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(54) **OPERATING DEVICE FOR DISCONNECT SWITCH**

(57) The present invention provides a small and highly reliable operating device for a disconnect switch. The operating device comprises: a motor 1 capable of positive and negative rotation; a main shaft 6 that rotates in response to the output from the motor 1 to thereby drive the main contact of a connected disconnect switch; and a driven shaft 11 that rotates with the rotation of the main shaft 6. The main shaft 6 is provided with a Geneva driver 10 having a driving roller 10b, and the driven shaft 11 is provided with a Geneva wheel 12 having slots 12a, 12b, 12c allowing the driving roller 10b to move therein and thereout. The Geneva wheel 12 rotates while the driving roller 10b moves along the slots 12a, 12b, 12c with the rotation of the Geneva driver 10.

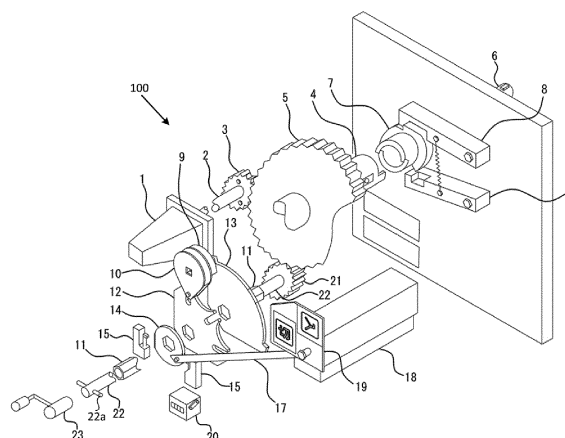


FIG. 1

Description

FIELD

[0001] An embodiment of the present disclosure relates to a disconnecter operating device that performs opening and closing operation of a disconnecter of a gas-insulated switchgear.

BACKGROUND

[0002] The disconnecter of the gas-insulated switchgear includes a disconnecter without a current switching duty and a disconnecter with a current switching duty. For the disconnecter without the current switching duty, the disconnecter is directly operated via a gear driven by a motor by using an operating device having a relatively simple structure such as an electric operation method. On the other hand, for example, a disconnecter with a loop current switching duty requires high-speed operation. Therefore, the disconnecter is operated by a releasing force of a spring stored by a motor, by using an operating device having a relatively complicated structure such as an electric spring system.

[0003] In recent years, the JEC standard (JEC-2310:2014) has been revised, and the loop current switching duty of the disconnecter has been reduced. Therefore, since the speed of high-speed operation by the electric spring operation method is no longer necessary, it is increased that the possibility to apply a low-cost and small electric operating device to a disconnecter with the current switching duty.

CITATION LIST

PATENT LITERATURE

[0004] Patent Document 1: JP H03-068335 U

TECHNICAL PROBLEM

[0005] Therefore, an attempt was made to improve the conventional operating device so that it can operate at high speed and apply it to the disconnecter with the current switching duty, however it became necessary to strengthen the strength of components in order to perform high-speed operation. Specifically, when a connecting cam type intermittent mechanism is provided, a stopper that stops an operation of the intermittent mechanism at a predetermined operating angle is required, however when high-speed operation is performed, the stopper may be damaged, or parts may be deformed or damaged due to the impact of the cam rotating in a reverse direction. Therefore, it is necessary to strengthen components by increasing the size, and the entire device has become large. In addition, it was necessary, in consideration of the high-speed operation, to increase the number of parts and to adjust a position of the stopper and the like. From

the above, it has been desired to develop the disconnecter operating device that is compact and has sufficient strength.

[0006] The present embodiment has been proposed to solve the above problems, and an object is to provide a compact and highly reliable disconnecter operating device.

SOLUTION TO THE PROBLEMS

[0007] In order to achieve the above object, the disconnecter operating device according to the embodiment of the present invention includes a motor capable of positive rotation and negative rotation, a main shaft rotating according to an output from the motor and driving a main contact of the connected disconnecter, and a driven shaft rotating with the rotation of the main shaft, in which a Geneva driver with a driving roller is provided on the main shaft, the driven shaft is provided with a Geneva wheel with a slot for the driving roller to enter and exit, and the Geneva wheel is configured to rotate while the driving roller moves along the slot according to the rotation of the Geneva driver.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG. 1 is a schematic three-dimensional view of the disconnecter operating device according to the first embodiment.

FIG. 2 is a partially enlarged view of the disconnecter operating device according to the first embodiment.

DETAILED DESCRIPTION

[1. The first embodiment]

[Configuration of disconnecter operating device]

[0009] The disconnecter operating device 100 (hereinafter referred to as the operating device 100) according to the first embodiment will be described with reference to FIGS. 1 and 2. The operating device 100 employs a Geneva mechanism and has a main shaft 6 provided with a Geneva driver 10 and a driven shaft 11 provided with a Geneva wheel 12 that intermittently moves with the rotation of the Geneva driver 10. The operating device 100 is configured to perform a switching operation of the disconnecter via the main shaft 6 and to stop the disconnecter switching operation at a predetermined position by using an intermittent mechanism including a Geneva driver 10 and a Geneva wheel 12 described later.

