



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
30.03.2022 Bulletin 2022/13

(51) International Patent Classification (IPC):
H01H 33/666 (2006.01) H01H 33/38 (2006.01)

(21) Application number: **19930085.6**

(52) Cooperative Patent Classification (CPC):
H01H 33/38; H01H 33/666

(22) Date of filing: **22.05.2019**

(86) International application number:
PCT/JP2019/020265

(87) International publication number:
WO 2020/235044 (26.11.2020 Gazette 2020/48)

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

(72) Inventors:
• **YOSHIDA, Tadahiro**
Tokyo 100-8310 (JP)
• **TANAKA, Naoki**
Tokyo 102-0073 (JP)

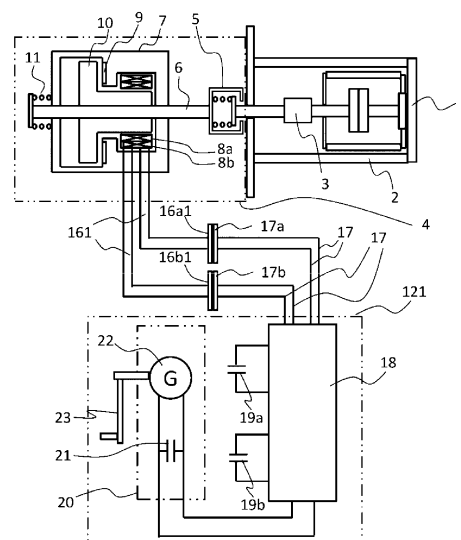
(71) Applicant: **Mitsubishi Electric Corporation**
Tokyo 100-8310 (JP)

(74) Representative: **Witte, Weller & Partner**
Patentanwälte mbB
Postfach 10 54 62
70047 Stuttgart (DE)

(54) **ELECTROMAGNETIC OPERATION DEVICE**

(57) An object of the present disclosure is to obtain an electromagnetic operation device that enables opening/closing control to be swiftly restarted even when an abnormality occurs in a control board for controlling an opening/closing operation of an opening/closing device. An electromagnetic operation device (100) includes: an electromagnetic operation unit connected to a movable side of an opening/closing device (1) and configured to open/close the opening/closing device (1); and a drive power supply unit configured to control supply of power to the electromagnetic operation unit (4), to control an opening/closing operation of the opening/closing device (1). In a normal case, the electromagnetic operation unit (4) and the drive power supply unit are connected by a connection circuit formed by connecting electromagnetic-operation-unit-side circuit connection means (16a1, 16b1) and drive-power-supply-unit-side circuit connection means. In an emergency case, an emergency operation device (121) including a control board (18) configured to control supply of power from a power supply unit (20) to the electromagnetic operation unit (4), to control an opening/closing operation of the opening/closing device (1), is connected to the electromagnetic-operation-unit-side circuit connection means (16a1, 16b1).

FIG. 3



Description

TECHNICAL FIELD

[0001] The present disclosure relates to an electromagnetic operation device.

BACKGROUND ART

[0002] An electromagnetic operation device used as an operation mechanism for an opening/closing device drives a movable core by exciting an electromagnetic coil with power accumulated in a capacitor and opens/closes a contact of the opening/closing device by the force of the drive. Such an electromagnetic operation device is required to swiftly restart opening/closing control in an emergency case such as the case of loss of control power. Conventionally, there has been a turn-on method for an electromagnetic operation type opening/closing apparatus, the turn-on method including: connecting a turn-on power supply to the electromagnetic operation type opening/closing apparatus disposed in a place where there is no power supply; accumulating energy in a capacitor by DC power that is supplied from the turn-on power supply; and performing a turn-on operation of the opening/closing device with the energy accumulated in the capacitor (see, for example, Patent Document 1).

CITATION LIST

PATENT DOCUMENT

[0003] Patent Document 1: Japanese Laid-Open Patent Publication No. 2005-197122

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] The technique disclosed in Patent Document 1 enables the turn-on operation of the opening/closing device by using the turn-on power supply in a case where, for example, power is not supplied from an ordinary power supply. However, the technique in Patent Document 1 has the following problem. That is, a control board for controlling a current-conduction circuit connecting the capacitor and an electromagnetic coil is physically disposed inside the electromagnetic operation type opening/closing apparatus, and thus, when an abnormality occurs in the control board, it may take time to restart the opening/closing control.

[0005] The present disclosure has been made to solve the above problem, and an object of the present disclosure is to obtain an electromagnetic operation device that enables opening/closing control to be swiftly restarted even when an abnormality occurs in a control board for controlling an opening/closing operation of an opening/closing device.

