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(54) Gas insulated switchgear

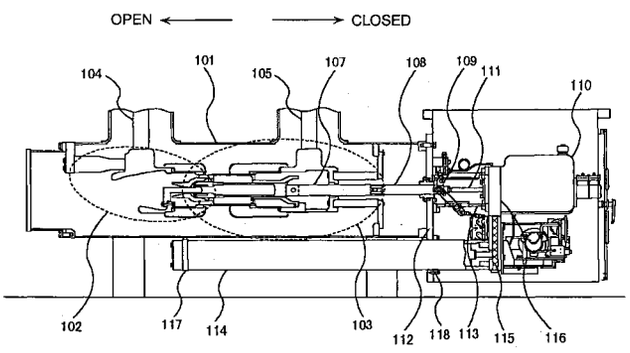
(57) (Subject)

In prior art gas insulated switchgear, the increasing size of equipment raises the drive force generated by a drive operation unit. When the drive operation unit is to be supported and fixed, a mounting flange or the like is installed on the movable contactor side of the drive operation unit and the drive operation unit is secured to a rigid grounded tank cover. However, this has required a cantilever support structure to be adopted, and many reinforcing parts have been employed, with the result that the overall dimensions have to be increased. The present invention solves this problem and provides gas insulated switchgear that allows a stable support and installation of the drive operation unit, despite increased equipment size.

(Means of Solving the Problems)

The output shaft of the hydraulic drive unit and the drive shaft of the movable contactor of gas insulated switchgear are linearly arranged, and the longitudinal shaft of an accumulator using gas as an accumulation source is arranged parallel to the output shaft of this hydraulic drive unit; further, a high pressure block equipped with a conduit for supplying high pressure hydraulic oil to the hydraulic drive unit from this accumulator is arranged perpendicularly to the aforementioned two drive shafts, thereby supporting and fixing the hydraulic drive unit in position.

FIG. 1



EP 1 406 278 A2

Description

BACKGROUND OF THE INVENTION

(Field of the Invention)

[0001] The present invention relates to gas insulated switchgear comprising a current breaking means further comprising a fixed contactor arranged inside a grounded container and a movable contactor that is connected and disconnected from this fixed contactor.

(PRIOR ART)

[0002] In the conventional gas insulated switchgear and gas circuit breaker in particular, a grounded container is filled with electric insulating gas such as SF_6 gas, and a fixed contactor and movable contactor are in perfect contact with each other to form an electric conductor in the normal state. The current breaking principle of the gas insulated switchgear is that, if ground fault or short circuiting has occurred in an power transmission line and power transforming equipment in a substation, the movable contactor of a circuit breaker consisting of a fixed contactor and movable contactor is opened and operated by the rotary motion of the drive unit in air connected through the main rotary shaft, lever and others installed inside or outside the grounded tank, whereby current is broken by the characteristics of insulating gas.

[0003] Further to the aforementioned arrangement, the following arrangement is also found in the prior art: A drive operation unit output shaft is mounted on the same shaft as that movable contactor traveling shaft, and linear movement is carried out while gas in the grounded tank is sealed by the gas tight seal provided around the connoting rod that performs linear movement through connection between the movable contactor and drive operation unit.

[0004] With reference to the drive force transfer arrangement for driving the movable contactor stored in the aforementioned two types of tanks, the following describes the comparison of the advantages and disadvantage between the arrangement where gas sealing is provided during the process of drive force being transferred by a rotary shaft and the arrangement of directly sealing linear movement.

[0005] Generally, a simpler structure is obtained in many cases by the method of direct sealing of linear movement for transfer of drive force between the inside the outside of the grounded container. This can be explained as follows: Since the drive force generated by the drive operation unit is linearly transferred, only tensile load is applied to many support/reinforcement members, with the result that deflection does not occur to parts. In the method of using a rotary shaft to transfer drive force through rotary movement, on the other hand, the component of force during rotation of drive force produced by the drive operation unit must be received without fail. This requires use of a rigid bearing, hence increased size and weight of the equipment.

[0006] However, the longitudinal dimension has been greater in the direct gas sealing structure than in the sealing structure with a rotary shaft. In addition to longer dimension, the drive device is fixed in a cantilever structure, and the device itself is vibrated by the drive force generated by the drive operation unit, with the result that reinforcement has been accompanied by difficulties due to the cantilever structure.

[0007] For example, the hydraulic drive operation unit disclosed in the Japanese Application Patent Laid-Open Publication No. Hei 10-50181 is equipped with an auxiliary switch, a pump unit and an accumulator as drive device. However, the drive operation unit itself is fixed on the gas insulated switchgear through a support member in a cantilever arrangement. When great drive force is generated, the drive device itself is vibrated, and it has been difficult to provide a stable movement of the movable contactor. The drive device shown in the aforementioned example is designed in a smaller configuration. Even if a cantilever support structure is used, there will be not a very serious problem. In the meantime, when a larger drive device and related parts are to be laid out in the operation unit, the hydraulic drive operation unit, accumulator and pump unit are separately installed, and the high pressure piping is used for this connection. Since such a structure is commonly adopted, increase in the size and weight of equipment is inevitable.