[0010] The motor 1 which is a drive source of the operating device 100 is connected to a power source, and is configured to be capable of positive rotation and negative rotation by switching the power source. The motor 1 serves as a drive source for driving the main contact

of an unillustrated disconnecter. The motor 1 has a motor output shaft 2, and a spur gear 3 is fixed to the motor output shaft 2. The spur gear 3 is configured to mesh with a spur gear 5 provided on a connecting cam 4 described later, which is configured on the main shaft 6 side.

(Configuration on main shaft side)

[0011] The main shaft 6 is a shaft with a polygonal cross section provided so as to be parallel to the motor output shaft 2. The main shaft 6 is directly or indirectly connected to the main contact of the unillustrated disconnecter. In the example of FIG. 1, a quadrangular main shaft 6 is shown, however the main shaft 6 may have a shape having corners, and the specific shape thereof is not limited to the quadrangle. The component members shown below are designed in shape and the like so as to be rotatable at a predetermined rotation angle when fixed at a predetermined position on the polygonal main shaft 6. That is, since, by only fixing each component member to the main shaft 6, a rotation angle and a contact position with other members are adjusted, it is not necessary to manually adjust the fixed position with respect to the main shaft 6.

[0012] The spur gear 5 that meshes with the spur gear 3 is fixedly provided on the connecting cam 4. Further, the connecting cam 4 is provided so as to be engaged with a connecting cam 7. The main shaft 6 is fixed to the connecting cam 7. The main shaft 6 penetrates inside of the connecting cam 4 and is connected to the unillustrated main contact. On an outer circumference of the connecting cam 7, a catch 8 is provided to lock a rotation of the connecting cam 7 when power is transmitted from the main shaft 6 side by pinching the connecting cam 7 so that the operating device 100 does not operate. When the connecting cam 7 is locked by the catch 8, the connecting cam 4 and the connecting cam 7 do not come into contact with each other and do not engage with each other.

[0013] The connecting cam 4 is provided with a protrusion, and the protrusion of the connecting cam 4 pushes the catch 8 to release the pinching of the connecting cam 7 by the catch 8. When the connecting cam 4 engages with the unlocked connecting cam 7, the main shaft 6 becomes rotatable according to an output from the motor 1 via the spur gears 3 and 5, and the connecting cams 4 and 7.

[0014] Further, a main shaft stopper plate 9 and the Geneva driver 10 are fixed to the main shaft 6. The main shaft stopper plate 9 and the Geneva driver 10 may be provided at predetermined positions by, for example, fixing them according to the shape of the polygonal cross section of the main shaft 6. As shown in FIG. 2, the main shaft stopper plate 9 is a plate-shaped flat plate with a substantially semicircular cross section, and has a convex portion at a central portion of the diameter. Therefore, the diameter of the main shaft stopper plate 9 is divided by the convex portion, and two line segments exist on

the diameter. A surface in a thickness direction of the main shaft stopper plate 9 with one of the line segments as one side is defined as a stop surface 9a. In addition, a surface in the thickness direction of the main shaft stopper plate 9 with another of the line segments as one side is defined as a stop surface 9b. The areas of the stop surfaces 9a and 9b are designed in consideration of the strength of collision.

[0015] The stop surface 9a is configured to collide with a stop surface 13a of a driven shaft stopper plate 13 described later, at a predetermined rotation angle. The predetermined rotation angle is an angle at which the main contact of the disconnecter is turned on. In addition, the stop surface 9b is configured to collide with a stop surface 13b of the driven shaft stopper plate 13 described later, at a predetermined rotation angle. The predetermined rotation angle is an angle at which the main contact of the disconnecter is cut off.

[0016] The Geneva driver 10 includes a cam plate 10a and a driving roller 10b. The cam plate 10a is a drop-shaped flat plate in which a part of a circle extends so as to be sharp. The driving roller 10b is provided at a corner of the drop-shaped cam plate 10a. The drive roller 10b is a protrusion that moves in and out of slots 12a, 12b, and 12c of the Geneva wheel 12 described later by the rotation of the cam plate 10a.

(Configuration on driven shaft side)

[0017] The driven shaft 11 is a shaft with a polygonal cross section provided on a lower side of the main shaft 6 so as to be parallel to the main shaft 6. The driven shaft 11 is a hollow rod, and bearings 16 (shown in FIG. 2) are inserted at both ends thereof. A manual operation shaft 22 described later is provided so as to penetrate through the hollow portion of the driven shaft 11.

[0018] In the example of FIG. 2, a hexagonal driven shaft 11 is shown, however the driven shaft 11 may have a shape having corners, and the specific shape thereof is not limited to the hexagon. In the example of FIG. 2, the reason for applying the hexagonal driven shaft 11 is that the load applied to the driven shaft 11 side is larger than that of the main shaft 6, and for securing as much surplus thickness as possible on the shaft since the driven shaft 11 is hollow. Same as the main shaft 6, the component members shown below are designed in shape and the like so as to be rotatable at a predetermined rotation angle when fixed at a predetermined position on the polygonal driven shaft 11.

