

DESCRIPTION

GROUND DISCONNECTOR

Technical Field

[0001] The present invention relates to a ground
5 disconnecter in which stopping means for maintaining
a movable contact in a stopped state at a specified
position is equipped.

Background Art

[0002] In general, a disconnecter opens or closes a
10 system circuit which has been charged. Hence, as is
different from a circuit breaker for opening or
closing a load current, the disconnecter is used to
switch and section the system circuit and to separate
a non-load equipment from the system circuit. In a
15 case where the maintenance and inspection for the
system circuit are performed, the disconnecter is
used to separate its portion of the system circuit
from a power supply and to secure the opening of the
system circuit.

20 [0003] For example, in the ground disconnecter
described in a patent literature 1, a movable contact
which is contacted with and is separated from both
contact portions is interposed between a ground
contact and a fixed contact. The ground contact is
25 grounded and the fixed contact is connected with a
system side power supply. The movable contact is
connected with a load side electrical equipment. Then,
a power is supplied from the system side power supply
to the load side electrical equipment in a state
30 where the movable contact is connected with the fixed
contact.

[0004] In order to perform the maintenance and

inspection for the load side electrical equipment,
the movable contact is pivoted and the movable
contact is separated from the fixed contact.
Thereafter, the movable contact is, furthermore.

5 pivoted and is passed through a disconnecting
position to contact with a ground contact to ground a
charge current charged in the negative load side
electrical equipment. With an electrical safety
secured, the maintenance and inspection for the load
10 side electrical equipment are performed.

[0005] A position at which the movable contact is
contracted with the fixed contact is called a closing
position and a position at which the movable contact
is separated from both of the fixed contact and the
15 ground contact is called a disconnecting position. It
is necessary not to generate an insulating breakdown
due to a thunder or so forth at the disconnecting
position and to take an insulating distance at which
an operator is not electrified at a load side circuit.

20 The disconnecting position is positioned at an
intermediate position between the ground contact
position and the closing position and the above-
described condition is needed to be provided. It is
often needed that the movable contact is certainly
25 stopped and is maintained at the stopped position of
each position of the closing position, the ground
position, and the disconnecting position.

Patent literature 1: A Japanese Patent Application
Publication (tokkai) Heisei 11-89027.

30 **DISCLOSURE OF THE INVENTION**

Solution Of Problem To be solved by the Invention

[0006] However, in patent literature 1, the
disconnecter is not equipped with a mechanism to

maintain the movable contact at each position due to a complexity in an operational mechanism or due to little demand.

5 [0007] However, in these days, an increased safety consciousness to such an operation as described above has been found and a more strong demand of an advent in the ground disconnecter having the mechanism to stop and maintain the movable contact assuredly at each position has been made.

10 [0008] It is, hence, an object of the present invention to provide a ground disconnecter which is capable of maintaining and stopping the movable contact at each of the positions with a simple operational mechanism.

15 Means For Solving the Problem

[0009] The ground disconnecter according to the claim 1 comprises a main shaft pivoted in accordance with a pivotal movement of a pivotal board; a movable contact linked to this main shaft via an insulating
20 link mechanism and pivoted to contact with or separate from a fixed contact portion; stopping means installed on the pivotal board for stopping the movable contact at a specified position; and engaging means engaged with the stopping means in response to
25 an external operation command for maintaining the pivotal board in a stopped state.

[0010] The ground disconnecter according to the claim 2, is in the ground disconnecter as claimed in claim 1, the stopping means comprises a plurality of
30 stopping holes, each stopping hole being formed in a right-angle direction with respect to a main surface of the pivotal board, and the engaging means includes a rod (plunger) which is moved in a direction

orthogonal to the main surface of the pivotal board and its tip portion of the rod is inserted into or drawn out of any one of the stopping holes.

[0011] The ground disconnecter according to the
5 claim 3 is that, in the ground disconnecter as claimed in claim 2, the stopping holes comprise three holes of a hole for closing position, a hole for disconnecting position, and a hole for ground
10 position, the engaging means being inserted into and being drawn out of each of the stopping holes, at specified positions of the movable contact of a closing position, a disconnecting position, and a ground position.

[0012] The ground disconnecter according to the
15 claim 4 is that, in the ground disconnecter described in either claim 2 or claim 3, the rod is biased in a direction toward the stopping holes by means of a spring and wherein an excitation of an electromagnetic coil causes the tip portion of the
20 rod to be drawn out of any one of the stopping holes against a biasing force of the spring.

[0013] The ground disconnecter as claimed in claim
5 is that, in the ground disconnecter as described in any one of the preceding claims 2 through 4, the rod
25 has a small diameter portion through which a manual lever (stopper) is inserted in order for the tip portion of the rod to lockably be inserted into any one of the stopping holes.

[0014] The ground disconnecter as claimed in claim
30 6 is that, in the ground disconnecter as recited in the claim 5, the manual lever is formed to have a larger diameter than the diameter of the rod and the manual lever comprises: a rod movement allowing hole

configured to allow a movement of the rod in the direction in which the rod is inserted therein or the rod is drawn out thereof; and a rod movement block hole formed in a state communicate with the rod movement allowance hole and formed to have a smaller diameter than the diameter of the rod and a larger diameter than the small diameter portion of the rod and wherein the small diameter portion of the rod is accommodated into the rod movement block hole to block the movement of the rod from being drawn out of any one of the stopping holes.

