the male arcing rod 20.

[0053] The male electrical contact 20 is configured to electrically engage the female electrical contact 40, when the grounding switch 2 is in a closed position. The male electrical connector 20 is configured to be electrically disconnected from the female electrical contact 40 when the grounding switch 2 is in an opened position.

[0054] The male electrical contact 20 is configured to move in translation axially along the longitudinal direction X-X of the male electrical contact 20 relative to the housing 27 and to the fixed body 23 to electrically engage the female electrical contact 40.

[0055] The mobile body 22 has a lateral wall 22a which is cylindrical around the longitudinal axis X-X of the male arcing contact rod. The mobile body 22 also comprises an upper wall 26 at one axial end of the lateral wall 22a nearest to the female contact 40. There is a central opening 22b in the upper wall 26 around the male electrical contact 20.

[0056] The mobile body 22 partially delimits with the fixed body 23 a compression chamber 29 to be filled with an arc extinguishing gas.

[0057] The mobile body 22 is configured to move in translation axially along the longitudinal direction X-X of the male electrical contact 20 both relative to the male electrical contact 20 to the fixed body 23.

[0058] The mobile body 22 acts as a piston expelling arc extinguishing gas out of the compression chamber 29 when the mobile body 22 moves axially opposite to the female electrical contact 40.

[0059] The fixed body 23 comprises a bottom wall 21 of the compression chamber 29 and a sleeve 35 surrounding the male electrical contact 20.

[0060] The bottom wall 21 closes the compression chamber 29 axially opposite to the upper wall 26 of the mobile body 22. The bottom wall 21 is at an axial end of the fixed body 23 closer to the female electrical contact 40.

[0061] The sleeve 35 is configured to guide the male electrical contact 20 axially relative to the fixed body 23.

[0062] The compression chamber 29 comprises at least an opening through which the arc extinguishing gas is configured to flow towards an electric arc formed between the male electrical contact 20 and the female electrical contact 40 when the earthing switch 2 is opening.

[0063] In the first embodiment disclosed in Figures 2 to 6, the compression chamber 29 is able to be in fluid communication with the outside of the male electrical connector 2 through a first channel 51 around the male electrical contact 20 in a first intermediate opened position of the earthing switch 2 or by through holes 57 of the nozzle 50 when the earthing switch 2 is opened in a second intermediate opened position.

[0064] The nozzle 50 has a cylindrical shape around the longitudinal axis X-X of the male electrical contact 20. The nozzle 50 extends radially between the male electrical contact 20 and the mobile body 22 through the central opening 22b of the mobile body 22. The nozzle

50 has a central orifice 55 configured to surround the male electrical contact 20.

[0065] The nozzle 50 delimits at least partially at least a channel 51 to conduct arc extinguishing gas towards the female electrical contact 40 when the earthing switch 2 is opening. The channel 51 extends from the male electrical contact 20 to a lateral wall 52, 54 of the nozzle 50 surrounding the male electrical contact 20.

[0066] In the first disclosed embodiment with reference to Figures 2 to 6, the nozzle 50 comprises a first channel 51a and a second channel 53 surrounding the first channel 51a. The first channel 51a extends from the male electrical contact 20 to an internal lateral wall 54 of the nozzle 50 surrounding the male electrical contact 20.

[0067] The second channel 53 surrounds the first channel 51a and extends from the internal lateral wall 54 to an external lateral wall 52 of the nozzle 50.

[0068] The nozzle 50 comprises through holes 57 through the external lateral wall 52 of the nozzle 50. The through holes 57 are preferably equally angularly spaced around the male electrical contact 20. They are in fluid communication with the second channel 53 when the male electrical contact 20 is sufficiently retracted into the housing 27 when the switch 2 is opening.

[0069] The actuation mechanism 30 comprises an entrance gear 31, a disconnecting lever 32, a slave connecting rod 34, two linking arms 36, a rudder 35 and traction rods 38.

[0070] The actuation mechanism 30 is configured to move the male electrical contact 20 and the mobile body 22 axially with different speeds relative to the fixed body 23. More precisely, the actuation mechanism 30 is configured to move the mobile body 22 relative to the fixed body 23 at a lower speed than the speed of the male electrical contact 20 relative to the fixed body 23.

[0071] The entrance gear 31 is mechanically coupled to the drive mechanism 3. The entrance gear 31 is configured to rotate the disconnecting lever 32 when it is driven in rotation by the drive command rod 9 of the drive mechanism 3.

[0072] The disconnecting lever 32 is a lever arm having a first longitudinal end coupled to the entrance gear 31. The disconnecting lever 32 has a second longitudinal end opposite to the first longitudinal end wherein the disconnecting lever 32 is coupled to the male electrical contact 20 through the slave connecting rod 34.

[0073] With reference to Figure 2 and Figure 6, the disconnecting lever 32 is configured to pivot from a first position closer to the female electrical contact 40 when the switch 2 is in a fully opened position to a second position farther from the female electrical contact 40 when the switch 2 is in a fully closed position.

[0074] The slave connecting rod 34 is connecting the male electrical contact 20 to the disconnecting lever 32 by a second link 62 and a third link 63. The slave connecting rod 34 is configured to have a rotation movement following the rotation of the disconnecting lever 32 and to move with an axial movement by moving the male electrical contact 20 axially.

[0075] The second link 62 is a pivot link between the slave connecting rod 34 and the disconnecting lever 32. The second link 62 is at a first longitudinal end of the slave connecting rod 34 and a second longitudinal end of the disconnector lever 32.

[0076] The third link 63 is a pivot link between the male electrical contact 20 and the slave connecting rod 34. The third link 63 is at a second longitudinal end of the slave connecting rod 34 and a first longitudinal end of the male electrical contact 20 opposite to the head 20b of the male electrical contact 20.

[0077] The linking arms 36 both connect the disconnecting lever 32 to the mobile body 22 by a first link 61 and they are fixed to a rudder. The linking arm 36 connect the disconnecting lever 32 to the rudder 35 to move the rudder 35 axially when the disconnecting lever 32 is pivoting.

[0078] The first link 61 is a pivot link between the disconnecting lever 32 and each of the linking arms 36. The first link 61 is at a first longitudinal end of the disconnecting lever 32 and at a first longitudinal end of each of the linking arms 36.

[0079] The linking arm 36 are each fixed to the rudder 35 at a second longitudinal end of the linking arms opposite to the first longitudinal end of the linking arms 36.