[0019] The Geneva wheel 12, the driven shaft stopper plate 13, and a limit switch cam 14 are fixed to the driven shaft 11. A plurality of fixing holes are provided in each of the Geneva wheel 12, the driven shaft stopper plate 13, and the limit switch cam 14, and are jointly fastened with fixing tools such as bolts so as to maintain a predetermined positional relationship. A pair of limit switches 15 is arranged around the limit switch cam 14. The limit switch 15 is a switch for shutting off the power supply of

the motor 1, and is provided one on each of the positive rotation side and the negative rotation side.

[0020] As shown in FIG. 2, the Geneva wheel 12 is a substantially fan-shaped flat plate, and has the slots 12a, 12b, and 12c cut out from the outer circumference toward the center direction in a circumferential portion. The slots 12a, 12b, and 12c are notched at 45 degree intervals. The outer circumference between the slots 12a and 12b and the outer circumference between the slots 12b and the slot 12c are notched in a semicircular shape so as to engage with the cam plate 10b of the Geneva driver 10. The driven shaft 11 is configured to rotate while the driving roller 10b of the Geneva driver 10 on the main shaft 6 side moves along the slots 12a, 12b, 12c of the Geneva wheel 12.

[0021] For example, in the state of FIG. 2, when the motor 1 rotates negatively, the driving roller 10b of the Geneva driver 10 escapes from the slot 12a of the Geneva wheel 12 and engages with the slot 12b to move while the Geneva driver 10 makes one rotation counterclockwise. The driving roller 10b of the Geneva driver 10 escapes from the slot 12b of the Geneva wheel 12 and engages with the slot 12c to move while making another rotation. By the operation of this Geneva mechanism, when the main shaft 6 rotates twice, the driven shaft 11 rotates 90 degrees. The operating device 100 is configured so that an auxiliary switch 18 is turned on or off by 90 degrees rotation of the driven shaft 11.

[0022] As shown in FIG. 1 and 2, the driven shaft stopper plate 13 is a fan-shaped and plate-shaped flat plate, and has convex portions at both ends of the circumference. The end face of one of the convex portions is the stop surface 13a, and the end surface of the other convex portion is the stop surface 13b. The stop surface 13a is configured to collide with the stop surface 9a of the main shaft stopper plate 9 at a predetermined rotation angle. The stop surface 13b is configured to collide with the stop surface 9b of the main shaft stopper plate 9 at a predetermined rotation angle. The areas of the stop surfaces 13a and 13b are designed in consideration of the strength of collision.

[0023] As described above, the operating device 100 is provided with the main shaft stopper plate 9 on the main shaft 6 and the driven shaft stopper plate 13 on the driven shaft 11 as a pair of stopper plates. In the above, the main shaft stopper plate 9 has a substantially semicircular shape according to the shape of the Geneva driver 10, and the driven shaft stopper plate 13 has a substantially fan shape according to the shape of the Geneva wheel 12. However, the shapes of the main shaft stopper plate 9 and the driven shaft stopper plate 13 are not limited thereto.

[0024] Here, the stop surface 9a of the main shaft stopper plate 9 and the stop surface 13a of the driven shaft stopper plate 13 in a colliding state are collectively referred to as a collision surface a. As shown in FIG. 2, in the operating device 100, it is preferable that the line segment I-I orthogonal to the collision surface a is con-

figured to pass through a shaft center of the driven shaft 11. Similarly, when the stop surface 9b and the stop surface 13b in the colliding state are collectively expressed as the collision surface b, it is preferable that the line segment orthogonal to the collision surface b is configured to pass through a shaft center of the driven shaft 11.

[0025] The limit switch cam 14 is a substantially circular flat plate in which a part of the circumference is cut out. By cutting out the circular flat plate, step portions 14a and 14b are formed at both ends of the notch. The step portion 14a abuts on the limit switch 15 on the positive rotation side at a predetermined rotation angle at which the stop surface 9a of the main shaft stopper plate 9 and the stop surface 13a of the driven shaft stopper plate 13 collide, and shuts off the power supply of the motor 1. The step portion 14b abuts on the limit switch 15 on the negative rotation side at a predetermined rotation angle at which the stop surface 9b of the main shaft stopper plate 9 and the stop surface 13b of the driven shaft stopper plate 13 collide, and shuts off the power supply of the motor 1.

[0026] As described above, the plurality of fixing holes are provided in each of the Geneva wheel 12, the driven shaft stopper plate 13, and the limit switch cam 14, and are jointly fastened with fixing tools. Of these, one end of a link 17 is fixed by a fixing tool in one of the fixing holes provided in the limit switch cam 14. The link 17 may be fixed to the fixing hole by using the fixing tool used for the joint fastening. The link 17 rotates about the shaft center of the driven shaft 11 and operates in conjunction with the intermittent operation of the Geneva mechanism.