SOLUTION TO THE PROBLEMS

[0006] An electromagnetic operation device according to the present disclosure includes: an electromagnetic operation unit connected to a movable side of an opening/closing device and configured to open/close the opening/closing device; a drive power supply unit including a first power supplying means and a first control means configured to control supply of power from the first power supplying means to the electromagnetic operation unit, to control an opening/closing operation of the opening/closing device; an electromagnetic-operation-unit-side circuit connection means provided at an end portion, of a circuit connected to the electromagnetic operation unit, that is located on an opposite side to the electromagnetic operation unit; and a drive-power-supply-unit-side circuit connection means provided at an end portion, of a circuit connected to the drive power supply unit, that is located on an opposite side to the drive power supply unit, the drive-power-supply-unit-side circuit connection means being connected to the electromagnetic-operation-unit-side circuit connection means to form a connection circuit that connects the electromagnetic operation unit and the drive power supply unit, wherein the electromagnetic-operation-unit-side circuit connection means is, in an emergency case, connected to an emergency operation device including a second power supplying means and a second control means configured to control supply of power from the second power supplying means to the electromagnetic operation unit, to control an opening/closing operation of the opening/closing device.

EFFECT OF THE INVENTION

[0007] The electromagnetic operation device according to the present disclosure enables opening/closing control to be swiftly restarted even when an abnormality occurs in the control board for controlling the opening/closing operation of the opening/closing device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

[FIG. 1] FIG. 1 is an entire configuration diagram showing an electromagnetic operation device according to embodiment 1 and an opening/closing device to be operated by the electromagnetic operation device.

[FIG. 2] FIG. 2 is a configuration diagram of an emergency operation device according to embodiment 1.

[FIG. 3] FIG. 3 illustrates an entire configuration in a state where an electromagnetic operation unit and the emergency operation device are connected in embodiment 1.

[FIG. 4] FIG. 4 is a configuration diagram of an emergency operation device according to embodiment 2.

[FIG. 5] FIG. 5 is an entire configuration diagram showing an electromagnetic operation device according to embodiment 3 and the opening/closing device to be operated by the electromagnetic operation device.

DESCRIPTION OF EMBODIMENTS

Embodiment 1

[0009] Hereinafter, embodiment 1 will be described with reference to FIG. 1 to FIG. 3. FIG. 1 is an entire configuration diagram showing an electromagnetic operation device according to embodiment 1 and an opening/closing device to be operated by the electromagnetic operation device. An electromagnetic operation device 100 includes: an electromagnetic operation unit 4 which is connected to a movable side of an opening/closing device 1 including therein a vacuum valve 2, and which opens/closes the opening/closing device 1; and a drive power supply unit 12 which supplies power to the electromagnetic operation unit 4. The electromagnetic operation unit 4 and the drive power supply unit 12 are connected by a connection circuit that is formed by connecting electromagnetic-operation-unit-side connection circuits 161 and drive-power-supply-unit-side connection circuits 162 as described later. Via each electromagnetic-operation-unit-side connection circuit 161 and the corresponding drive-power-supply-unit-side connection circuit 162, power is supplied from the drive power supply unit 12 to the electromagnetic operation unit 4.

[0010] In the electromagnetic operation unit 4, a fixed core 7 and a movable core 10 are provided, and an opening coil 8a and a closing coil 8b are disposed coaxially with the movable core 10 so as to enclose a part of the movable core 10. In addition, a permanent magnet 9 for attracting the movable core 10 in a closing direction is provided inside the fixed core 7, and a release spring 11 for urging the movable core 10 in an opening direction is provided on an axially outer side of the fixed core. In addition, one end of a movable shaft 6 is fixed to the movable core 10. The movable shaft 6 extends from the movable core 10 toward the opening/closing device 1, and another end of the movable shaft 6 is connected to one end of an insulating rod 3 via a contact-pressure spring 5. The insulating rod 3 extends from the contact-pressure spring 5 to the inside of the vacuum valve 2, and another end of the insulating rod 3 is provided with an electrode.

[0011] The movable core 10 moves in the opening direction and the closing direction owing to electromagnetic forces from the excited opening coil 8a and closing coil 8b. Consequently, an opening operation and a closing operation of the opening/closing device 1 are performed. The opening coil 8a and the closing coil 8b are excited by supply of power from the drive power supply unit 12. The drive power supply unit 12 includes: a DC power supply 13 which is a first power supplying means; two

electromagnetic coil capacitors 15a and 15b in each of which power from the DC power supply 13 is accumulated; and a control board 14 which is a first control means and which is operated by power from the DC power supply 13 and controls a current that flows upon electric discharge by each of the electromagnetic coil capacitors 15a and 15b. The control board 14 controls, according to an opening command or a closing command made by a higher-order control device (not shown) or a user input, a current to be supplied from the electromagnetic coil capacitor 15a or 15b to a corresponding one out of the opening coil 8a and the closing coil 8b, to control an opening/closing operation of the opening/closing device 1.