[0080] The rudder 35 comprises a central hole through which the male electrical contact 20 extends and through which the male electrical contact 20 is configured to move axially, e.g. by sliding. The linking arms 36 are fixed to the rudder 35 near the central hole. The rudder 35 is configured to guide axially together with the fixed body 23 the male electrical contact 20 and the mobile body 22.

[0081] The actuation mechanism 30 comprises two traction rods 38 which are fixed to the rudder 35 at a longitudinal end of the rudder 35. The traction rods 38 may also be integral with the rudder 35.

[0082] A first longitudinal end of the traction rods 38 is fixed to the rudder. A second longitudinal end of the traction rods 38 opposite to the first longitudinal end is fixed to the upper wall 26 of the mobile body 22. The traction rods 38 extend each parallel to the male arcing contact rod 20.

[0083] The traction rods 38 are each configured to move in translation along the longitudinal direction X-X of the male electrical contact 20 to move the mobile body 22 axially relative to the male electrical contact 20. The traction rods 38 are configured to pull the mobile body 22 axially relative to the fixed body 23 and to the housing 27 when the switch 2 is opening.

[0084] A method 100 of electrically disconnecting the male electrical connector 2 from the female electrical connector 4 is illustrated with reference to Figures 2 to 7.

[0085] With reference to Figure 2, the switch 2 is in fully closed position. The male electrical connector 2 is electrically connected to the female electrical connector 40. The conductive head 20b of the male electrical connector 20 is grasped by the electrical fingers 42 of the

female electrical contact 40. An arc extinguishing gas is in the compression chamber 29 at a pressure which is similar to the pressure in the cavity 5b.

[0086] With reference to Figure 3, the switch 2 is in an intermediate closed position. The head 20b of the male electrical connector 2 is mechanically disengaging the electrical contact fingers 42 at a step 101. The mobile body 22 is starting to move axially towards the housing 27 so as the male electrical connector 20 at a step 103. The arc extinguishing gas inside the compression chamber 29 is compressed. Arc extinguishing gas starts being expelled from the male connector 2 into the cavity 5b through the first channel 51a in the direction of Arrow A towards the female electrical contact 40 at a step 105.

[0087] With reference to Figure 4 and to Figure 7, the switch 2 is in a first intermediate opened position. The head 20b of the male electrical connector 2 is moving axially inside the nozzle 50. The head 20b is flush with the through holes 57 of the nozzle 50 at a step 107. Arc extinguishing gas is still expelled from the male connector 2 through the first channel 51a in the direction of Arrow A towards the female electrical contact 40 at a step 105. Arc extinguishing gas starts being expelled from the male connector 2 through the secondary channel 53 and then through the through holes 57 of the nozzle 50 into the cavity 5b in the direction of Arrow B towards the female electrical contact 40 at a step 109.

[0088] With reference to Figure 5, the switch 2 is in a second intermediate opened position. The head 20b of the male electrical connector 2 is still moving axially inside the nozzle 50 but the head 20b no longer closes the through holes 57 of the nozzle 50. Arc extinguishing gas at this stage is still expelled from the male connector 2 through the secondary channel 53 and then through the through holes 57 of the nozzle 50 into the cavity 5b in the direction of Arrow B towards the female electrical contact 40.

[0089] With reference to Figure 6, the switch 2 is in a fully opened position. The male electrical contact 20 is electrically disconnected from the female electrical contact 40. There is a gap between the male electrical connector 2 and the female electrical connector 4 through the cavity 5b. The head 20b of the male electrical conductor 20 is inside the nozzle 50 and abuts an end of the nozzle. Almost all Arc extinguishing gas has been expelled from the compression chamber 29 and electric arcs have been blown out in a step 113.

[0090] Figure 8 discloses a switch 2 including a male electrical connector 2 according to a second embodiment of the invention. The male electrical connector 2 of the second embodiment is identical with the one of the first embodiment except for the nozzle 50.

[0091] The nozzle 50 of the male connector 2 of the second embodiment has only a first channel 51b. This first channel 51b extends from the male contact arcing rod 20 to an external lateral wall 52 of the nozzle 50. An arc extinguishing gas flow can be expelled from the male connector 2 through the first channel 51b along the direction of arrow D.

[0092] The inner surface of the external lateral wall 52 is curved and the first channel 51a has a diminishing width d3 towards the central orifice 55 of the nozzle 50. Hence, gas flow speed is increased towards the central orifice 55 of the nozzle and an electric arc may be blown more efficiently.

[0093] Figure 9 discloses a switch 2 including a male electrical connector 2 according to a third embodiment of the invention. The male electrical connector 2 of the third embodiment is identical with the one of the second embodiment except for the nozzle 50.

[0094] The nozzle 50 of the male connector 1 of the third embodiment has a first channel 51c having a constant width d4 along the whole axial length of the nozzle 50. An arc extinguishing gas flow can be expelled from the male connector 2 through the first channel 51c along the direction of arrow C. The nozzle 50 according to the third embodiment is easier to manufacture than the one of the male connector 1 of the first embodiment.

[0095] Figure 10 discloses a switch 2 including a male electrical connector 2 according to a fourth embodiment of the invention. The male electrical connector 2 of the fourth embodiment is identical with the one of the second embodiment except for the nozzle 50.

[0096] The nozzle 50 of the male connector 1 of the fourth embodiment has a tapered first channel 51d. The first channel 51d has a first tapered portion with a diminishing width d5 towards the exit of the male connector 1. A second portion of the first channel 51d nearer the exit of the nozzle 50 has a constant width. An arc extinguishing gas flow can be expelled from the male connector 2 through the first channel 51d in the direction of arrow E. Gas flow speed is also increased in the tapered section of the first channel 51d.

[0097] Thanks to the switch 2 according to the invention, an arc between the male arcing rod 20 and the female contact 40 can be efficiently blown out with a smaller and lighter switch 2. Accordingly, the switch 2 including can also be smaller and lighter. It is possible to use an arc extinguishing gas with smaller greenhouse effect in the switch 2, such as alternative gas mixtures to SF_6.

[0098] The mobile body 22 moves axially at a lower speed than the male electrical contact 20. Hence, the arc extinguishing gas tends to be expelled at a higher speed and at a higher pressure when the male electrical contact 20 is sufficiently far away from the female electrical contact 40 and when an electric arc can be efficiently blown out.

[0099] The above described embodiments could of course be modified by the man of ordinary skill in the art.