[0008] The operation unit for the gas insulated switchgear based on the linear sealing structure is commonly equipped with a lock mechanism for ensuring locking of the movable contactor in position when hydraulic pressure is reduced or under special conditions during transport. In the Japanese Application Patent Laid-Open Publication No. Sho 62-237102 for example, this lock mechanism is arranged inside the hydraulic operation unit. So when the gas insulated switchgear is operated slowly in the manual mode at the time of maintenance and inspection, the equipment may be damaged if manual opening/closing operation is performed with the unlocking of the lock mechanism neglected.

References Cited 1

[0009] Japanese Application Patent Laid-Open Publication No. Hei 10-50181

References Cited 2

[0010] Japanese Application Patent Laid-Open Publication No. Sho 62-237102

SUMMARY OF THE INVENTION:

(Problems to be Solved by the Invention)

[0011] In the prior art gas insulated switchgear, when a drive operation unit is to be supported and fixed, a mounting flange or the like is installed on the movable contactor side of the drive operation unit and the drive operation unit is secured to a rigid grounded tank cover. However, this has required a cantilever support structure to be adopted, so a sufficient rigidity cannot be ensured. To make up for this defect, many reinforcement parts and highly rigid support parts have to be used in combination, and this has led to an increase in overall dimensions.

[0012] Further, when a linear gas sealing structure is adopted in the prior art gas insulated switchgear, the movable contactor parts are moved to a completely disconnected position from an activated contact position, and the portion having been stored in gas is pulled out into air at the activated contact position. In this arrangement, the longitudinal dimension has been increased because of such structural characteristics, as compared to the arrangement where the output of the drive device is changed by the drive shaft using a rotary lever or the like. Further, when an auxiliary switch for detecting the contact state of the gas insulated switchgear is installed, the output of the lever for driving this switch must be taken using the output shat of the drive operation unit in the same manner. This requires the longitudinal dimension to be increased.

[0013] In the prior art gas insulated switchgear, a lock mechanism is installed inside the hydraulic operation unit. So the lock mechanism is likely to be neglected when the gas insulated switchgear is operated by hand at the time of maintenance and inspection. When the manual opening/closing operation was performed under this condition, the equipment was damaged.

[0014] The object of the present invention is to provide gas insulated switchgear characterized by the compact structure of the overall switch and reduced longitudinal dimension.

[0015] Another object of the present invention is to provide gas insulated switchgear that is designed to ensure that the equipment is not damaged by an operation error at the time of maintenance and inspection.

(Means for Solving the Problems)

[0016] The present invention provides gas insulated switchgear comprising a current breaking means further comprising a fixed contactor arranged inside a grounded container and a movable contactor that is connected and disconnected from the fixed contactor. This gas insulated switchgear is characterized in that the output shaft of the operation unit for driving the movable contactor and the drive shaft of the movable contactor are linearly arranged; a support member is provided for connection with the accumulator; and a hydraulic pump unit is installed on the support member.

[0017] To achieve the aforementioned objects, the present invention provides gas insulated switchgear comprising a current breaking means further comprising a fixed contactor arranged inside a grounded container and a movable contactor that is connected and disconnected from the fixed contactor. This gas insulated switchgear is characterized in that the output shaft of the operation unit for driving the movable contactor and the drive shaft of the movable contactor are linearly arranged; the longitudinal shaft of the accumulator for driving the operation unit is arranged parallel to the output shaf t of the operation unit ; a support member is provided for connection with the accumulator; and the operation unit is secured to the support member.

[0018] To achieve the aforementioned objects, the present invention provides gas insulated switchgear comprising a current breaking means further comprising a fixed contactor arranged inside a grounded container and a movable contactor that is connected and disconnected from the fixed contactor. This gas insulated switchgear is characterized in that the output shaft of the operation unit for driving the movable contactor and the drive shaft of the movable contactor are linearly arranged; a support member is provided for connection with the accumulator; and a hydraulic pump unit is installed on the support member.

[0019] To achieve the aforementioned objects, the present invention provides gas insulated switchgear comprising a current breaking means further comprising a fixed contactor arranged inside a grounded container and a movable contactor that is connected and disconnected from the fixed contactor. This gas insulated switchgear is characterized in that the output shaft of the operation unit for driving the movable contactor and the drive shaft of the movable contactor are linearly arranged; a support member is provided for connection with the operation unit; and an auxiliary switch is installed on the support member.

[0020] To achieve the aforementioned objects, the present invention provides gas insulated switchgear comprising a current breaking means further comprising a f ixed contactor arranged inside a grounded container and a movable contactor that is connected and disconnected from the fixed container. This gas insulated switchgear is characterized in that the output shaft of the operation unit for driving the movable contactor and the drive shaft of the movable contactor are linearly arranged; and a locking device is installed to lock the operation of the operation unit using a holder for connecting between the output shaft of the operation unit and the drive shaft of the movable contact.