[0012] It is noted that the electromagnetic coil capacitor 15a corresponds to the opening coil 8a, and a current from the electromagnetic coil capacitor 15a is supplied to the opening coil 8a. Likewise, the electromagnetic coil capacitor 15b corresponds to the closing coil 8b, and a current from the electromagnetic coil capacitor 15b is supplied to the closing coil 8b. To this end, the electromagnetic-operation-unit-side connection circuits 161 include at least a circuit corresponding to the opening coil 8a and a circuit corresponding to the closing coil 8b, and the drive-power-supply-unit-side connection circuits 162 also include at least a circuit corresponding to the opening coil 8a and a circuit corresponding to the closing coil 8b.

[0013] The electromagnetic-operation-unit-side connection circuits 161 are connected to the opening coil 8a and the closing coil 8b of the electromagnetic operation unit 4, and electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1 are each provided at an end portion, of the corresponding one of the electromagnetic-operation-unit-side connection circuits 161, that is located on an opposite side to the electromagnetic operation unit 4. The drive-power-supply-unit-side connection circuits 162 are connected to the control board 14 of the drive power supply unit 12, and drive-power-supply-unit-side circuit connection means 16a2 and 16b2 are each provided at an end portion, of the corresponding one of the drive-power-supply-unit-side connection circuits 162, that is located on an opposite side to the drive power supply unit 12. The electromagnetic-operation-unit-side circuit connection means 16a1 and the drive-power-supply-unit-side circuit connection means 16a2 correspond to the opening coil 8a and the electromagnetic coil capacitor 15a, and the electromagnetic-operation-unit-side circuit connection means 16b1 and the drive-power-supply-unit-side circuit connection means 16b2 correspond to the closing coil 8b and the electromagnetic coil capacitor 15b. The electromagnetic-operation-unit-side connection circuits 161 and the drive-power-supply-unit-side connection circuits 162 are connected to each other by connecting the electromagnetic-operation-unit-side circuit connection means 16a1 and the drive-power-supply-unit-side circuit connection means 16a2 and connecting the electromagnetic-operation-unit-side circuit connection means 16b1 and the

drive-power-supply-unit-side circuit connection means 16b2. This leads to formation of a connection circuit that connects the electromagnetic operation unit 4 and the drive power supply unit 12.

[0014] In embodiment 1, each of the electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1, and the corresponding one of the drive-power-supply-unit-side circuit connection means 16a2 and 16b2, have forms allowing contact and separation therebetween and are, for example, respectively a plug and a receptacle connected to the plug. In this manner, each of the electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1, and the corresponding one of the drive-power-supply-unit-side circuit connection means, can be implemented by connectors which are a plug and a receptacle.

[0015] As described above, in a normal case, the electromagnetic operation unit 4 and the drive power supply unit 12 are in a state of being connected through the electromagnetic-operation-unit-side connection circuits 161 and the drive-power-supply-unit-side connection circuits 162, and the drive power supply unit 12 supplies power to the opening coil 8a and the closing coil 8b and performs opening/closing control for the opening/closing device 1.

[0016] Next, an operation in an emergency case will be described. FIG. 2 is a configuration diagram of an emergency operation device according to embodiment 1. It is noted that, here, the "emergency case" refers to a situation in which it has become impossible to supply power from the drive power supply unit 12 to the electromagnetic operation unit 4. Examples of the emergency case include: a case where power from the DC power supply 13 is lost; a case where the control board 14 malfunctions; a case where the electromagnetic coil capacitors 15a and 15b malfunction; a case where the drive-power-supply-unit-side connection circuits 162 between the drive power supply unit 12 and the drive-power-supply-unit-side circuit connection means 16a2 and 16b2 are broken; a case where a plurality of the above failures occur; and the like. An emergency operation device 121 includes: a power supply unit 20 which is a second power supplying means; two electromagnetic coil capacitors 19a and 19b in each of which power from the power supply unit 20 is accumulated; and a control board 18 which is second control means and which controls a current that flows upon electric discharge by each of the electromagnetic coil capacitors 19a and 19b. In the emergency operation device 121, the power supply unit 20, the electromagnetic coil capacitors 19a and 19b, and the control board 18 are integrated with one another. The emergency operation device 121 is of a portable type that allows the emergency operation device 121 to be carried around.

[0017] Emergency-operation-device-side connection circuits 17 are connected to the control board 18. Emergency-operation-device-side circuit connection means 17a and 17b that are connectable to the electromagnetic-

operation-unit-side circuit connection means 16a1 and 16b1, are each provided at an end portion, of the corresponding one of the emergency-operation-device-side connection circuits 17, that is located on an opposite side to the control board 18. The emergency-operation-device-side circuit connection means 17a and 17b are, for example, plugs or receptacles and have the same connector forms as the connector forms of the drive-power-supply-unit-side circuit connection means 16a2 and 16b2 so as to be connectable to the electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1 in the same manner as the drive-power-supply-unit-side circuit connection means 16a2 and 16b2.