[0015] The ground disconnecter as claimed in claim 7 is that, in the ground disconnecter described in the claim 6, the manual lever has one end pivotably attached to the main shaft and a pivoting force is provided for the manual lever by means of a spring and wherein, when the tip portion of the rod is inserted within any one of the stopping holes, a biasing force of the spring causes the small diameter portion of the rod to be introduced within the rod movement block hole.

[0016] The ground disconnecter as claimed in claim 8 is that, in the ground disconnecter as claimed in claim 7, the manual lever has a manual operation portion at a free end thereof projected externally from an opening installed on a drive mechanism compartment and a lever engagement portion is installed at one side portion of the opening to be pressed down against the biasing force of the spring in order for the manual lever through which the small diameter portion is introduced within the rod movement block hole to be engaged therewith.

[0017] The ground disconnecter as claimed in claim

9 is that, in the ground disconnecter as claimed in any one of the preceding claims 1 through 8, the disconnecter includes a drive shaft to pivot the pivotal board and wherein the drive shaft includes: a
5 motor; a drive shaft revolved by means of the motor; and a female screw installed on the pivotal board configured to convert the revolution of the drive shaft into the pivotal movement of the pivotal board.

[0018] The ground disconnecter as claimed in claim
10 is that, in the ground disconnecter as described in claim 9, the drive shaft includes: a first drive shaft; and a second drive shaft linked to the first drive shaft via an universal joint and wherein a male screw formed on the second drive shaft is screwed
15 into the female screw.

Effect of the invention

[0019] The invention according to the claim 1 can maintain the movable contact at each specified stopping position with simple structure and operation
20 such that the engaging means is engaged with the stopping means.

[0020] The invention according to the claim 2 can form the stopping means with such a simple operation that each of a plurality of stopping holes is
25 installed in the right angle direction with respect to the main surface of the pivotal board. In addition, the rod constituting the engaging means is moved in a direction orthogonal to the main surface of the pivotal board and is inserted into each of the
30 stopping holes in order for enabling the movable contact to be positioned.

[0021] The invention according to the claim 3 can maintain the movable contact at the closing position

by inserting the engaging means into the hole for closing position constituting the stopping holes, can maintain the movable contact at the disconnecting position by inserting the engaging means into the

5 hole for disconnecting position, can maintain the movable contact at the ground position by inserting the engaging means into the hole for ground position.

[0022] The invention according to the claim 4 can position the movable contact with the rod biased by

10 means of the spring by inserting the tip portion of the rod within any one of the stopping holes and can release the positioning of the movable contact with the tip portion of the rod drawn out of the one of the stopping holes against the biasing force of the

15 spring by an excitation of the electromagnetic coil.

[0023] The invention according to the claim 5 can maintain the tip portion of the rod in a state in which the tip of the rod is inserted into each of the stopping holes by inserting the manual lever into the

20 small diameter portion of the rod with the tip portion of the rod inserted into each of the stopping holes.

[0024] The invention according to the claim 6 can lock the rod to a slide disabled state by positioning

25 the rod movement block portion of the manual lever at the small diameter portion of the rod in a state in which the tip of the rod is inserted into one of the stopping holes.

[0025] The invention according to the claim 7 can

30 block the movement of the rod in the insertion or drawn out direction by introducing the small diameter portion of the rod into the rod movement block portion by pivoting the manual lever against the

biasing force of the spring in a state in which the tip portion of the rod is inserted into any one of the stopping holes.

[0026] The invention according to the claim 8 can
5 block the movement of the rod in the insertion or drawn out direction by pressing down the manual operation portion of the manual lever projected externally from the opening installed on the drive mechanism compartment against the biasing force so
10 that the small diameter portion is introduced within the rod movement block portion and, thereafter, the manual lever is engaged with the lever engagement portion installed on the one side portion of the opening.

15 [0027] The invention according to the claim 9 can pivot the pivotal board with the revolution of the drive shaft converted into the pivotal movement of the pivotal board by means of the female screw when the drive shaft is revolved.

20 [0028] The invention according to the claim 10 is that, in the ground disconnecter described in the claim 9, the drive shaft includes the first drive shaft and the second drive shaft linked to the first drive shaft via the universal joint and the female
25 screw formed on the second drive shaft is screwed into the male screw and, thus, a transition movement of the second shaft involved in the pivotal movement of the pivotal board is absorbed by the universal joint so that the first shaft and the second shaft
30 can smoothly be revolved.

Best Mode for Carrying Out the Invention

[0029] Hereinafter, a preferred embodiment of the present invention will be made with reference to Figs.