[0021] To achieve the aforementioned objects, the present invention provides gas insulated switchgear comprising a current breaking means further comprising a fixed contactor arranged inside a grounded container and a movable contactor that is connected and discon-

nected from the fixed contactor. This gas insulated switchgear is characterized in that the output shaft of the operation unit for driving the movable contactor and the drive shaft of the movable contactor are linearly arranged; a support member is provided for connection with the operation unit; and an auxiliary switch is installed on the path where the output shaft of the operation unit or the drive shaft of the movable contactor moves.

[0022] To achieve the aforementioned objects, the present invention provides gas insulated switchgear comprising a current breaking means further comprising a fixed contactor arranged inside a grounded container and a movable contactor that is connected and disconnected from the fixed contactor. This gas insulated switchgear is characterized in that the output shaft of the operation unit for driving the movable contactor and the drive shaft of the movable contactor are linearly arranged; a support member is provided for connection with the operation unit; and a locking device is installed on the path where the output shaft of the operation unit or the drive shaft of the movable contactor moves.

BRIEF DESCRIPTION OF THE DWAWINGS

[0023]

Fig. 1 is an overall side view of gas insulated switchgear as an embodiment of the present invention;
Fig. 2 is a cross sectional view of a movable contactor unit used in gas insulated switchgear as an embodiment of the present invention;
Fig. 3 is a side view of a hydraulic operation unit as an embodiment of the present invention;
Fig. 4 is a view taken along line A-A of Fig. 4;
Fig. 5 is a plan view of an indicator drive section as an embodiment of the present invention as viewed from below;
Fig. 6 is a side view of a joint of lock mechanism high pressure piping as an embodiment of the present invention; and
Fig. 7 is a side view of a lock mechanism as an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] The following describes the preferred embodiments of the present invention with reference to drawings:

[0025] Fig. 1 shows gas insulated switchgear as an embodiment of the present invention. A fixed contactor unit 102 and a movable contactor unit 103 are installed inside the grounded tank 101 filled with SF_6 gas having excellent insulation characteristics, and are electrically connected to another gas insulated switchgear or bus via the main circuit conductors 104 and 105. The movable contactor 106 shown in Fig. 2 is pin-jointed to the output shaft 111 of a hydraulic operation unit 110 used as a drive shaft, through an insulated operation rod 107 , a linearly sealed rod 108 and connecting holder 109. The contact comprising the aforementioned fixed contactor unit 102 and movable contactor unit 103 is opened when the output shaft 111 moves to the right and is closed when it moves to the left.

[0026] The hydraulic operation unit 110 is fixed to the upper position of the cover plate 112 for shuts off gas inside the ground tank 101 through an upper installation holder 113. The accumulator 114 arranged at the bottom of the grounded tank 101 is inserted into and fastened to an operation unit manifold 116 which is the support member having a conduit 115 for supplying a high pressure hydraulic oil to the hydraulic operation unit 110. The accumulator 114 is firmly installed on the grounded tank by means of an accumulator fixing holder 117 arranged on the bottom of the ground tank 101 and an accumulator fixing holder 118 bolted to the cover plate 112 shown in Fig. 4.

[0027] This arrangement allows the hydraulic operation unit 110 to be firmly supported and locked in position by an installation holder 113 for fixing on the upper portion of the grounded tank and a manifold supported by the accumulator fixed on the bottom of the grounded tank. Further, the manifold is arranged and fixed perpendicularly to the output shaft of the hydraulic operation unit; this arrangement minimizes a linear vibration that is caused when the output shaft is moved.

[0028] Fig. 3 shows the view before installation on the grounded tank 101 equipped with the auxiliary equipment essential as the hydraulic operation unit for the gas insulated switchgear. The operation units mounted on the gas insulated switchgear includes, in addition to the 110 and 111 as a portion of the operation unit that generates drive force,

a hydraulic pump unit 201 for boosting hydraulic oil pressure and accumulating it into an accumulator 114;

auxiliary switches 202 and 203 for cutting off the current signal for controlling hydraulic operation unit and electrically displaying the mechanical position of the gas insulated switchgear;

a lock mechanism 270 for preventing the movable contactor 106 from moving when hydraulic pressure is reduced;

an on/off indicator 304 forvisual display of the contact position of gas insulated switchgear as shown in Fig. 5; and

an operation counter for counting the operations of the gas insulated switchgear.

[0029] The aforementioned hydraulic pump unit 201 is mounted through an installation holder 210 on the manifold 116 having a conduit 115 for supplying high pressure hydraulic oil to the hydraulic operation unit 110 . A vibration proof rubber 211 is provided under the pump unit 201 in order to protect the equipment against possible damage due to vibration and against transfer

of vibration during the operation of the hydraulic operation unit. A small-diameter high pressure piping 212 and low pressure piping 213 are used for connection between the pump unit 201 and hydraulic operation unit, thereby absorbing the phase displacement due to vibration between the operation unit 110 and pump unit 201. Further, the hydraulic pump unit 201 is located under the hydraulic operation unit 110; this arrangement reduces the longitudinal dimension of the entire gas insulated switchgear. Further, the hydraulic pump unit is firmly secured in position since it is mounted on the manifold supported by the installation holder and accumulator.