[0100] The first electrical connector 2 can be a female electrical connector and the second electrical connector 4 is then a male electrical connector.

[0101] The electrical connector 2 can be used in a disconnector and/or a grounding device.

[0102] The male electrical connector 2 can be without nozzle 50. In that case, the arc extinguishing gas can be

expelled through the mobile body 22.

[0103] The actuation mechanism 30 may comprise a cam and a cam follower outside of the entrance gear 31.

[0104] The actuation mechanism 30 can comprise more than two traction rods 38. The traction rods 38 can be replaced by a single tube surrounding the male electrical contact 20.

[0105] The first link 61, the second link 62 and/or the third link 63 can comprise a ball joint link instead of a pivot link.

Claims

1. Electrical switch (2) for a medium or a high voltage gas insulated electrical equipment (1) comprising:

   a first electrical contact (20) configured to move axially along a longitudinal direction (X-X) of the first electrical contact (20) to electrically engage a second electrical contact (40),
   a mobile body (22) partially delimiting a compression chamber (29) to be filled with an arc extinguishing fluid, wherein the mobile body (22) comprises an upper wall (26) of the compression chamber, wherein the upper wall (26) is configured to be the nearest wall of the mobile body (22) to the second electrical contact (40),
   a fixed body (23) comprising a bottom wall (21) of the compression chamber (29), wherein the bottom wall (21) closes the compression chamber (29) axially opposite to the upper wall (26) of the mobile body (22),
   wherein the compression chamber (29) comprises at least an opening through which the arc extinguishing fluid is configured to flow towards an electric arc formed between the first electrical contact (20) and the second electrical contact (40) when the first electrical contact (20) electrically disengages the second electrical contact (40) to blow out the electrical arc,
   wherein the mobile body (22) and the fixed body (23) surround the first electrical contact (20),
   wherein the mobile body (22) acts as a piston expelling arc extinguishing gas out of the compression chamber (29) when the mobile body (22) moves axially opposite to the second electrical contact (40),
   wherein the mobile body (22) moves axially when the first electrical contact (20) electrically disengages the second electrical contact (40) by moving axially,
   characterized in that the electrical switch (2) comprises an actuation mechanism (30) configured to move the first electrical contact (20) and the mobile body (22) axially and in a same way with different speeds relative to the fixed body (23).

2. The electrical switch according to the preceding claim, comprising a nozzle (50) inside the opening of the compression chamber (29), wherein the nozzle (50) comprises at least a hole for expelling arc extinguishing fluid out of the first electrical switch (2), wherein the nozzle (50) comprises preferably an annular hole forming a channel (51) around the first electrical contact (20), wherein the channel (51) most preferably extends from the first electrical contact (20) to a lateral wall (52, 54) of the nozzle (50) surrounding the first electrical contact (20).

3. The electrical switch according to the preceding claim, wherein the nozzle (50) comprises through holes (57) through an external lateral wall (52) of the nozzle (50), wherein the through holes (57) are preferably equally angularly spaced around the first electrical contact (20), and/or
   wherein the channel (51) has a diminishing width (d3, d5) towards the outside of the first electrical switch (2).

4. The electrical switch according to any one of preceding claim 2 and claim 3, wherein the channel (51) has a constant width (d4) towards the outside of the first electrical switch (2), or
   wherein the channel (51) is tapered towards the outside of the first electrical switch or wherein the channel (51) is curved towards the outside of the first electrical switch (2).

5. The electrical switch according to any one of the preceding claims 1 to 3, wherein the nozzle (50) has a first channel (51) extending from the first electrical contact (20) to an internal lateral wall (54) of the nozzle (50) surrounding the first electrical contact (20), and wherein the nozzle (50) has a second channel (53) surrounding the first channel (51) and extending from the internal lateral wall (54) to an external lateral wall (52) of the nozzle (50).

6. The electrical switch according to any one of the preceding claims, wherein the actuation mechanism (30) is configured to move the mobile body (22) relative to the fixed body (23) at a lower speed than the speed of the first electrical contact (20) relative to the fixed body (23).

7. The electrical switch according to any one of the preceding claims, wherein the actuation mechanism (30) comprises a disconnecting lever (32), at least a linking arm (36) connecting the disconnecting lever (32) to the mobile body (22) by at least a first link (61), and wherein the first electrical contact (20) is connected to the disconnecting lever (32) by at least a second link (62),
   wherein the first link (61) and the second link (62) are preferably pivot link.

8. The electrical switch according to the preceding claim, wherein the actuation mechanism (30) comprises a rudder (35) through which the first electrical contact (20) is configured to extend and to move axially,
wherein an end of the linking arm (36) is fixed to the rudder (35), and wherein the actuation mechanism (30) comprises at least a traction rod (38) extending from the rudder (35) to the mobile body (22) to move the mobile body (22) axially relative to the fixed body (23).

9. The electrical switch according to any one of the preceding claims 6 and 7, wherein the actuation mechanism (30) comprises a slave connecting rod (34) connecting the first electrical contact (20) to the disconnecting lever (32) by at least a link, preferably a pivot link at each longitudinal end of the slave connecting rod (34).

10. The electrical switch according to any one of the preceding claims, wherein the fixed body (23) comprises a sleeve (35) surrounding the first electrical contact (20) to guide the first electrical contact (20) axially relative to the fixed body (23), and/or
wherein the first electrical switch (2) comprises a housing (27) surrounding at least part of the actuation mechanism (30), wherein the fixed body (23) is integral with or fixed to the housing (27).

11. The electrical switch according to any one of the preceding claims, wherein the first electrical contact (20) comprises a first arcing contact rod,

wherein the mobile body (22) is cylindrical around the longitudinal axis (X-X) of the first arcing contact rod, wherein the fixed body (23) is annular around the longitudinal axis (X-X) of the first arcing contact rod, and
preferably wherein the nozzle (50) has a generally cylindrical shape around the longitudinal axis (X-X) of the first arcing contact rod, the nozzle (50) extending preferably radially between the first arcing contact and the mobile body (22).

12. A medium or a high voltage gas insulated electrical equipment (1), comprising:

a first switch (2) according to any one of the preceding claims, and
a second electrical connector (4) comprising a second electrical contact (40), preferably a tulip type electrical contact, wherein the first electrical contact (20) of the first electrical switch (2) is configured to electrically engage the second electrical contact (40),
a gas insulated enclosure (5) surrounding one of the first electrical switch (2) and of the second electrical connector (4), the gas insulated enclosure (5) at least partially delimiting a cavity (5b) forming a gap between the second electrical contact (40) and the first electrical contact (20) when the gas insulated equipment (1) is in an opened position wherein the first electrical switch (2) is electrically disconnected from the second electrical connector (4).