1 through 11. Fig. 1 shows a view of a ground
disconnecter 1 viewed from a front portion. Ground
disconnecter 1 is constituted by a drive compartment
1A, an switching compartment 20, and a drive
5 mechanism compartment 30. Fig. 2 shows a cross
sectional view at a proximity of a right side surface
of ground disconnecter 1 in Fig. 1. Fig. 3 is a
cross sectional view of open-and-closure type chamber
20 cut away along a line A - A in Fig. 1. Fig. 4 is
10 a cross sectional view of drive compartment 1A and
drive mechanism compartment 30 cut away along a line
A - A shown in Fig. 1. Fig. 4 are cross sectional
views of drive compartment 1A and drive mechanism
compartment 30 cut away along a line B - B in Fig. 1.
15 [0030] In Figs. 1 through 4, drive compartment 1A
and drive mechanism compartment 30 are supported on a
supporting plate 2 made of a circular steel plate.
Supporting plate 2 is provided with ground tightening
plates 21 which are placed at a higher position than
20 drive compartment 1A. As shown in Figs. 2, an
switching compartment 20 is installed at a rear
surface side of ground tightening plates 21 and
supporting plate 2. Drive compartment 1A and drive
mechanism compartment 30 are positioned at a lower
25 position than ground tightening plates 21 and are
formed in a box shape projected from a front surface
of supporting plate 2, the box shape being formed by
a bending working of a steel.
[0031] As shown in Figs. 2 and 3, three-phase
30 contact portions 22A through 22C (represented by a
reference numeral 22 in Fig. 2) are arranged on an
upper-side supporting plate 2 upper than each of
insulating links 6A connected with a movable contact

7 disposed within switching compartment 20. Each of contact portions 22A through 22C is projected toward the movable contact and linked with a conductor 23. Conductor 23 is supported by insulating bushings 24, 5 24 respectively arranged between closing contact portion 22A and disconnecting contact portion 22B and between disconnecting contact portion 22B and ground contact 22C.

[0032] An outer diameter of each insulating 10 bushing 24 is formed which becomes gradually smaller in diameter as each insulating bushing 24 goes from a supporting plate side to conductor 23.

Each insulating bushing 24 is so constructed that ground tightening plate 21 is inserted at the 15 insulating bushing side through which supporting plate 2 is penetrated, each nut 21B is screwed into a bolt 21A of supporting plate 2 so that ground tightening plates 21 are inserted into insulating bushings 24. Thus, ground tightening 20 plates 21 and insulating bushings 24 are fixed to supporting plate 2.

[0033] Switching compartment 20 is formed within a grounded metallic casing 50 and a movable contact portion 9A is supported by an insulator 52 attached 25 onto supporting plate 2. A closing contact portion 10 is also supported on an insulator 54 attached onto metallic casing 50. In addition, a load side conductor 9B is connected with an external load side electrical equipment 9C penetrating metallic 30 casing 50. An insulating spacer is inserted into a penetrated portion of metallic casing 50.

[0034] As shown in Fig. 3, one end side of internal conductor 24A of each insulating bushing 24 is

electrically connected to conductor 23 by means of each bolt 24B. On the other hand, the other end of each internal conductor 24A is inserted into a ground conductor 25 and, by tightening

5 attaching screws 25A, the other end of each internal conductor 24A is electrically connected to ground conductor 25 which is grounded as denoted by E. By moving movable contact 7 at the ground position, an electrical charge charged into load

10 side electrical equipment 9C shown in Fig. 2 is discharged to an earth E. Thus, in a state where an electrical safety is secured, the maintenance and inspection for load side electrical equipment 9C can be performed.

15 [0035] As shown in Fig. 4, a main shaft 4 is rotatably attached between a pair of side plates 1B, 1C of drive compartment 1A. Main shaft 4 is fixed with three couples of levers 5 to attach one end portion of each insulating link 6A.

20 These levers 5 are constituted by a pair of link grasping plates 5A, 5B, one end portion of each insulating link 6A being grasped between link grasping plates 5A, 5B and a pin 5C serves to link these respective three plates and links.

25 [0036] In addition, the other end portion of each insulating link 6A, as shown in Fig. 2, is rotatably attached at approximately a center portion of movable contact 7 via a supporting pin 6B. A lower end portion of movable contact 7 is

30 pivotably attached to movable contact attachment portion 9A via a shaft 11. Lever 5 and insulating link 6A constitute an insulating link mechanism. Then, if movable contact 7 is

pivoted from a disconnecting position denoted by a solid line in Fig. 2 through a predetermined angle in a clockwise direction (X1 direction) with shaft 11 as a center, a tip portion of movable contact

5 7 is moved at a closing position denoted by a dot-dot-and-dash line in order for the tip portion of movable contact 7 to be contacted with a fixed contact 10. In addition, if movable contact portion

10 7 is pivoted through a predetermined angle in a counterclockwise direction (X2 direction) with shaft 11 as a center, the tip portion of movable contact portion 7 is moved at a ground position denoted by a dot-and-dash line in Fig.2 so that the tip portion of movable contact 7 is

15 contacted with a ground contact 22 (22A through 22C). [0037] As shown in Fig. 4, movable contact 7 includes: a pair of blades 7A, 7B grasping the other end portions of insulating links 6A; adjustment bolts 7C inserted into through holes

20 penetrated through these blades 7C; adjustment springs 7D inserted through adjustment bolts 7C; and nuts 7E screwed into adjustment bolts. Fixed contact 10 and ground contact

25 22 (22A through 22C) are grasped by means of pair of blades 7A and 7B. Thus, the pair of blades 7A, 7B are contacted with both surfaces of closing contact portion 10 and ground contact 22 (22A through 22C). The pair of blades 7A, 7B are contacted

30 against both surfaces of each closing portion 10. According to its necessity, each nut 7E is tightened to adjust a spring pressure of corresponding adjustment spring 7D. Thus, a contact pressure against fixed contact 10 and ground contact

portion 22 are adjusted.