[0030] Similarly, the auxiliary switches 202 and 203 are mounted on the operation unit manifold 116. The drive force of the auxiliary switches 202 and 203 is connected to the upper-stage auxiliary switch 202 through the lever 252 from the joint pin 251 of the connecting holder 109 fixed to the nut 111a screwed into the tip of the output shaft of hydraulic operation unit 111. The auxiliary switches are laid out in two stages - upper and lower stages, and drive force is driven by the lever 254 mounted on the rotary shaft of the upper stage auxiliary switch 202 , link 255 and the lever 256 mounted on the rotary shaft of the lower stage auxiliary switch 203.

[0031] Fig. 5 is a view of a hydraulic operation unit as viewed from below. It shows the viewwhere the on/off indicator 304 and operation counter 305 are added.

[0032] As shown in Fig. 5, the rotary shaft of the lower stage auxiliary switch 202 extends over to the non-link connection side, and a lever 302 is mounted there. This lever 302 is connected to an indicator drive wire 303. When this wire 303 is linked to the lever mounted on the operation counter, the on/off indicator 304 for visual indication of the contact position of the gas insulated switchgear and the operation counter 305 are driven.

[0033] As described above, the auxiliary switch is fixed to the manifold 116 on the side of the movable contactor. This arrangement permits an effective use of the space for the movement of the output shaft 111, thereby minimizing the length of the hydraulic operation unit and reducing the length of the entire gas insulated switchgear in a compact configuration.

[0034] The lock mechanism 270 shown in Fig. 3 is hydraulically connected to the operation unit manifold 116 by the high pressure piping 271. High pressure piping joints 272 and 273 are connected to both ends of the high pressure piping 271. The joint 273 mounted on the manifold side of the operation unit is designed in the structure shown in Fig. 6 in such a way that it can rotate without mechanically loosening the installation portion.

[0035] Fig. 7 shows the detailed structure of the lock mechanism. This lock mechanism is designed to lock the operation automatically since the movable contactor 106 does not move in the direction of opening when hydraulic pressure is released or is reduced due to some trouble.

[0036] The lock mechanism 270 is hydraulically operated. Under pressure, i.e. under normal working conditions, the hydraulic pressure acting on the lock piston 501 is greater than the load produced by the Belleville spring 502 , so the piston 501 moves upward. If some error has occurred to reduce the pressure of the hydraulic system, the piston 501 moves downward and locks the connecting holder 109.

[0037] Unlike the aforementioned prior art gas insulated switchgear where a lock mechanism is built in the operation unit, a lock mechanism is installed outside the operation unit according to the present invention. This arrangement ensures that a maintenance and inspection tool can be mounted only when the lock mechanism is removed. This maintenance and inspection tool is connected by screwing into the connecting holder 109 shown in Fig. 7. It is a special-purpose tool for manual low-speed operation of the gas insulated switchgear at the time of maintenance and inspection. When this tool is mounted, maintenance and inspection tools and connecting holder 109 can be connected only if the lock mechanism has been removed. Accordingly, the lock mechanism is designed so that it can be easily dismounted. To dismount the lock mechanism, the installation bolt 503 is removed and the lock mechanism 270 is turned approximately 30 degrees about the rotary center of the joint 273. It is placed on an accompanying special-purpose bench for temporary installation. This procedure ensures manual operations without neglecting the unlocking of the lock mechanism, and eliminates the need of worrying about a possible damage of the equipment.

[0038] Similarly to the auxiliary switch, the lock mechanism is arranged to permit an effective use of the space for the movement of the output shaft 111 or the drive shaft of the movable contactor of the insulated operation rod 107 , thereby minimizing the length of the hydraulic operation unit and reducing the length of the entire gas insulated switchgear in a compact configuration.

(EFFECTS OF THE INVENTION)

[0039] In large-sized gas insulated switchgear adopting a linear gas sealing structure according to the present invention, a drive operation unit is supported by an installation holder and accumulator through a manifold. This arrangement ensures a sufficient rigidity to be maintained against the load and drive force produced from the operation drive unit, and eliminates the need of using many reinforcing parts that have been required in the prior art, thereby reducing the overall dimensions and production costs.

[0040] In large-sized gas insulated switchgear adopting a linear gas sealing structure where length has been increasing, the present invention makes an effective use of the space for the movement of the drive shaft of the operation unit to arrange such a member as an auxiliary switch or lock mechanism, thereby reducing the overall length.

[0041] The gas insulated switchgear according to the present invention is arranged in such a way that working tools for maintenance and inspection can be mounted only when the lock mechanism is removed. This arrangement ensures that maintenance and inspection is carried out only after the lock mechanismhas been removed, thereby preventing the equipment from being damaged.

[0042] In the gas insulated switchgear according to the present invention, the drive operation unit is rigidly supported and installed independently of the increasing size of the drive operation unit, and a sufficient rigidity is maintained against the load produced by the drive operation unit. At the same time, the gas insulated switchgear is provided with all the equipment essential to the drive operation unit and the drive operation unit is operated and tested as an independent unit. The aforementioned effects provide gas insulated switchgear and drive unit characterized by lower costs, compact configuration, enhanced assembling workability and improved maintainability.