13. A medium or a high voltage gas insulated electrical equipment (1) according to claim 12, wherein the first electrical switch (2) is an earthing switch of the gas insulated equipment, and wherein the gas insulated electrical equipment (1) preferably comprises a first electrical switch (2) and a second electrical connector (4) for each phase of an AC electric line.

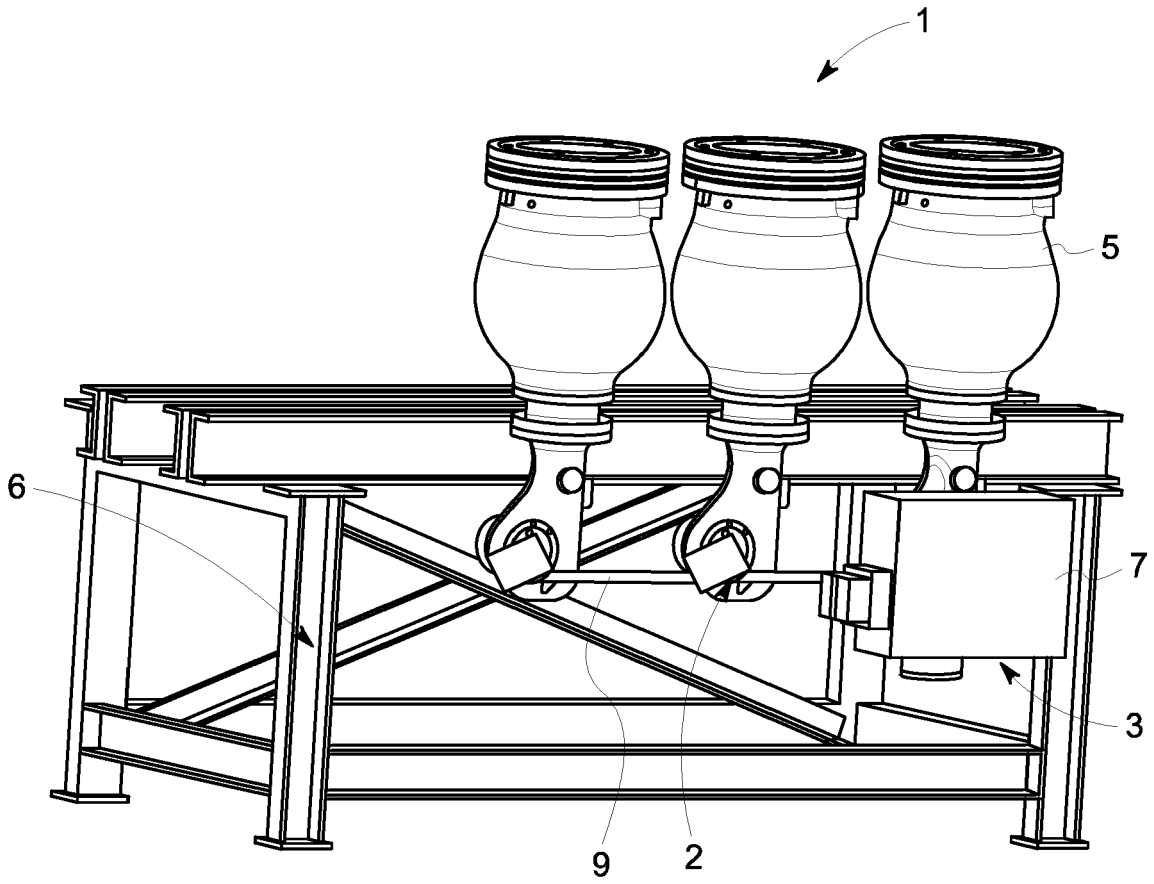

FIG. 1

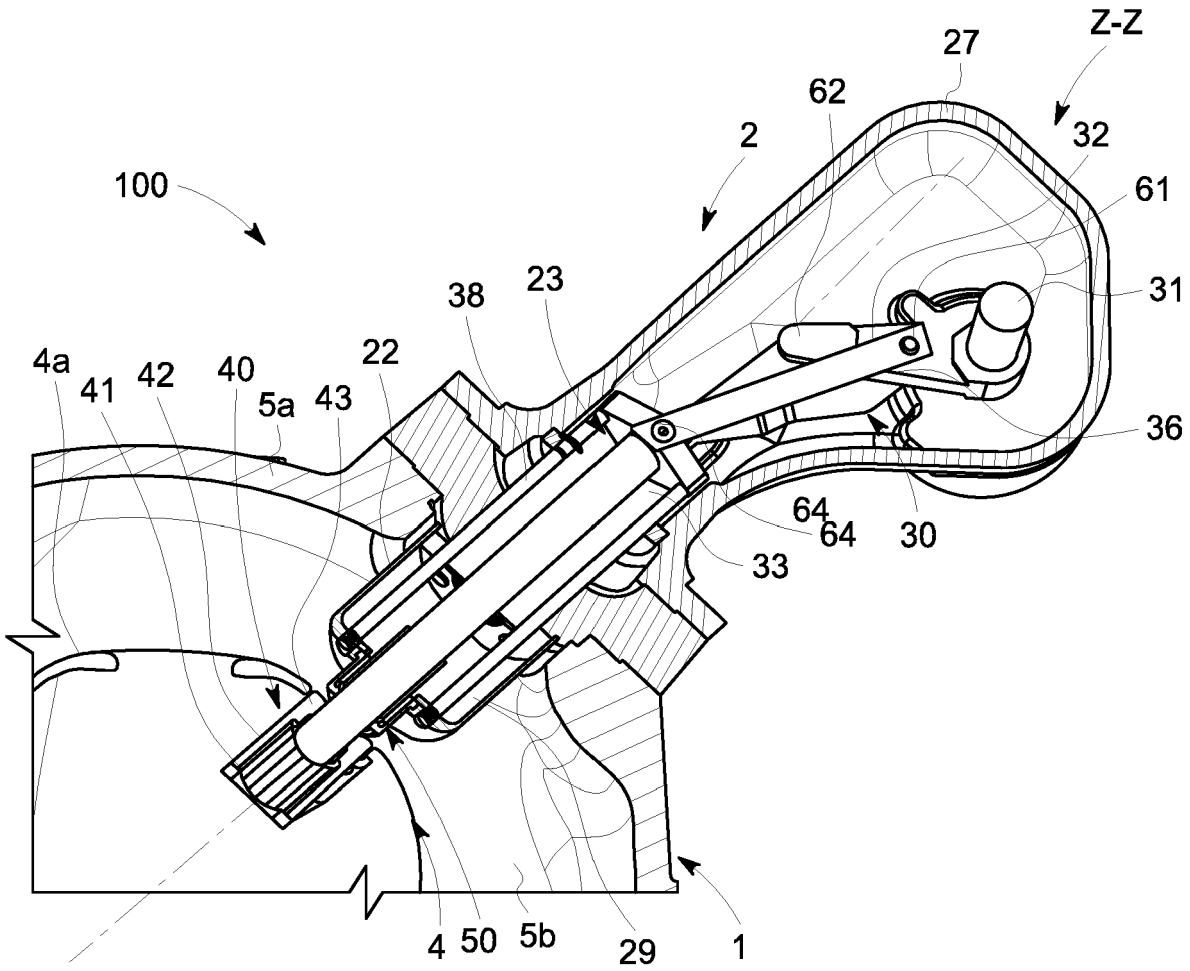
Z-Z
27
62
2
32
100
61
31
38
23
4a
41
42
40
22
5a
43
36
64
64
30
33
4
50
5b
29
1