[0038] As shown in Fig. 2, the load side conductor 9B is attached to movable contact attachment portion (load purpose terminal portion) 9A at which
5 movable contact 7 is attached. Load side electrical equipment 9C is connected with load side conductor 9B.

[0039] If, in order to make movable contact 7 operate, for example, as shown in Fig. 2, main
10 shaft 4 is pivoted in the clockwise direction (X1 direction), insulating link 6A is accordingly moved in a rightward direction (X'1 direction).

Thus, movable contact 7 is turned into fixed contact 10 as denoted by the dot-and-dash line.
15 The closure of closing contact portion 10 causes a power supply from power source 10G to load side electrical equipment 9C.

A position at which movable contact 7 is turned on at the fixed contact is called
20 a closing position A. On the contrary, if main shaft 4 is pivoted in a counterclockwise direction X2, insulating link 6A is moved in the leftward direction (X2' direction), movable contact 7 is separated from fixed contact 10, passing
25 disconnecting contact position B to be contacted with ground contact 22. This position is called a ground position C.

[0040] Disconnecting position B interposed between closing position A and ground position C is an
30 insulating distance in which movable contact 7 is separated from fixed contact 10 and no insulating breakdown due to a thunder or so forth occurs and the operator is not electrified by

load side conductor 9B.

[0041] As shown in Fig. 4, a right end portion of main shaft 4 penetrates a right side plate 1C of drive compartment 1A and is inserted in a
5 pivotal board 31 within drive mechanism compartment 30. As shown in Fig. 6, pivotal board 31 includes: a shaft inserting portion 32 which is thick in the direction of main shaft; a flat surface portion 33 which is thinner than shaft inserting
10 portion 32; and an inversed letter U shaped arm portion 34. Main shaft 4 is inserted into shaft inserting portion 32. Flat surface portion 33 is formed of a disk shape or a sector shape. A cylindrical shaft 36E is attached to an inverse
15 letter-U shaped arm 34. Pivotal board 31 is formed of an insulating resin member.

[0042] As shown in Fig. 5, main shaft 4 and shaft inserting portion 32 are integrally coupled together by means of a fastening bolt 35A by
20 inserting fastening bolt 35A into a penetrated hole penetrated from an upper side to a lower side and by tightening a nut 35B inserted into a tightening bolt end exposed from shaft inserting portion 32. Hence, if pivotal board 31 is pivoted, main
25 shaft 4 is accordingly pivoted in the same direction. Drive shaft 36 to pivot pivotal board 31 is disposed below shaft inserting portion 32. Although drive shaft 36A of drive shaft 36 is pivoted by means of a motor 37 (refer to Fig. 2),
30 it is possible to be pivoted manually.

[0043] As shown in Fig. 5, drive shaft 36A is constituted by a first drive shaft 36B rotatably attached onto an attachment plate 44 and

a second drive shaft 36C linked via a universal joint 38 to first drive shaft 36B.

[0044] As shown in Fig. 2, a gear 37B is provided on first drive shaft 36B and is engaged with a pinion gear 37A of motor 37. First drive shaft 36B or
5 second drive shaft 36C is rotated according to the revolution of motor 37. As shown in Figs. 5 and 6, a male screw 36Y is provided on a second drive shaft 36C. Male screw 36Y is screwed
10 into female screw 36D. An outer peripheral surface of this female screw 36D is formed in a barrel shape and is pivotable in an inner peripheral direction of shaft 36E of a cylindrical shape.

[0045] As shown in Fig. 5, when first drive shaft 36B is rotated in the clockwise direction (X1
15 direction), second drive shaft 36C is rotated in the same direction via a universal joint 38. Thus, a female screw 36D screwed on second drive shaft 36C moves in the axial direction (X'1 direction) to drive
20 a cylindrical shaft 36E. Thus, together with shaft 36E, pivotal board 31 and main shaft 4 are pivoted in the X'1 direction. On the contrary, when drive shaft 36A is rotated in the counterclockwise direction (X2 direction), female screw 36D screwed
25 to second drive shaft 36C is moved at the shaft direction (X'2 direction) of second drive shaft 36C to drive cylindrical shaft 36E. Thus, together with shaft 36E, pivotal board 31 and main shaft 4 are pivoted in the X2 direction. A tip of second drive
30 shaft 36C is rotatably and vertically movably supported in a grasped state by means of a pair of drop preventive supporting attachments 39 shown in Fig.2. A drop preventive supporting attachment

39 is attached onto supporting plate 2. A transition movement of second drive shaft 36C is absorbed by means of universal joint 38. Hence, second drive shaft 36C can smoothly be rotated.