[0043] The gas insulated switchgear according to the present invention, furthermore, is provided with all the equipment including a pump unit, auxiliary switch and lock mechanism that are essential to the drive operation unit. This arrangement allows the drive operation unit to be operated and tested as an independent unit, thereby reducing the assembling time and trouble shooting time for solving the problems that may occur after delivery of a product.

Claims

1. Gas insulated switchgear comprising a current breaking means further comprising:

a fixed contactor arranged inside a grounded container and
a movable contactor that is connected and disconnected from said fixed contactor,
said gas insulated switchgear **characterized in that**
the output shaft of the operation unit for driving said movable contactor and the drive shaft of said movable contactor are linearly arranged;
the longitudinal shaft of an accumulator, is arranged parallel to the output shaft of said operation unit; and
a support member equipped with a conduit for supplying fluid under pressure to the operation unit from said accumulator is arranged and secured perpendicularly to the output shaft of said operation unit.

2. Gas insulated switchgear according to Claim 1 further **characterized in that** a manifold block is used as said support member, and said conduit for supplying high pressure fluid to the operation unit from the accumulator is arranged in said manifold block.

3. Gas insulated switchgear comprising a current breaking means further comprising:

a fixed contactor arranged inside a grounded container and
a movable contactor that is connected and disconnected from said fixed contactor,
said gas insulated switchgear **characterized in that**
the output shaft of the operation unit for driving said movable contactor and the drive shaft of said movable contactor are linearly arranged;
the longitudinal shaft of the accumulator for driving the operation unit is arranged parallel to the output shaft of the operation unit;
a support member is provided for connection with the accumulator; and
the operation unit is secured to the support member.

4. Gas insulated switchgear according to Claim 3 further **characterized in that** a manifold block is used as said support member, and said conduit for supplying high pressure fluid to the operation unit from the accumulator is arranged in said manifold block.

5. Gas insulated switchgear according to Claim 3 further **characterized in that** said support member is arranged and secured perpendicularly to the output shaft of said operation unit.

6. Gas insulated switchgear comprising a current breaking means further comprising:

a fixed contactor arranged inside a grounded container and
a movable contactor that is connected and disconnected from said fixed contactor,
said gas insulated switchgear **characterized in that**
the output shaft of the operation unit for driving said movable contactor and the drive shaft of said movable contactor are linearly arranged;
a support member is provided for connection with the accumulator; and
a hydraulic pump unit is installed on the support member.

7. Gas insulated switchgear according to Claim 6 further **characterized in that** a manifold block is used as said support member, and said conduit for supplying high pressure fluid to the operation unit from the accumulator is arranged in said manifold block.

8. Gas insulated switchgear comprising a current

breaking means further comprising:

a fixed contactor arranged inside a grounded container and
a movable contactor that is connected and disconnected from said fixed contactor.
said gas insulated switchgear **characterized in that**
the output shaft of the operation unit for driving said movable contactor and the drive shaft of said movable contactor are linearly arranged;
a support member is provided for connection with the operation unit; and
an auxiliary switch is installed on the support member.

9. Gas insulated switchgear according to Claim 8 further **characterized in that** said auxiliary switch is connected with a display unit by means of a wire.

10. Gas insulated switchgear comprising a current breaking means further comprising:

a fixed contactor arranged inside a grounded container and
a movable contactor that is connected and disconnected from said fixed contactor,
said gas insulated switchgear **characterized in that**
the output shaft of the operation unit for driving said movable contactor and the drive shaft of said movable contactor are linearly arranged; and
a locking device is installed to lock the operation of said operation unit using a holder for connecting between the output shaft of the operation unit and the drive shaft of said movable contact.

11. Gas insulated switchgear comprising a current breaking means further comprising:

a fixed contactor arranged inside a grounded container and
a movable contactor that is connected and disconnected from said fixed contactor,
said gas insulated switchgear **characterized in that**
the output shaft of the operation unit for driving said movable contactor and the drive shaft of said movable contactor are linearly arranged;
a support member is provided for connection with the operation unit; and
an auxiliary switch is installed on the portion where the output shaft of said operation unit or the drive shaft of the movable contactor moves.

12. Gas insulated switchgear comprising a current breaking means further comprising:

a fixed contactor arranged inside a grounded container and
a movable contactor that is connected and disconnected from said fixed contactor,
said gas insulated switchgear **characterized in that**
the output shaft of the operation unit for driving said movable contactor and the drive shaft of said movable contactor are linearly arranged;
a support member is provided for connection with the operation unit; and
a locking device is installed on the portion where the output shaft of said operation unit or the drive shaft of the movable contactor moves.

13. Gas insulated switchgear according to any one of Claims 1 through 12 further **characterized in that** said operation unit accumulator, support member, pump unit and the others are unitized so that each unit can be operated independently.