FIG. 2

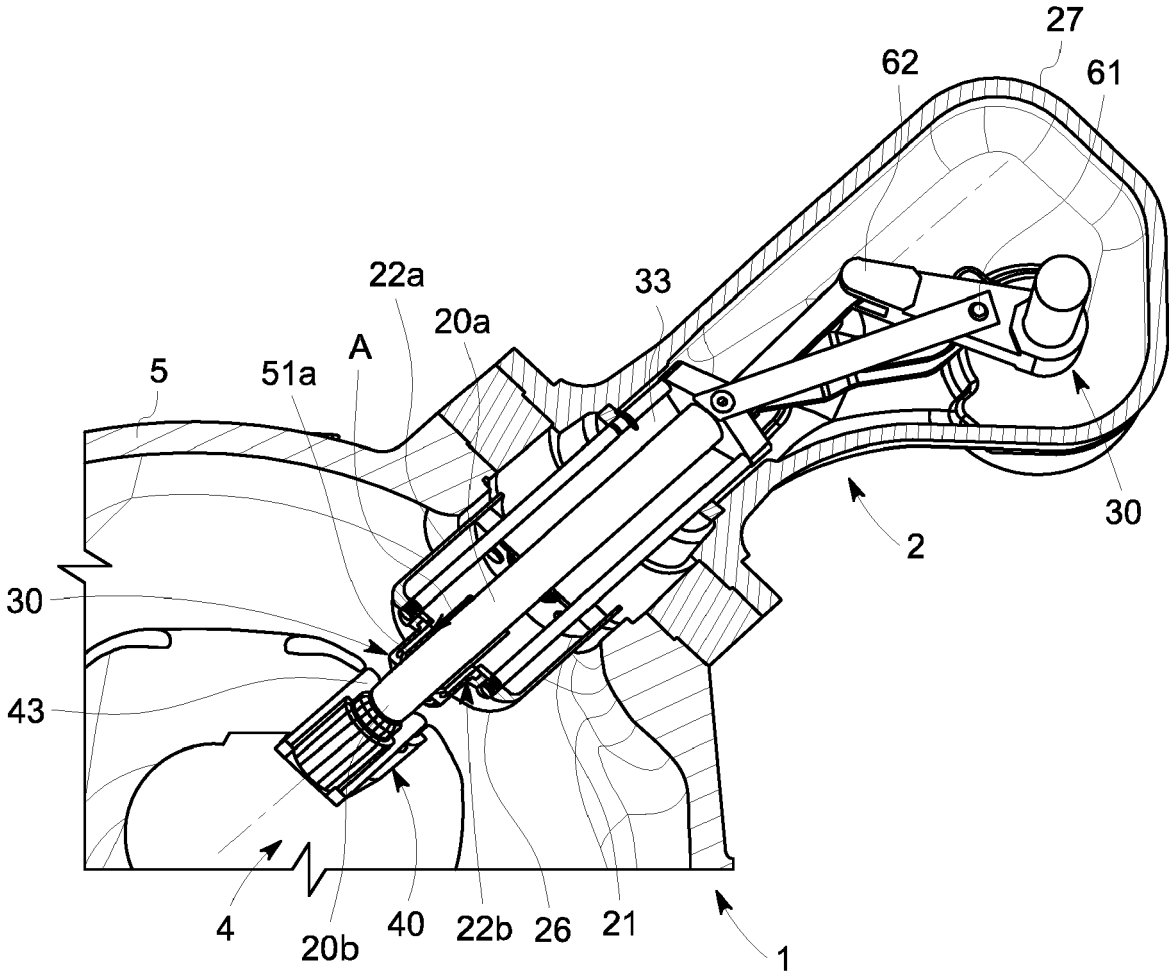

FIG. 3

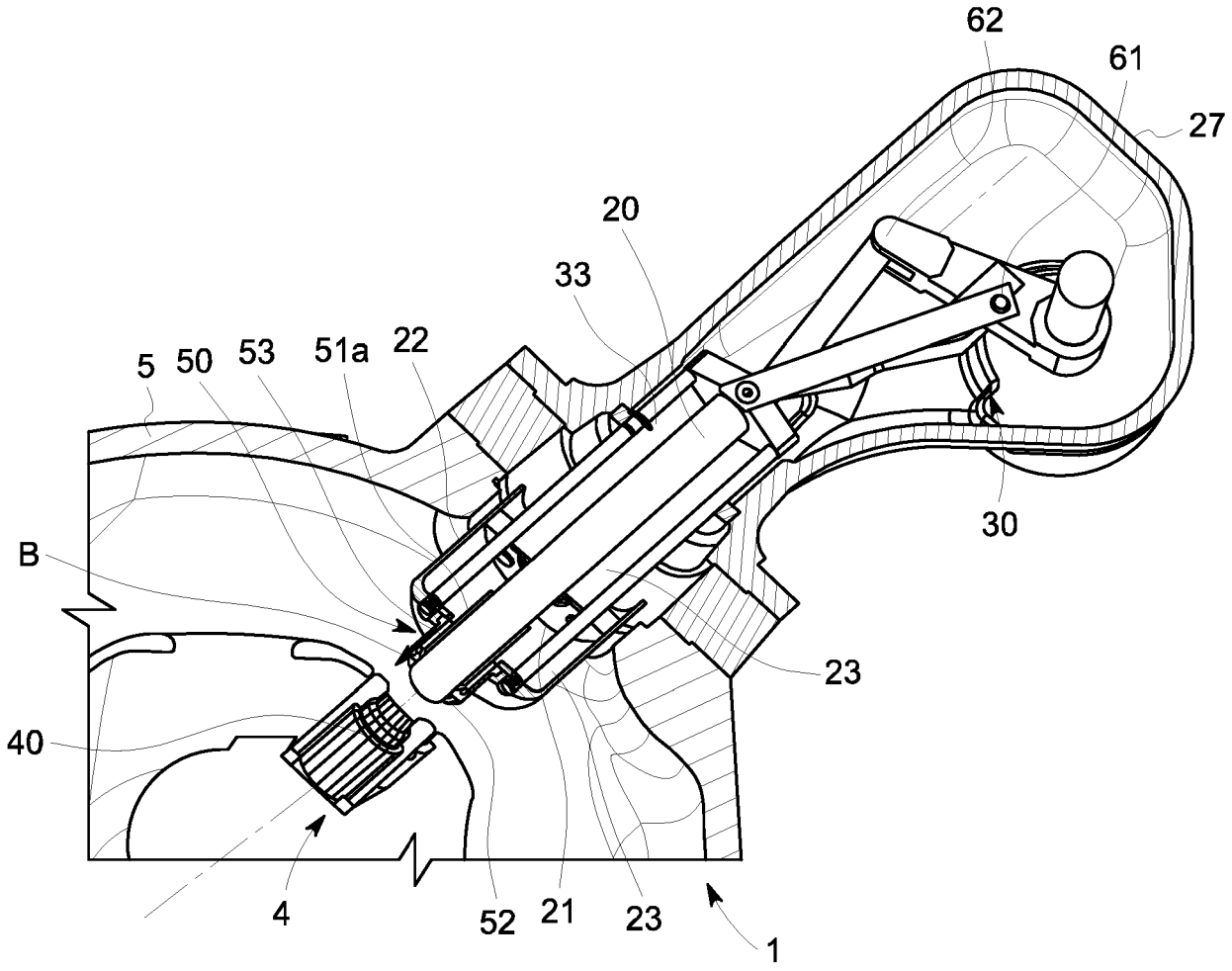

FIG. 4

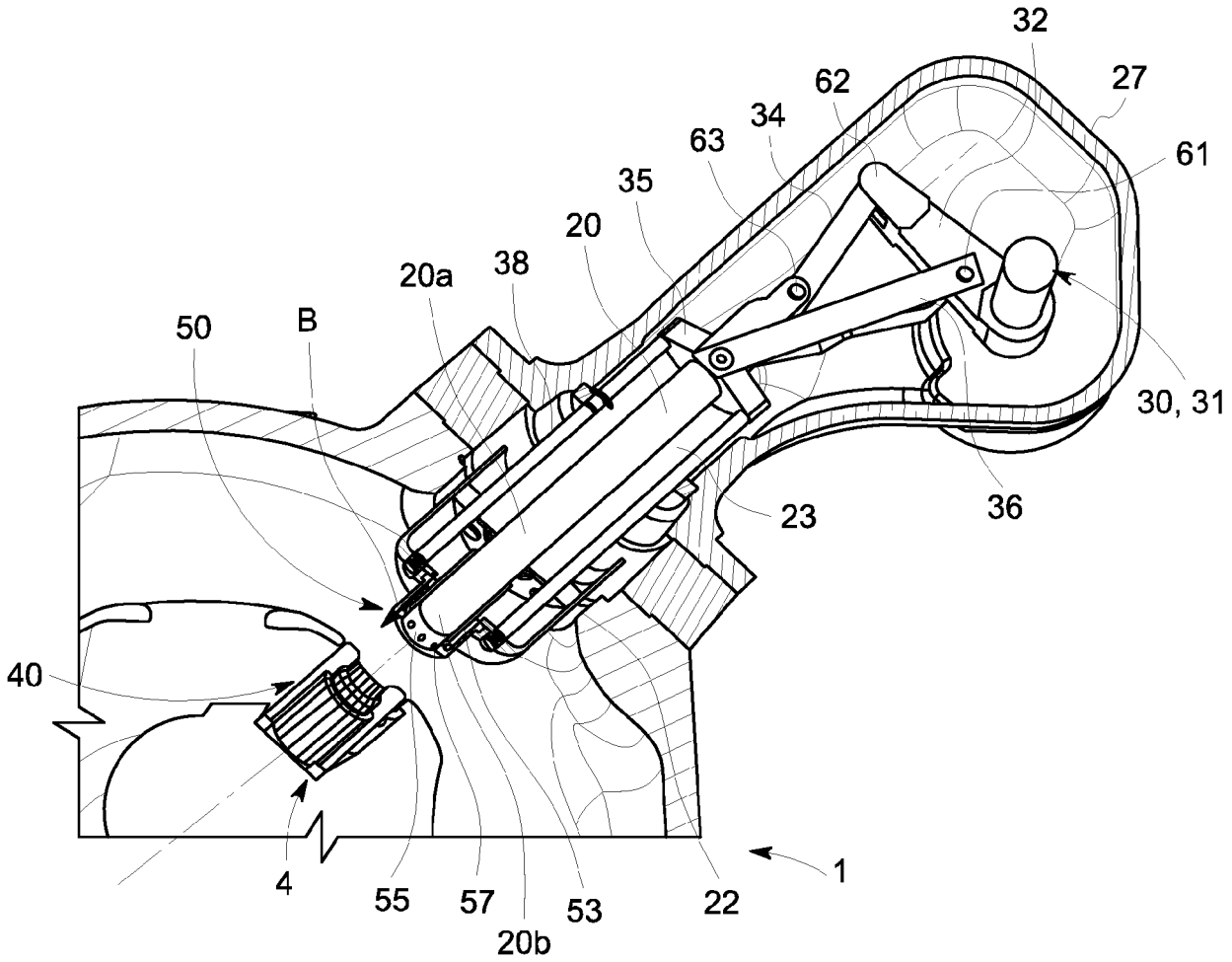

FIG. 5