[0027] The auxiliary switch 18, an open/close indicator 19, and an operation counter 20 are connected to the other end of the link 17. The auxiliary switch 18 is an auxiliary contact that operates in conjunction with turning on or off of the main contact of the disconnecter. The open/close indicator 19 is an indicator that displays the open/close status of the disconnecter. The operation counter 20 is a measuring instrument that counts the number of times the disconnecter is opened and closed. The auxiliary switch 18, the open/close indicator 19, and the operation counter 20 operate in conjunction with the intermittent operation of the Geneva wheel 12 via the link 17.

[0028] Further, as a configuration on the driven shaft 11 side, for example, the manual operation shaft 22 used by an operator for manual operation during inspection work of the disconnecter is provided. The manual operation shaft 22 is provided so as to penetrate the hollow portion of the driven shaft 11. The manual operation shaft 22 has the same shaft center as the driven shaft 11. In addition, the manual operation shaft 22 is configured to idle with respect to the driven shaft 11. That is, the driven shaft 11 and the manual operation shaft 22 are configured to rotate independently of each other.

[0029] At one end of the manual operation shaft 22, a gear 21 that meshes with the spur gear 5 of the main shaft 6 is provided. A spring pin 22a is inserted at the

other end of the manual operation shaft 22. The manual handle 23 has a handle groove that engages with the spring pin 22a, and is detachably fixed to the manual operation shaft 22. When the operator rotates the manual operation shaft 22 in the inspection work or the like, the rotation is transmitted to the main shaft 6 via the gear 21, the gear 5, and the connecting cams 4 and 7.

[Operation of disconnecter operating device]

[0030] When the motor 1 rotates in the positive direction, the motor output shaft 2 and the spur gear 3 rotate clockwise. When the spur gear 3 rotates, the spur gear 5 that meshes with the spur gear 3 rotates, so that the connecting cam 4 to which the spur gear 5 is fixed starts idling. Then, when the protrusion of the connecting cam 4 abuts the catch 8, the lock of the connecting cam 7 by the catch 8 is unlocked. The idling of the connecting cam proceeds and it engages with the unlocked connecting cam 7. As a result, the main shaft 6 rotates clockwise according to the output from the motor 1.

[0031] When the main shaft 6 rotates, the main shaft stopper plate 9 fixed to the main shaft 6 and the Geneva driver 10 rotate. Along with the rotation, the drive roller 10b of the Geneva driver 10 escapes from the slot 12c of the Geneva wheel 12, enters the slot 12b at the next rotation and moves along the slot 12b and then escapes from it, and enters the slot 12a at the further next rotation and moves along the slot 12a.

[0032] In this series of movements, the driven shaft 11 rotates while the driving roller 10b of the Geneva driver 10 moves along the slots 12a, 12b, 12c of the Geneva wheel 12. On the other hand, while the drive roller 10b of the Geneva driver 10 is escaped from the slots 12a, 12b, and 12c of the Geneva wheel 12, the semicircular portion of the cam plate 10a of the Geneva driver 10 and the semicircular notch of the Geneva wheel 12 engage with each other, and the rotation of the driven shaft 11 stops. In this way, the rotational force of the Geneva driver 10 is transmitted to the Geneva wheel 12, so that the Geneva wheel 12 operates intermittently. Accordingly, when the main shaft 6 rotates twice, the driven shaft 11 rotates 90 degrees. With the rotation of the main shaft 6 by 720 degrees, the main contact of the disconnecter is turned on.

[0033] When the main shaft 6 rotates twice and the driven shaft 11 rotates 90 degrees, the stop surface 9a and the stop surface 13a of the main shaft stopper plate 9 and the driven shaft stopper plate 13 that rotate accordingly collide with each other, and the drive of the Geneva mechanism is stopped. When the stop surface 9a and the stop surface 13a in the colliding state are the collision surface a, the line segment I-I orthogonal to the collision surface a is configured to pass through the shaft center of the driven shaft 11. Therefore, the main shaft 6 torque applied to the driven shaft stopper plate 13 at the time of a collision is received by the bearing 16 that supports the driven shaft 11.

[0034] Further, the step portion 14a of the limit switch cam 14 rotated with the rotation of the driven shaft 11 comes into contact with the limit switch 15 on the positive rotation side, and the power supply of the motor 1 is shut off. As described above, the stop surfaces 9a and 13a collide with each other, and the limit switch cam 14 shuts off the power supply of the motor 1, so that the main shaft 6 and the driven shaft 11 rotate at a predetermined angle and then stop.

[0035] At the same time, the auxiliary switch 18 is turned on via the link 17 fixed to the limit switch cam 14, and the open/close indicator 19 becomes to a state of turning on. Further, the operation counter 20 counts the number of times of opening and closing. As described above, the operation of the operating device 100 is completed.

[0036] When the motor 1 rotates negatively, the motor output shaft 2 rotates counterclockwise so that the rotation operation opposite to the above is performed. As a result, the stop surface 9b of the main shaft stopper plate and the stop surface 13b collide with each other, and the step portion 14b of the limit switch cam 14 comes into contact with the limit switch 15 on the negative rotation side. At the same time, the auxiliary switch 18 is shut off via the link 17 fixed to the limit switch cam 14, and the open/close indicator 19 becomes to a state of turning off.