5 [0046] If universal joint 38 is not used, second drive shaft 36C is not revolved nor an extra load weight is applied onto second drive shaft 36C even if it is revolved. A defect such that the drive shaft in which the power is magnified is
10 required is developed. However, in this embodiment, less power motor 37 and drive shaft 36 can be used. The less consumption energy of drive shaft 36, So--called, a saved energy can be achieved.

[0047] In addition, if, to pivot pivotal board 31,
15 a tooth profile of a worm wheel is formed on part of a peripheral surface portion, viz., a thickness surface of pivotal board 31. Thus, if the teeth profile of this worm wheel is engaged with the pinion gear of the motor. At this time, the number of
20 constituent parts can be reduced than the number of constituent parts used in the above-described drive shaft.

[0048] In the way as described below, when pivotal board 31 and main shaft 4 are pivoted in the
25 clockwise direction (X1 direction) as shown in Fig. 2, movable contact 7 is also pivoted in the same direction and is inserted into closing contact portion 10. In the reverse order as described before, when pivotal board 31 and main shaft 4 are
30 pivoted in the counterclockwise direction (X2 direction), movable contact 7 is contacted with ground contact 22 from closing position. A via disconnecting position B to contact with

Ground contact 22 and is stopped at ground
Position C. As shown in Fig. 5, a cam surface 60 is
formed to pick up a position signal of pivotal board
31 and, in cooperation with a micro-switch, the
5 stopped position of pivotal board 31 is controlled
as will be described later.

[0049] As stopping means for stopping and
maintaining movable contact 7 at
each position, in this embodiment, as shown in Fig. 5,
10 three stopping holes are formed at predetermined
intervals at an arc position of a main surface 33A of
flat portion 33 of pivotal board 31 with main
shaft 4 as a center. Each stopping hole is
called from the lower side of Fig. 5 toward the upper
15 side thereof, a hole for closing position 31A, a
disconnecting
hole 31B, and a hole for ground position 31C. Each of
these
hole for closing position 31A, hole for disconnecting
20 position 31B, and
hole for ground position 31C is formed at a right
angle to
main surface 33A.

[0050] Engaging means, for example, a tip end
25 portion of a plunger (rod) 41 of an electromagnetic
plunger 40 is inserted into each hole 31A through 31C.
For example, as shown in Fig. 5, the tip end portion
of plunger 41 is inserted into hole for
disconnecting position 31B at disconnecting position
30 B. The tip end portion of plunger 41 is inserted into
closing position 31A at closing position A.
The tip end portion of plunger 41 is inserted into
hole for ground position 31C at ground position C.

[0051] As described hereinabove, pivotal board 31 is provided with stopping means such as holes, grooves, and magnets at a position corresponding to each position specified and, when engagement means
5 such as the plunger or operating rod is engaged with this stopping means so that the pivotal board is stopped at the specified position.

[0052] As shown in Fig. 5, electromagnetic plunger 40 is tightened onto attachment plate 44 mounted
10 on a floor plate within the drive chamber by means of bolts 44A. First drive shaft 36B is rotatably inserted into a through hole 44B located at a lower side of bolts 44A.

[0053] As shown in Figs. 7 and 8, electromagnetic
15 plunger 40 includes: plunger (rod) 41; a spring 42 which biases plunger 41 in a press-out direction; and an electromagnetic coil 43 which biases spring 42 in a direction at which spring 42 is compressed.

[0054] Plunger 41 includes: a shaft 41A; a
20 main part of plunger 41B having a larger diameter than shaft 41A; a stopper flange 41C formed against one end portion of the main body portion at a predetermined interval of distance; and a pin 41D installed at the tip portion of
25 main part of plunger 41B to be inserted through respective holes 31A through 31C.

A shaft portion for hole 41E is provided to insert a manual lever 45 as will be described later between main part of plunger 41B and stopper flange 41C.

30 [0055] Plunger 41 is biased by means of an extension force of spring 42, as shown in Fig. 7, when the disconnecter is placed at one of closing position, the disconnecting position, and

the ground position. Pin 41D is fitted into hole for closing position 31A, hole for disconnecting position 31B, or hole for ground position 31C. In this state, when the power is supplied to

5 electromagnetic coil 43, as shown in Fig. 8, plunger 41 is biased and moved in the compression direction. And pin 41D is drawn out of hole for closing position 31A, disconnecting hole 31B, or hole for ground position 31C to be moved in a state

10 wherein pivotal board 31 is pivotable.

[0056] As shown in Fig. 7, manual lever 45 is arranged to be intersected at a right angle to plunger 41. Manual lever 45 blocks the movement of plunger 41 in a case where a close command is

15 erroneously issued from a central control portion. Specifically, the safety of the operator is secured for movable contact 7 not to be moved to either the disconnecting position or the closing position during the maintenance and inspection at the

20 ground contact side portion.