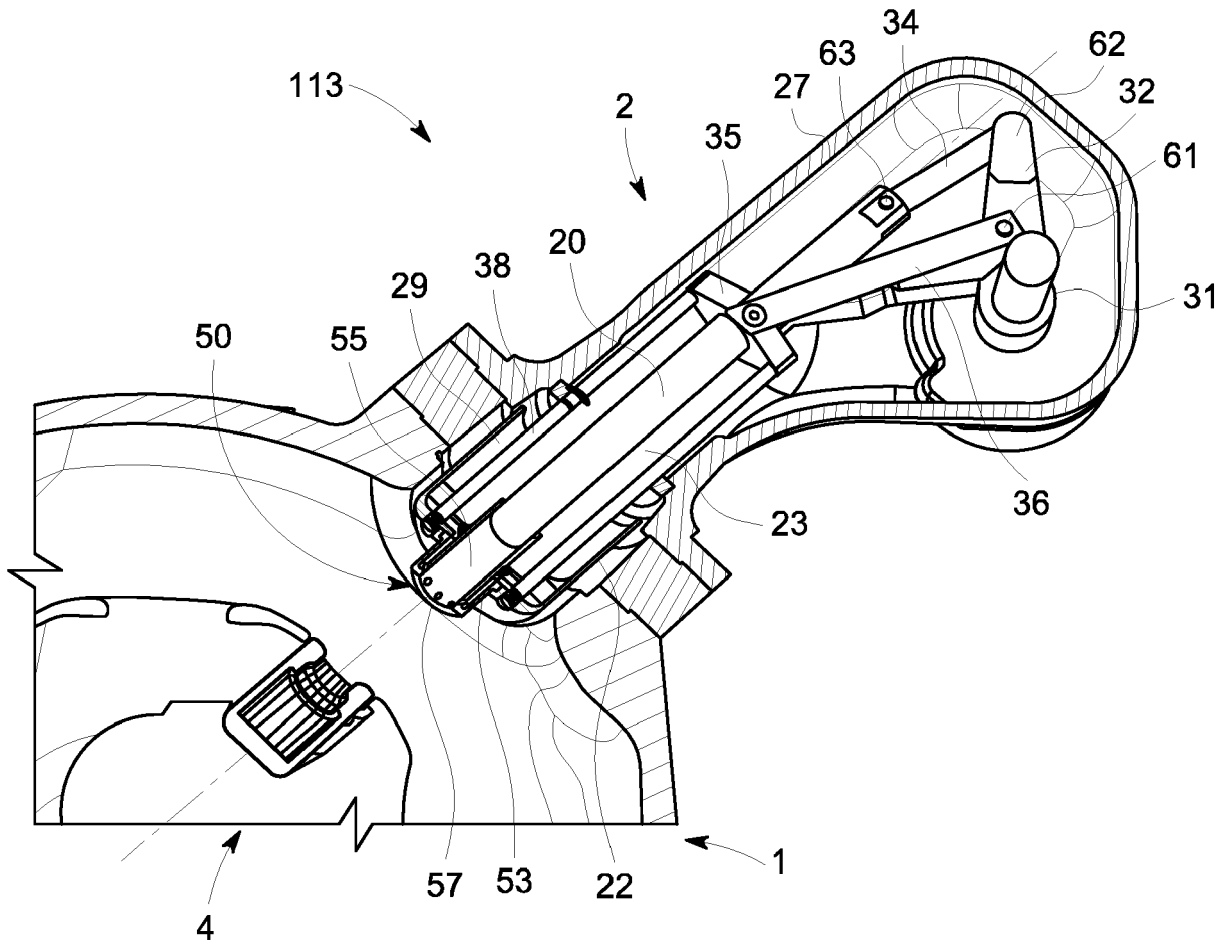

FIG. 6

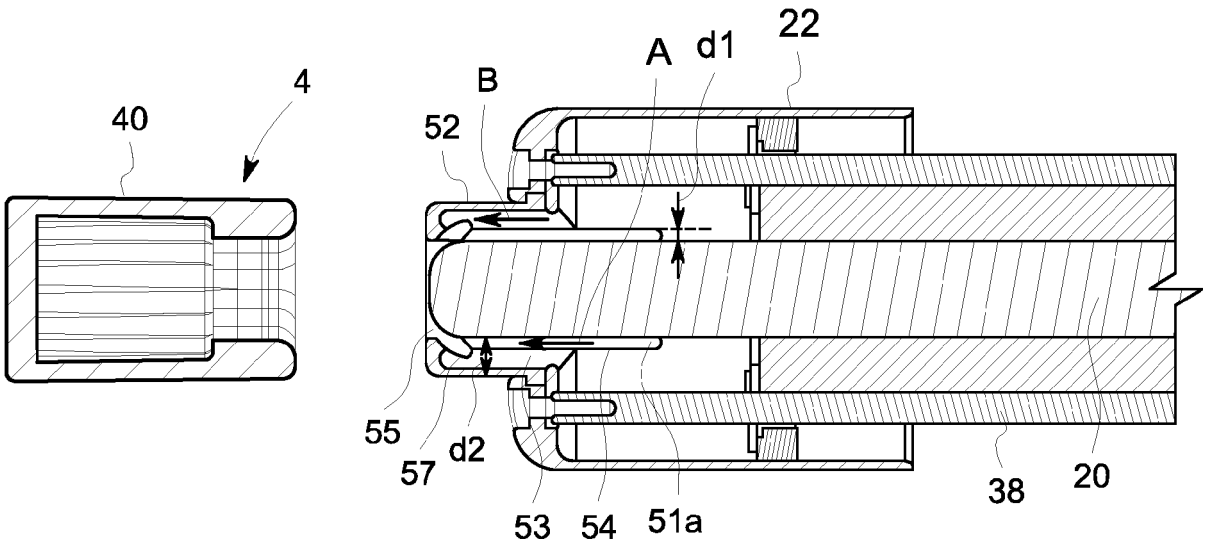

FIG. 7

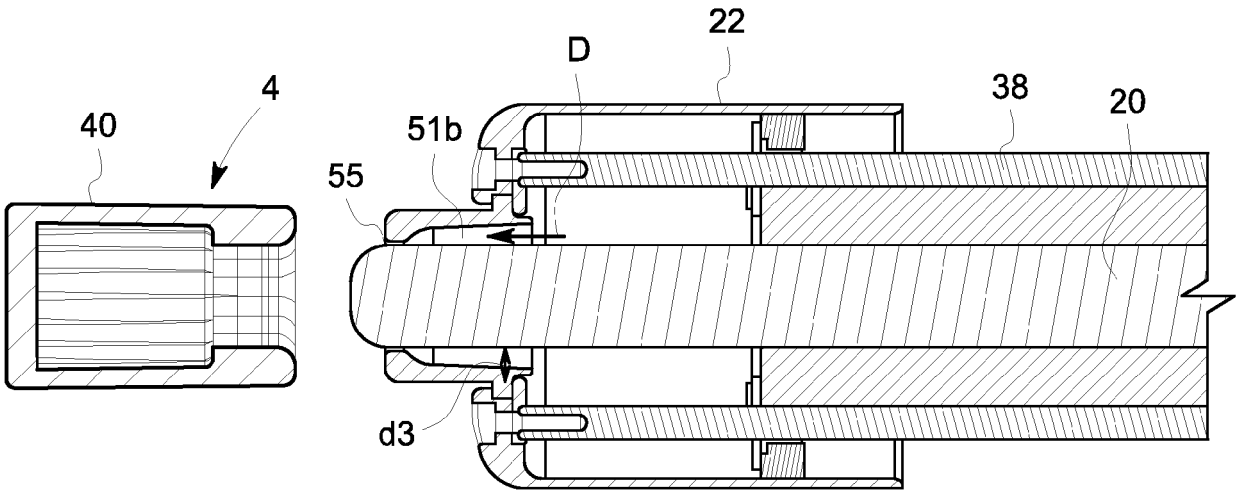

FIG. 8

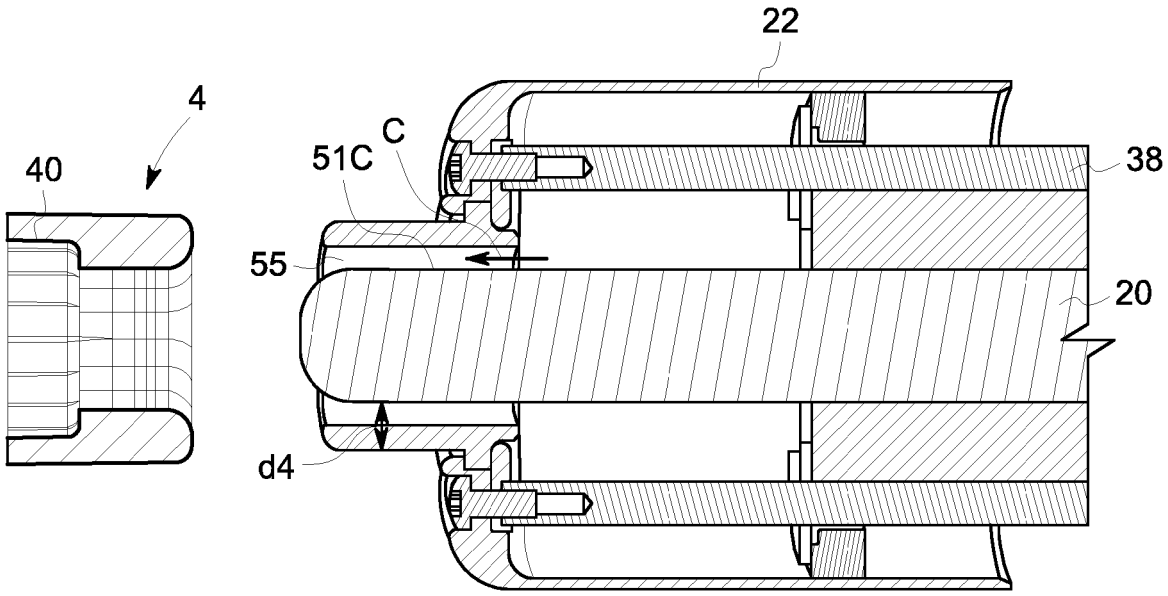