[Function and effect]

[0037]

(1) The disconnecter operating device 100 of the present embodiment as described above includes a motor 1 capable of positive rotation and negative rotation, a main shaft 6 rotating according to an output from the motor 1 and driving a main contact of the connected disconnecter, and a driven shaft 11 rotating with the rotation of the main shaft 6, in which a Geneva driver 10 with a driving roller 10b is provided on the main shaft 6, the driven shaft 11 is provided with a Geneva wheel 12 with slots 12a, 12b, and 12c for the driving roller 10b to enter and exit, and the Geneva wheel 12 is configured to rotate while the driving roller 10b moves along the slots 12a, 12b, and 12c according to the rotation of the Geneva driver 10b.

As described above, in the conventional operation device that adopts the connecting cam method, when high-speed operation is performed, the stopper may be damaged, or parts may be deformed or damaged due to the impact of the cam rotating in a reverse direction. Therefore, it is necessary to strengthen components by increasing the size, and the entire device has become large.

On the other hand, the disconnecter operating device 100 of the present embodiment employs the Geneva mechanism using a Geneva driver 10 provided on the main shaft 6 and the Geneva wheel 12 pro-

vided on the driven shaft 11. Therefore, it is possible to perform high-speed operation as compared with a conventional operating device using a plurality of cams. Further, since the Geneva mechanism has only the Geneva driver 10 and the Geneva wheel 12, the operating device 100 can be miniaturized. Further, in the case of the connecting cam method, the intermittent operation joint connected to the cam connected to, for example, the auxiliary switch or the open/close indicator, is temporarily in a free status when the engagement is disengaged. Even in such a case, the intermittent operation joint needs to be maintained in a neutral state so as not to operate the auxiliary switch or the like unnecessarily. Therefore, a neutral spring for supporting the intermittent operation joint is required, and the number of parts is increased.

However, the disconnecter operating device 100 of the present embodiment employs the Geneva mechanism using the Geneva driver 10 and the Geneva wheel 12. Therefore, during the operation of the Geneva mechanism, the status maybe either the drive roller 10b of the Geneva driver 10 is in any of the slots 12a, 12b, and 12c of the Geneva wheel 12, or the cam plate 10a of the Geneva driver 10 and the cam of the Geneva wheel 12 are engaged with each other. Therefore, since the state of the intermittent mechanism is fixed to two states, it is possible to provide a highly reliable operating device without separately providing a component such as a neutral spring.

(2) The main shaft stopper plate 9 is further provided on the main shaft 6, the driven shaft stopper plate 13 is further provided on the driven shaft 11, and the stop surfaces 9a, 9b of the main shaft stopper plate 9 and the stop surface 13a, 13b of the driven shaft stopper plate 13 collide with each other at a predetermined rotation angle to stop the rotation of the Geneva driver 10 and the Geneva wheel 12.

In the conventional operation device, a stopper plate is provided on the main shaft, and a fixed stopper for stopping the stopper plate is fixedly provided in the device. Therefore, it is necessary to adjust the position of the fixed stopper so that the fixed stopper and the stopper plate collide with each other.

On the other hand, in the present embodiment, the main shaft 6 and the driven shaft 11 that operate in synchronization are provided with the stopper plates 9 and 13, respectively, to form a pair of stopper plates. Therefore, the main shaft stopper plate 9 and the driven shaft stopper plate 13 collide with each other in conjunction with the operation of the main shaft 6 and the driven shaft 11. That is, the stopper plates collide with each other at a rotation angle synchronized with the Geneva mechanism. Therefore, the Geneva mechanism can be reliably stopped at a predetermined rotation angle without adjusting the positions of the main shaft stopper plate 9 and the

driven shaft stopper plate 13, so that a highly reliable disconnecter operating device 100 can be provided. (3) When the stop surface 9a, 9b of the main shaft stopper plate 9 and the stop surface 13a, 13b of the driven shaft stopper plate 13 in a colliding state are collision surface a, b, a line segment I-I orthogonal to the collision surface a, b is configured to pass through the shaft center of the driven shaft 11.

If the line segment I-I does not pass through the shaft center of the driven shaft 11, the load due to the collision is applied to the driven shaft stopper plate 13 and the bearing 16. In that case, since a bending load is also applied to the driven shaft stopper plate 13, it is necessary to increase the strength such as increasing the thickness of the stopper plate.

However, in the present embodiment, the torque of the main shaft 6 applied to the driven shaft stopper plate 13 at the time of collision between the stop surfaces 9a and 9b and the stop surfaces 13a and 13b can be received by the bearing 16 incorporated in the driven shaft 11. Even if the bearing 16 is small in size, it can exhibit sufficient load bearing capacity. Therefore, the driven shaft stopper plate 13 may be designed in consideration of only the compression strength due to collision. From the above, it is not necessary to increase the strength of parts of the Geneva mechanism and the stopper plate by increasing the size or the like, and it is possible to provide a compact and highly reliable disconnecter operating device 100.