[0057] As shown in Figs. 9 and 10, one end 45A of manual lever 45 is rotatably attached on main shaft 4 and a manual operation portion 45B at the other end thereof is projected externally from an

25 opening 48 installed on a front surface wall 30A of the drive mechanism compartment. Manual lever 45 is formed having a larger diameter than the diameter of main part of plunger 41B.

Manual lever 45 is formed with a plunger movement

30 allowance hole 45C (hereinafter, referred to as a passage hole) which can accommodate main part of plunger 41B and a plunger movement block hole 45D (hereinafter, referred to as a

block hole) interlinked to this hole 45C, having a smaller diameter than the diameter of main body portion 41B and larger than shaft 41A.

[0058] Since passage hole 45C and block hole 45D are communicated with each other and only a shaft portion 41A can be communicated between passage hole 45C and block hole 45D. A tension spring 46 is installed between drive mechanism compartment inner wall 30B and manual lever 45.

10 A stopper 47 is supported on drive mechanism compartment internal wall 30B.

It should be noted that manual lever 45 may rotatably be mounted on a supporting shaft within the drive chamber.

15 [0059] Next, an operation of manual lever 45 will be described below. As shown in Fig. 11, in a case where manual operation portion 45B of manual lever 45 is placed at an upper side of an opening 48, main part of plunger 41B of plunger 41 is placed at passage hole 45C, as shown in Fig. 9, to be in a movable state toward pivotal board 31. Hence, in this state, plunger 41 is moved in a rightward direction of Fig. 8 due to a tension of spring 42. As shown in Fig. 7, 20 a pin 41D of plunger 41 is, for example, inserted into hole for ground position 31C and is positioned. In addition, a lever inserting portion 41E, namely, shaft 41A between main part of plunger 41B and stopper flange 41C is moved at a position of 25 manual lever 45.

[0060] Then, as denoted by a broken line of Fig. 11, manual operation portion 45B of manual lever 45 is dropped from an upper side of opening 48 to

a lower side. At this time, manual lever 45 is pivoted toward a counterclockwise direction with main shaft 4 as a fulcrum (refer to Figs. 9 and 10). At this time, tension spring 46 is extended to store an energy. Then, as shown in Fig. 11, manual operation portion 45B is engaged with a hook portion (stepped portion) 48A to store the energy of tension spring 46.

[0061] If the engagement between manual operation portion 45B and hook 48A is released, the stored energy of tension spring 46 is released. Then, manual lever 45 is pivoted in an opposite direction to the direction described before and is contacted with stopper 47 to block the pivotal movement. Manual lever 45 is reset at a position before the start. Then, manual operation portion 45B is moved toward an upper side and plunger 41 is in a state enabled to be passed through passage hole 45C.

[0062] In the embodiment described above, when pin 41D of plunger 41 is, for example, inserted into hole for ground position 32C, as shown in Fig. 7, shaft portion for hole 41E, namely, shaft 41A between main part of plunger 41B and stopper flange 41C is moved at the position intersected to manual lever 45. Hence, it becomes possible to insert shaft portion for hole 41E into a block hole 45D. Shaft 41A between main body portion 41B and stopper flange 41C is inserted within block hole 45D to block the movement of plunger 41. Hence, even if, in this state, the close command is erroneously issued from the central control portion, electromagnetic coil 43 is energized and plunger 41 is tried to be moved, one end portion

41F of main part of plunger 41B is contacted with a side surface of manual lever 45.

Thus, the plunger cannot be moved. Consequently, a safety of the operator located at the ground
5 contact during the maintenance-and-inspection operation can be secured.

In other words, an erroneous operation is prevented so that the safety of the operator can be secured.

[0063] Fig. 12 shows a control circuit of the
10 ground disconnector. Any one of push button switches 67 is pushed during the operation of the disconnector. Micro-switches MS1 through MS3 are switches operated by means of a cam formed on the side surface of the above-described
15 pivotal board and signals are issued when the cam is placed at the closing position, the disconnecting position, and the ground position, respectively. MS4 and MS5 denote switches from which signals are issued when the plunger is interposed From among
20 the closing position, the disconnecting position, and the ground position. MS6 denotes a signal issued when plunger (rod) 41 is fitted into any one of the stopping holes. A control unit 70 inputs these signals to control motor 37 and
25 electromagnetic plunger 40. That is to say, when, in the state of the closing position, a button of DSOFF is pushed, control unit 70 determines whether motor 37 should be rotated normally or reversely from the positional information of the present movable contact
30 portion. Then, electromagnetic plunger 40 is excited, a lock of the pivotal board is released, and motor 37 is rotated in a predetermined direction so that movable contact 7 is driven at the

disconnecting position. When the movable contact portion reaches to the Disconnecting position, the signal of the corresponding one of the micro-switches causes the excitation of

5 electromagnetic plunger 40 to be released. Hence, electromagnetic plunger 40 is engaged with one of the stopping holes of the pivotal board and a power supply to motor 37 is released.

[0064] As described above, according to the

10 ground disconnecter, an external operation command causes the engaging means to be engaged with the stopping means. A simple operation mechanism which stops the pivotal board can cause the movable contact at the specified

15 position to accurately be stopped without failure.