FIG. 9

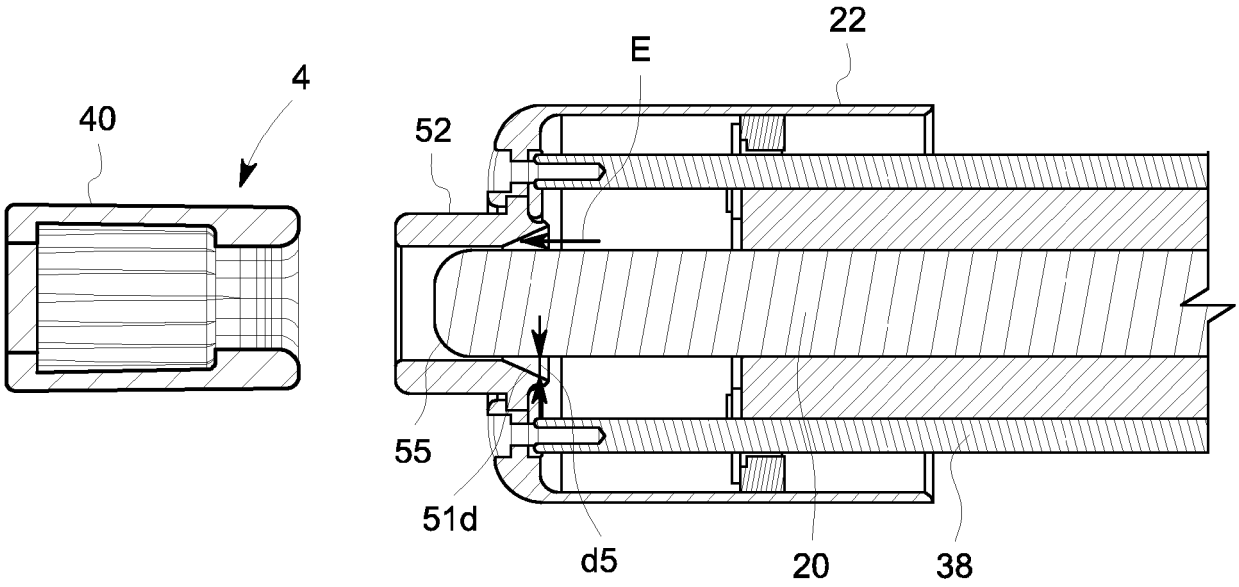

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 7320

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 November 2022	Nieto, José Miguel

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24-11-2022

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