FIG. 1

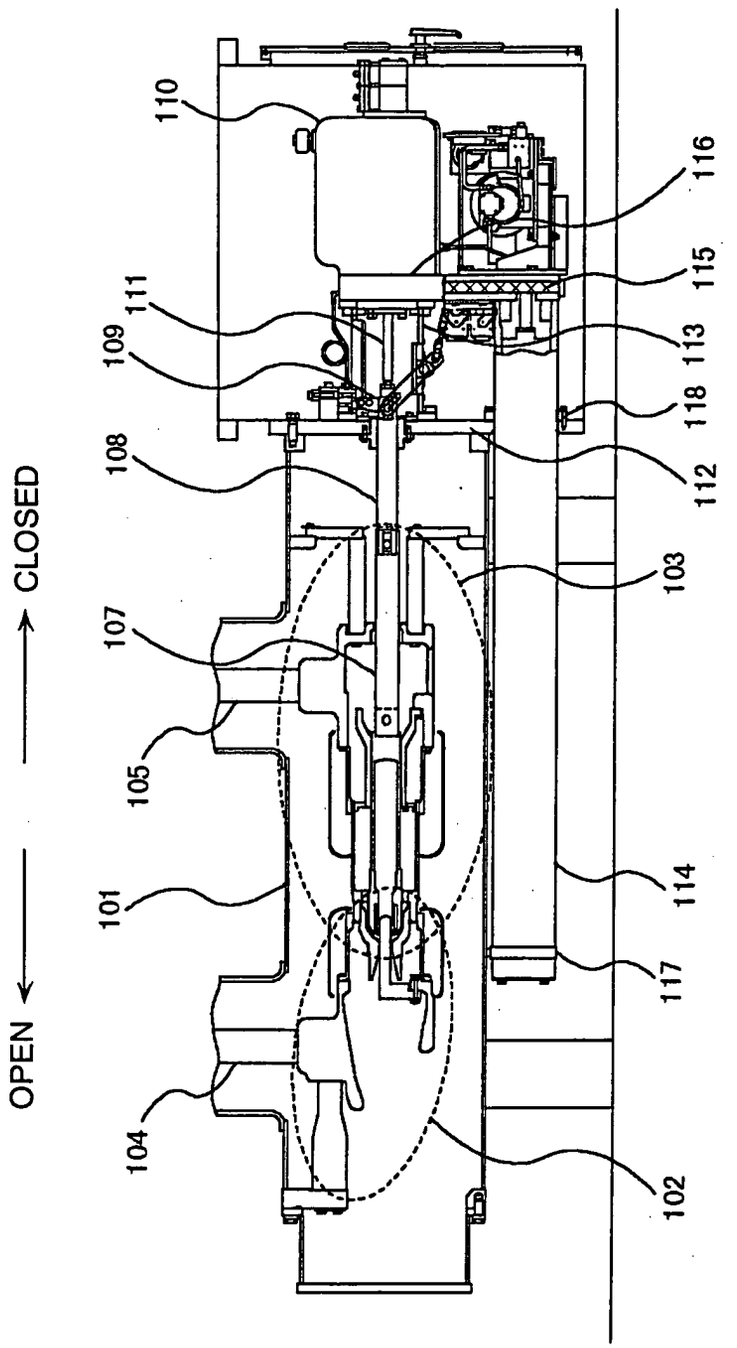

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FIG. 2

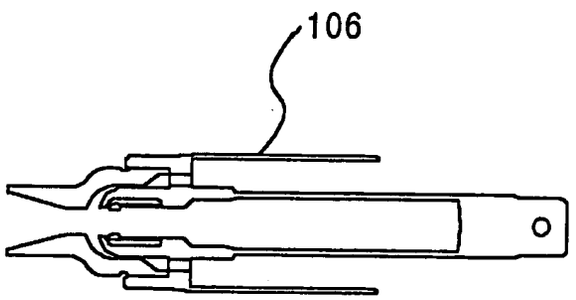