(4) The driven shaft 11 is hollow, the manual operation shaft 22 is provided coaxially with the driven shaft 11 so as to penetrate the hollow, and at the manual operation shaft 22, the gear 21 meshing with the gear 5 provided on the main shaft 6 is provided. In the present embodiment in which the Geneva mechanism is adopted as the intermittent mechanism, it is necessary to provide the driven shaft 11 in addition to the main shaft 6. Conventionally, although a manual operation shaft provided with a gear that meshes with the gear 5 of the main shaft 6 is further added as a separate shaft, in the present embodiment, the driven shaft 11 and the manual operation shaft 22 are provided coaxially, and the driven shaft 11 and the manual operation shaft 22 are not integrated and can operate independently of each other. Therefore, it is possible to provide a smaller disconnecter operating device 100. Further, by providing the manual operation shaft 22 and the gear 21 coaxially with the driven shaft 11 instead of the main shaft 6, the force required for the operator to operate the manual operation shaft 22 is reduced, and the operability is improved.

(5) The limit switch cam 14 is provided on the driven shaft 11, the limit switch 15 shutting off a power supply of the motor 1 is provided around the limit switch cam 14, and the limit switch cam 14 abuts on the limit switch 15 at a predetermined angle at which the

stop surface 9a, 9b of the main shaft stopper plate 9 and the stop surface 9a, 9b of the driven shaft stopper plate 13 collide, and the limit switch 15 shuts off the power supply of the motor 1.

By providing the limit switch cam 14 on the driven shaft 11, after the main shaft 6 rotates by a predetermined angle, the limit switch cam 14 operates in conjunction with the main shaft 6 and the Geneva mechanism. Therefore, the operation of the motor 1 can be stopped with high accuracy when reaching the stop position. Therefore, the reliability of the disconnecting operating device 100 can be further improved.

(6) The link 17 is fixed to the Geneva wheel 12 so as to operate in conjunction with the Geneva wheel 12, the auxiliary switch 18 and an open/close indicator 19 are connected to the link so as to operate in conjunction with the Geneva wheel 12 via the link 17.

[0038] By connecting the auxiliary switch 18 and the open/close indicator 19 to the Geneva wheel 13, the auxiliary switch 18 and the open/close indicator 19 can be interlocked with the operation of the main shaft 6, so that the auxiliary switch 18 is operated with high accuracy, and at the same time, it is possible to indicate the open/close state of the switch.

[0039] Each of the above embodiments and aspects is presented as an example in the present specification and is not intended to limit the scope of the invention. Various other forms, and various omissions, replacements, and changes may be made without departing from the scope of the invention. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

[0040] For example, in the above embodiment, the manual operation shaft 22 is provided coaxially with the driven shaft 11, but it can also be provided coaxially with the main shaft 6.

Claims

1. A disconnecting operating device, comprising:

a motor capable of positive rotation and negative rotation;
a main shaft rotating according to an output from the motor and driving a main contact of the connected disconnecting device; and
a driven shaft rotating with the rotation of the main shaft,
wherein a Geneva driver with a driving roller is provided on the main shaft;
the driven shaft is provided with a Geneva wheel with a slot for the driving roller to enter and exit;
and

the Geneva wheel is configured to rotate while the driving roller moves along the slot according to the rotation of the Geneva driver.

2. The disconnecting operating device according to claim 1, wherein:

a main shaft stopper plate is further provided on the main shaft;
a driven shaft stopper plate is further provided on the driven shaft; and
a stop surface of the main shaft stopper plate and a stop surface of the driven shaft stopper plate collide with each other at a predetermined rotation angle to stop the rotation of the Geneva driver and the Geneva wheel.

3. The disconnecting operating device according to claim 2, wherein:

when the stop surface of the main shaft stopper plate and the stop surface of the driven shaft stopper plate in a colliding state are collision surface, a line segment orthogonal to the collision surface is configured to pass through the shaft center of the driven shaft.

4. The disconnecting operating device according to any one of claims 1-3, wherein:

the driven shaft is hollow;
a manual operation shaft is provided coaxially with the driven shaft so as to penetrate the hollow; and
at the manual operation shaft, a gear meshing with a gear provided on the main shaft is provided.

5. The disconnecting operating device according to any one of claims 1-4, wherein:

a limit switch cam is provided on the driven shaft;
a limit switch shutting off a power supply of the motor is provided around the limit switch cam; and
the limit switch cam abuts on the limit switch at a predetermined angle at which the stop surface of the main shaft stopper plate and the stop surface of the driven shaft stopper plate collide, and the limit switch shuts off the power supply of the motor.

6. The disconnecting operating device according to any one of claims 1-5, wherein:

a link is fixed to the Geneva wheel so as to operate in conjunction with the Geneva wheel;
an auxiliary switch and an open/close indicator

are connected to the link so as to operate in conjunction with the Geneva wheel via the link.