[0065] In addition, in place of the plunger, an operation rod may be used. Thus, the manual operation by the operator may cause the operation rod to be inserted or to be drawn out, in other words, may

20 removably be attached. In addition, if an electromagnetic type repulsion type plunger is used which reciprocates plunger 41 by changing a direction of an exciting current supplied to electromagnetic coil 43, with the direction of the exciting current

25 supplied to electromagnetic coil 43, spring 42 is not needed. In addition, in the embodiment described above, the so-called electromagnetic plunger is used as the engaging means, the engaging means may be an air cylinder, a hydraulic pressure cylinder, or so

30 forth. In the latter case, a tip of a piston rod thereof is inserted into one of the stopping holes

[0066] In summary, the external operational command causes the stopping means to be engaged with

the stopping means and the pivotal board may be stopped at each of the specified positions.

The external command includes a manual operation command, and commands such as an electrical command and a communication command.

5 [0067] As described hereinabove, pivotal board 31 is pivoted in accordance with the revolution of the drive shaft 36 and, the pivotal motion of this pivotal board pivots main shaft 4 and pivotal
10 board 31 is provided with hole for closing position 31A, hole for disconnecting position 31B, and hole for ground position 31C on the pivotal board at positions corresponding for movable contact 7 to be moved to closing position A,
15 disconnecting position B, and ground position C at the same distances.

For example, when movable contact position 7 is caused to be stopped at ground position C, plunger 41 is inserted into hole for ground position
20 31C of pivotal board 31 interlocked with movable contact 7 to block the pivotal movement of pivotal board 31. Hence, the assured stop of movable contact 7 at ground position C contacted with ground contact 22 can be made. For the other closing
25 position A and disconnecting position B, the same advantage as described before can be obtained. Therefore, the description will herein be omitted.

[0068] As described hereinabove, a simple
30 mechanism in which movable contact position 7 and stopping means are installed on pivotal board 31 permits the stop position of the movable contact portion to assure the holding thereof.

[0069] Furthermore, plunger 41 is arranged at a right-angle direction with respect to pivotal board 31 so that plunger 41 may be inputted into or outputted from each hole 31A through 31C disposed on pivotal board 31. Thus, the operational mechanism of the engaging means can be simplified.

[0070] As described hereinabove, according to the ground disconnecter in the present invention, the external operation command causes the engaging means to be engaged with the stopping means to stop the pivotal board. Thus, the simple operation mechanism which stops the pivotal board can assure the stop of the movable contact at the specified position.

15 **Brief Description of Drawings**

[Fig. 1] Fig. 1 is a front view representing a ground disconnecter drive chamber in a preferred embodiment according to the present invention.

[Fig. 2] Fig. 2 is a cross-sectional view at a proximity of a right side surface of the ground disconnecter shown in Fig. 1.

[Fig. 3] Fig. 3 is a cross-sectional view of an switching compartment cut away along a line A - A in Fig. 1.

25 [Fig. 4] Fig. 4 is a cross-sectional view of a disconnecting drive chamber and drive chamber cut away along a line B - B in Fig.1.

[Fig. 5] Fig. 5 is a cross-sectional view representing the proximity of a pivotal board arranged within a drive board shown in Figs. 2 and 4.

[Fig. 6] Fig. 6 is a cross-sectional view representing the relationship between the pivotal board and the drive shaft arranged within the drive

board shown in Fig. 5.

[Fig. 7] Fig. 7 is a partially cross sectional view representing a state in which a tip of a rod is inserted into a stopping hole.

5 [Fig. 8] Fig. 8 is a partially cross sectional view representing a state in which the tip of the rod is drawn out of the stopping hole.

[Fig. 9] Fig. 9 is a partially cross sectional view representing a state in which a shaft of the rod
10 is placed within a passage hole.

[Fig. 10] Fig. 10 is an explanatory view representing a state in which a small-diameter portion of the rod is placed within a block hole.

[Fig. 11] Fig. 11 is a partial front view of an
15 operation board representing the tip of a manual lever shown in Figs. 1, 7, and 8.

[Fig. 12] Fig. 12 is a control circuit diagram of the ground disconnecter.

Explanation of signs

20 [0072]

1---ground disconnecter, 1A --- drive compartment, 2--- supporting plate, 4--- main shaft, 5--- mounting attachment, 6A--- insulating link, 6B --- supporting pin. 7--- movable contact, 7A, 7B --- blades, 7C ---
25 adjusting bolt, 7D--- adjustment spring, 7E --- nut, 9A --- load side terminal (a load side terminal portion), 9B --- load side conductor, 9C --- load side electrical equipment, 10 --- fixed contact, 10G --- power supply, 20 --- switching
30 compartment, 21 --- plate, 21A --- bolt, 21B --- nut, 22 --- ground contact, 23 ---conductor, 24 --- insulating bushings, 24A --- internal conductor, 24B --- bolt, 25 --- ground conductor, 30 --- drive