FIG. 3

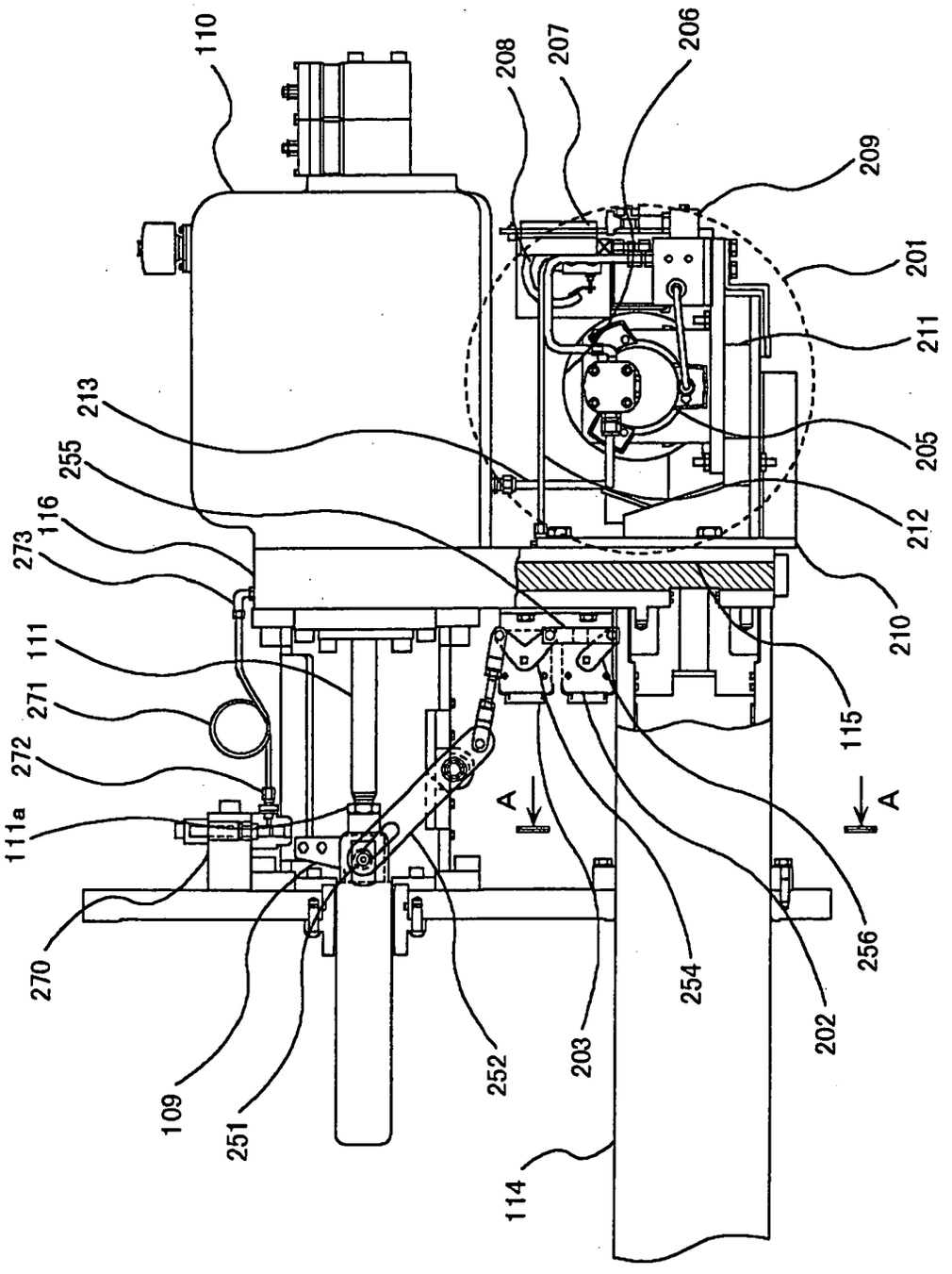
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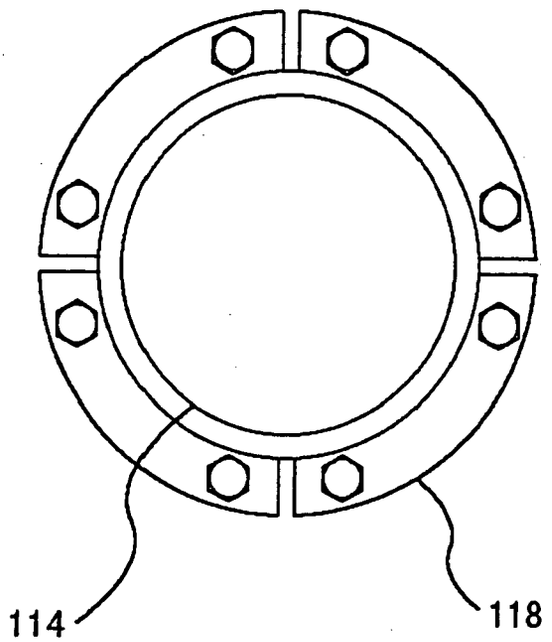
FIG. 4