Amended claims under Art. 19.1 PCT

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1. Corrected) A disconnecter operating device, comprising:

a motor capable of positive rotation and negative rotation; 10
 a main shaft rotating according to an output from the motor and driving a main contact of the connected disconnecter; and
 a driven shaft rotating with the rotation of the main shaft, 15
 wherein a Geneva driver with a driving roller and a main shaft stopper plate are provided on the main shaft;
 the driven shaft is provided with a Geneva wheel 20
 with a slot for the driving roller to enter and exit and a driven shaft stopper plate;
 the Geneva wheel is configured to rotate while the driving roller moves along the slot according 25
 to the rotation of the Geneva driver; and
 a stop surface of the main shaft stopper plate and a stop surface of the driven shaft stopper plate collide with each other at a predetermined rotation angle to stop the rotation of the Geneva driver and the Geneva wheel. 30

2. cancelled)

3. corrected) A disconnecter operating device according to Claim 1, wherein when the stop surface 35
 of the main shaft stopper plate and the stop surface of the driven shaft stopper plate in a colliding state are collision surface, a line segment orthogonal to the collision surface is configured to pass through the shaft center of the driven shaft. 40

4. corrected) The disconnecter operating device according to claim 1 or 3, wherein:

the driven shaft is hollow; 45
 a manual operation shaft is provided coaxially with the driven shaft so as to penetrate the hollow; and
 at the manual operation shaft, a gear meshing with a gear provided on the main shaft is provided. 50

5. corrected) The disconnecter operating device according to any one of claims 1, 3, 4, wherein:

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a limit switch cam is provided on the driven shaft;
 a limit switch shutting off a power supply of the motor is provided around the limit switch cam;

and

the limit switch cam abuts on the limit switch at a predetermined angle at which the stop surface of the main shaft stopper plate and the stop surface of the driven shaft stopper plate collide, and the limit switch shuts off the power supply of the motor.

6. corrected) The disconnecter operating device according to any one of claims 1, 3-5, wherein:

a link is fixed to the Geneva wheel so as to operate in conjunction with the Geneva wheel;
 an auxiliary switch and an open/close indicator are connected to the link so as to operate in conjunction with the Geneva wheel via the link.