mechanism compartment, 31--- pivotal board, 31A ---
 hole for closing position, 31B --- hole for
 disconnecting position, 31C --- hole for ground
 position, 32 --- shaft inserting portion, 33 ---
 5 plate, 33A ---main surface, 34 ---U shaped arm , 35A
 --- bolt, 35B --- nut, 36 ---drive shaft, 36A ---
 drive shaft, 36B ---first drive shaft, 36C --- second
 drive shaft, 36D --- female screw, 36E --- bearing
 for female screw, 36Y ---male screw, 37--- motor, 37A
 10 --- pinion gear, 37B --- gear, 38 --- universal joint,
 39 --- drop preventive supporting attachment, 40---
 electromagnetic plunger, 41--- rod, 41A --- shaft,
 41B --- main part of plunger, 41C --- stopper flange,
 41D --- pin, 41E --- shaft portion for hole, 42---
 15 spring, 43--- electromagnetic coil, 44 --- attachment
 plate, 44A --- bolt, 45 --- manual lever, 45C ---
 passage hole, 45D --- block hole, 46 --- tension
 spring, 47 --- stopper, 48 --- opening, 48A --- hook,
 A--- closing position, B --- disconnecting position,
 20 C --- ground position.

CLAIMS

1 1. A ground disconnecter, comprising:
2 a main shaft pivoted in accordance with a
3 pivotal movement of a pivotal board;
4 a movable contact linked to this main shaft via
5 an insulating link mechanism and pivoted to contact
6 with or separate from a fixed contact portion;
7 stopping means installed on the pivotal board
8 for stopping the movable contact at a specified
9 position; and
10 engaging means engaged with the stopping means
11 in response to an external operation command for
12 maintaining the pivotal board in a stopped state.

1 2. The ground disconnecter as claimed in claim 1,
2 wherein the stopping means comprises a plurality of
3 stopping holes, each stopping hole being formed in a
4 right-angle direction with respect to a main surface
5 of the pivotal board, and the engaging means includes
6 a rod which is moved in a direction orthogonal to the
7 main surface of the pivotal board and its tip portion
8 of the rod is inserted into or drawn out of any one
9 of the stopping holes.

1 3. The ground disconnecter as claimed in claim 2,
2 wherein the stopping holes comprise three holes of a
3 hole for closing position, a hole for disconnecting
4 position, and a hole for ground position, the
5 engaging means being inserted into and being drawn
6 out of each of the stopping holes, at specified
7 positions of the movable contact of a closing
8 position, a disconnecting position, and a ground

9 position.

1 4. The ground disconnecter as claimed in either
2 claim 2 or 3, wherein the rod is biased in a
3 direction toward the stopping holes by means of a
4 spring and wherein an excitation of an
5 electromagnetic coil causes the tip portion of the
6 rod to be drawn out of any one of the stopping holes
7 against a biasing force of the spring.

1 5. The ground disconnecter as claimed in any one of
2 the preceding claims 2 through 4, wherein the rod has
3 a small diameter portion through which a manual lever
4 is inserted in order for the tip portion of the rod
5 to lockably be inserted into any one of the stopping
6 holes.

1 6. The ground disconnecter as claimed in claim 5,
2 wherein the manual lever is formed to have a larger
3 diameter than the diameter of the rod and the manual
4 lever comprises: a rod movement allowing hole
5 configured to allow a movement of the rod in the
6 direction in which the rod is inserted thereinto or
7 the rod is drawn out thereof; and a rod movement
8 block hole formed in a state communicate with the rod
9 movement allowance hole and formed to have a smaller
10 diameter than the diameter of the rod and a larger
11 diameter than the small diameter portion of the rod
12 and wherein the small diameter portion of the rod is
13 accommodated into the rod movement block hole to
14 block the movement of the rod from being drawn out of
15 any one of the stopping holes.

1 7. The ground disconnecter as claimed in claim 6,
2 wherein the manual lever has one end pivotably
3 attached to the main shaft and a pivoting force is
4 provided for the manual lever by means of a spring
5 and wherein, when the tip portion of the rod is
6 inserted within any one of the stopping holes, a
7 biasing force of the spring causes the small diameter
8 portion of the rod to be introduced within the rod
9 movement block hole.

1 8. The ground disconnecter as claimed in claim 7,
2 wherein the manual lever has a manual operation
3 portion at a free end thereof projected externally
4 from an opening installed on a drive mechanism
5 compartment and a lever engagement portion is
6 installed at one side portion of the opening to be
7 pressed down against the biasing force of the spring
8 in order for the manual lever through which the small
9 diameter portion is introduced within the rod
10 movement block hole to be engaged therewith.

1 9. The ground disconnecter as claimed in any one of
2 the preceding claims 1 through 8, wherein the
3 disconnecter includes a drive shaft to pivot the
4 pivotal board and wherein the drive shaft includes: a
5 motor; a drive shaft revolved by means of the motor;
6 and a female screw installed on the pivotal board
7 configured to convert the revolution of the drive
8 shaft into the pivotal movement of the pivotal board.

1 10. The ground disconnecter as claimed in claim 9,
2 wherein the drive shaft includes: a first drive
3 shaft; and a second drive shaft linked to the first

4 drive shaft via an universal joint and wherein a male
5 screw formed on the second drive shaft is screwed
6 into the female screw.