VIEW A-A

FIG. 5

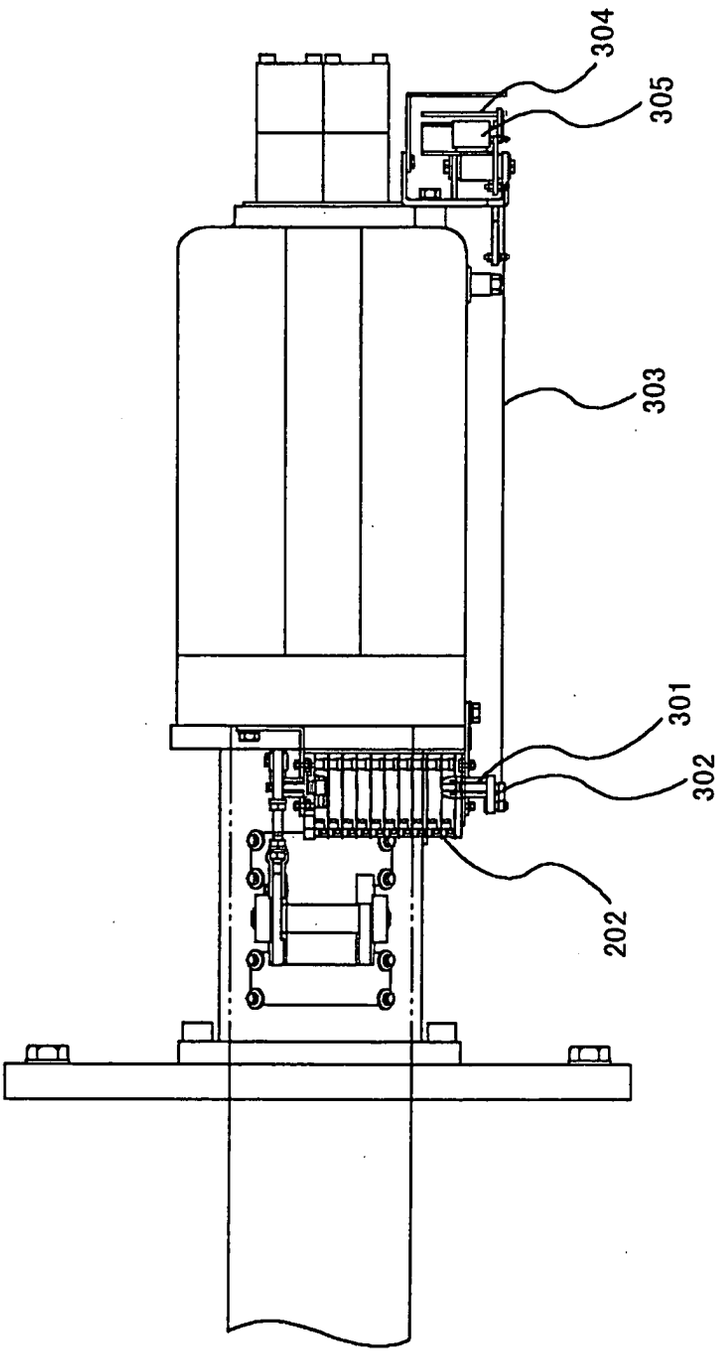


FIG. 6

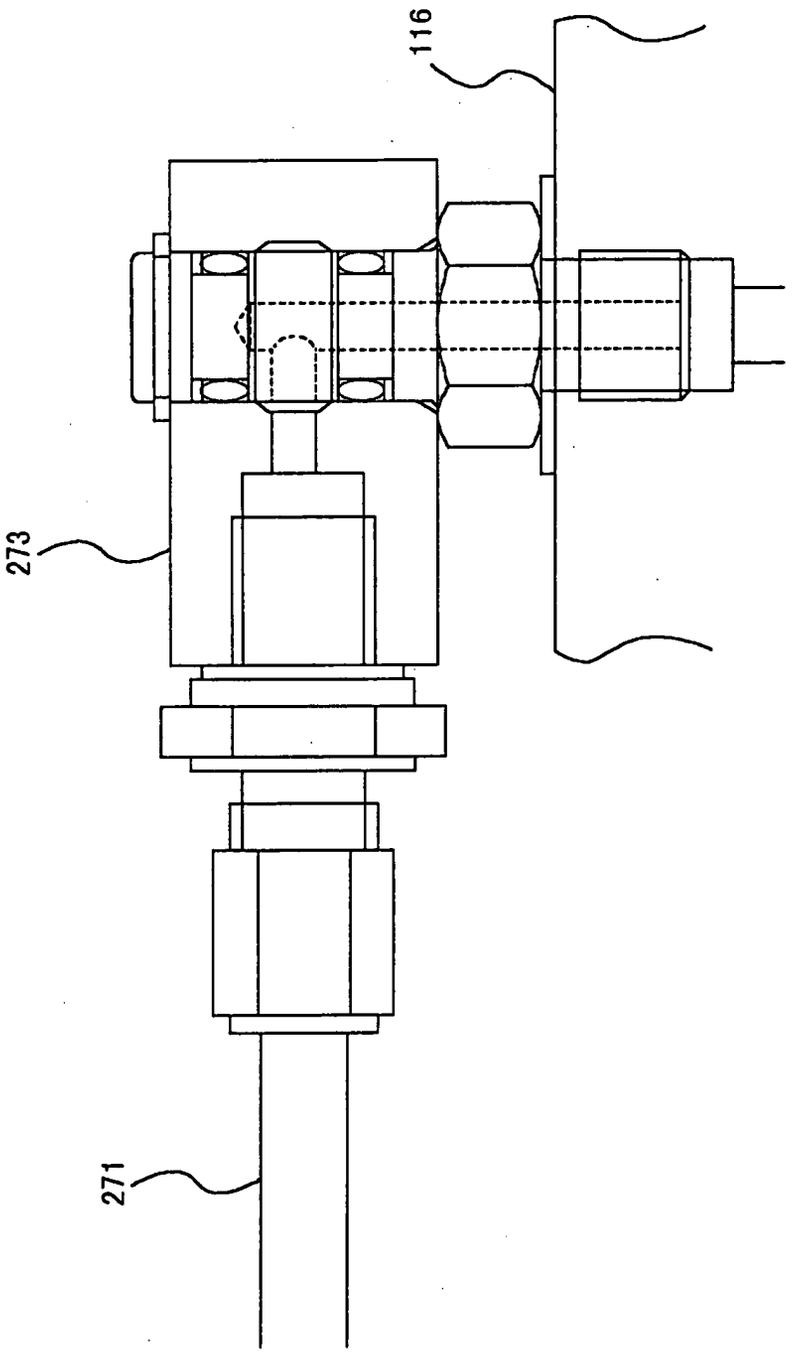


FIG. 7