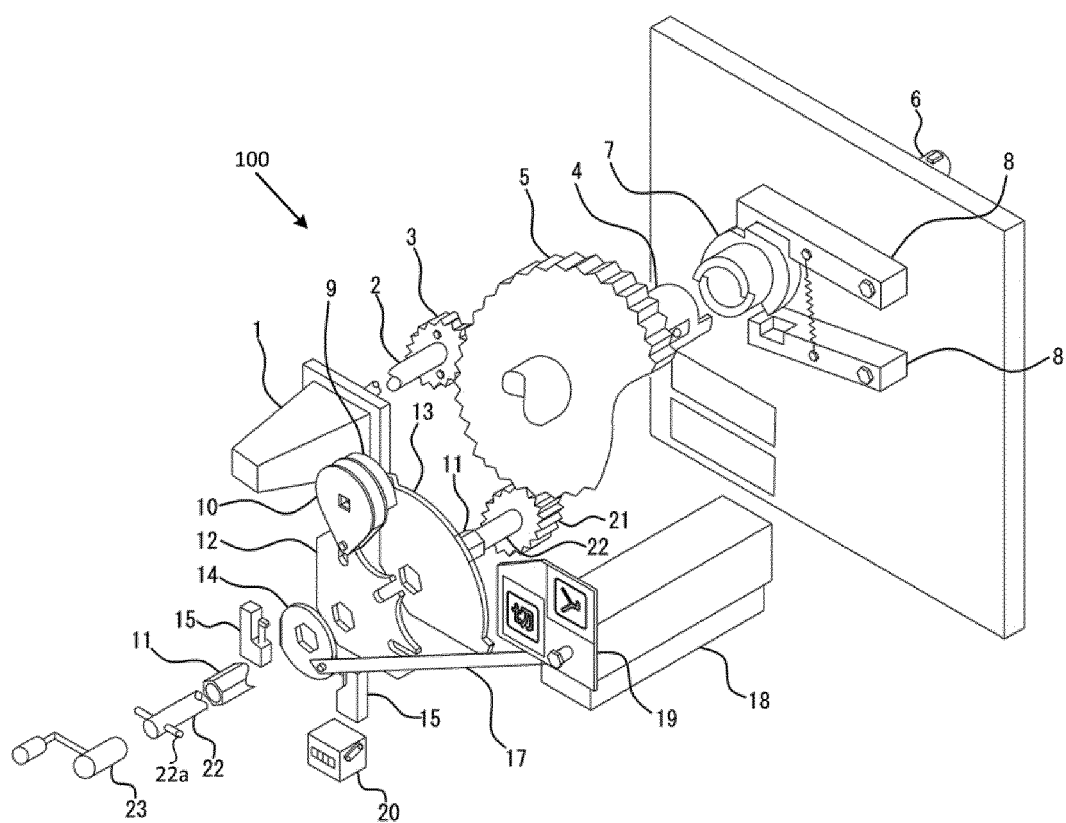


FIG. 1

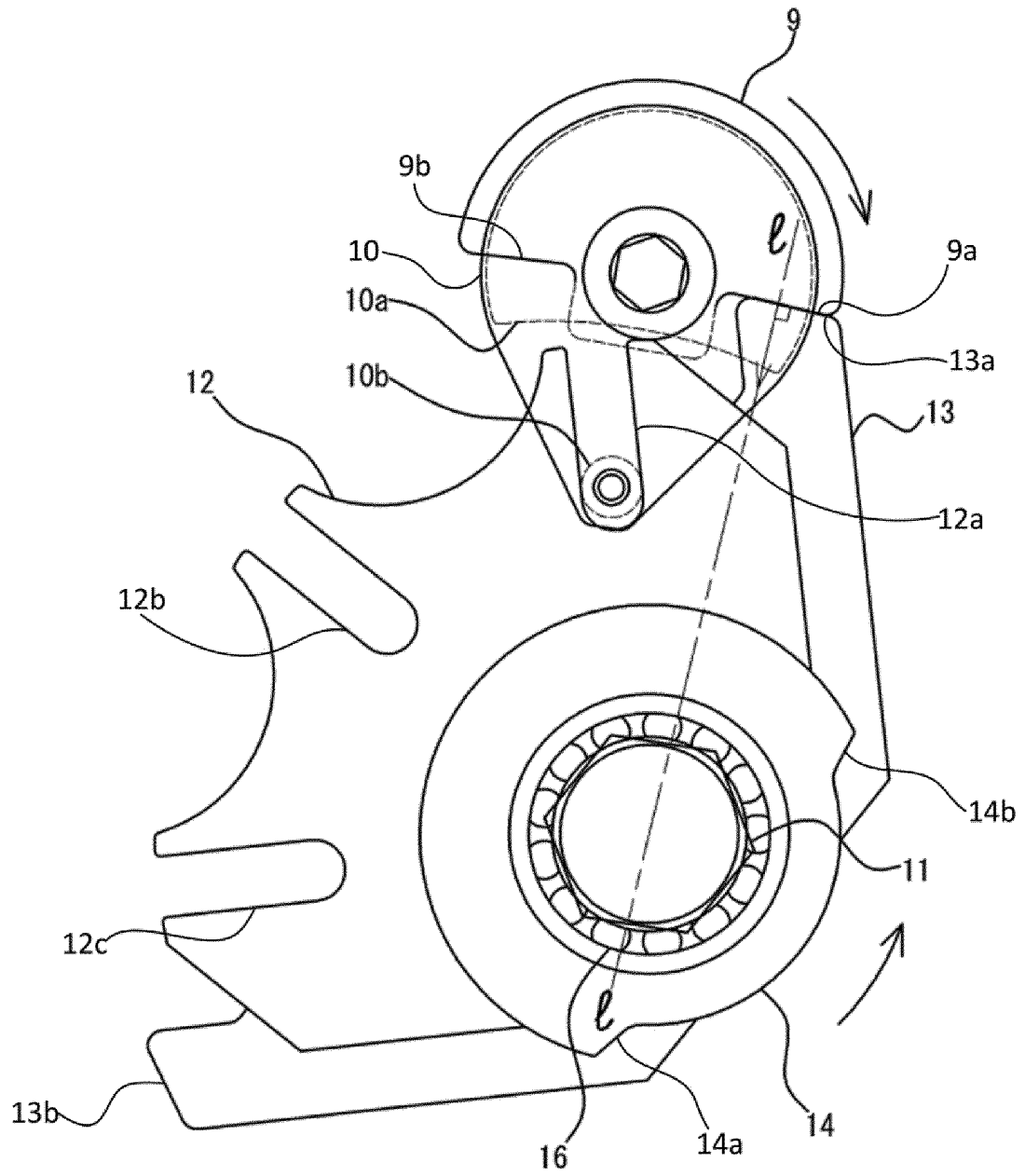


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/023172

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. H01H31/02 (2006.01) i, H01H33/28 (2006.01) i, H01H33/36 (2006.01) i,
H01H33/42 (2006.01) i, H02B13/035 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl. H01H31/02, H01H33/28, H01H33/36, H01H33/42, H02B13/035

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2018
Registered utility model specifications of Japan 1996-2018
Published registered utility model applications of Japan 1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Microfilm of the specification and drawings	1
A	annexed to the request of Japanese Utility Model Application No. 088647/1974 (Laid-open No. 016854/1976) (TOKYO SHIBAURA ELECTRIC CO., LTD.) 06 February 1976, description, page 3, line 2 to page 7, line 14, fig. 1, 2 (Family: none)	2-6
A	JP 51-5701 B1 (MEIDENSHA CORP.) 21 February 1976, entire text, all drawings (Family: none)	1-6
A	JP 2013-77394 A (TKD KK) 25 April 2013, entire text, all drawings & CN 103035425 A & KR 10-2013-0035171 A & TW 201320137 A	1-6



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
16.08.2018

Date of mailing of the international search report
28.08.2018

Name and mailing address of the ISA/
Japan Patent Office
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H03068335 U **[0004]**