[0018] The power supply unit 20 includes: a manual power generator 22 to which a rotary handle 23 is attached and which generates power by rotation of the rotary handle 23; and a control power supply capacitor 21 in which power generated by the manual power generator 22 is accumulated. The control board 18 is operated by the power accumulated in the control power supply capacitor 21 and controls a current that is generated upon electric discharge by each of the electromagnetic coil capacitors 19a and 19b.

[0019] FIG. 3 illustrates an entire configuration in a state where the electromagnetic operation unit and the emergency operation device are connected. In an emergency case, the electromagnetic-operation-unit-side circuit connection means 16a1 and the drive-power-supply-unit-side circuit connection means 16a2 which are in a connected state, and the electromagnetic-operation-unit-side circuit connection means 16b1 and the drive-power-supply-unit-side circuit connection means 16b2 which are also in a connected state, are separated from each other first so that the states of electrical connections therebetween are canceled. Next, the electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1 and the emergency-operation-device-side circuit connection means 17a and 17b are connected so that supply of power from the emergency operation device 121 to the electromagnetic operation unit 4 is enabled. The control board 18 controls, according to an opening command or a closing command made by a higher-order control device (not shown) or a user input, a current to be supplied from the electromagnetic coil capacitors 19a or 19b to a corresponding one out of the opening coil 8a and the closing coil 8b, to restart the opening/closing control for the opening/closing device 1.

[0020] If restoration is ended and a return to a normal case happens, the state of connection between the electromagnetic-operation-unit-side circuit connection means 16a1 and the emergency-operation-device-side circuit connection means 17a, and the state of connection between the electromagnetic-operation-unit-side circuit connection means 16b1 and the emergency-operation-device-side circuit connection means 17b, are canceled. Next, the electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1 and the drive-power-supply-unit-side circuit connection means 16a2 and 16b2

are connected so that a return to the state for a normal case happens.

[0021] It is noted that the electromagnetic coil capacitor 19a corresponds to the opening coil 8a, and a current from the electromagnetic coil capacitor 19a is supplied to the opening coil 8a. Likewise, the electromagnetic coil capacitor 19b corresponds to the closing coil 8b, and a current from the electromagnetic coil capacitor 19b is supplied to the closing coil 8b. To this end, the emergency-operation-device-side connection circuits 17 include at least a circuit corresponding to the opening coil 8a and a circuit corresponding to the closing coil 8b.

[0022] In addition, the emergency operation device 121 may include a monitoring means which monitors the level of accumulated power in each of the control power supply capacitor 21 and the electromagnetic coil capacitors 19a and 19b and which generates an alarm if the monitoring means determines that necessary power for the opening/closing control for the opening/closing device 1 has not been accumulated or if there is a heightened probability of experiencing a situation in which the necessary power has not been accumulated. If such a monitoring means is provided, power generation with use of the power supply unit 20 can be performed by a user at an appropriate time, whereby control of the opening/closing operation can be prevented from being stopped owing to insufficiency of power.

[0023] Embodiment 1 enables the opening/closing control to be swiftly restarted even when an abnormality occurs in the control board for controlling the opening/closing operation of the opening/closing device. More specifically, in connection between the electromagnetic operation unit for opening/closing the opening/closing device and the drive power supply unit for controlling supply of power to the electromagnetic operation unit, each electromagnetic-operation-unit-side connection circuit and the corresponding drive-power-supply-unit-side connection circuit are connected to form a connection circuit that connects the electromagnetic operation unit and the drive power supply unit. The electromagnetic-operation-unit-side connection circuit and the drive-power-supply-unit-side connection circuit are connected through the electromagnetic-operation-unit-side circuit connection means and the drive-power-supply-unit-side circuit connection means which are provided at the respective end portions. When an abnormality such as a malfunction occurs in the control board of the drive power supply unit, the state of connection between the electromagnetic-operation-unit-side circuit connection means and the drive-power-supply-unit-side circuit connection means is canceled, and the emergency operation device including the control board for controlling the opening/closing operation of the opening/closing device is connected to the electromagnetic-operation-unit-side circuit connection means. Consequently, the emergency operation device is connected to the electromagnetic operation unit, and thereafter, the emergency operation device controls the opening/closing operation of the open-

ing/closing device. The emergency operation device includes the manual power generator, and thus it is not necessary to prepare any power supply for emergency. In this manner, the opening/closing control can be restarted merely by changing the connection destination for the electromagnetic-operation-unit-side circuit connection means from the drive power supply unit to the emergency operation device. Therefore, even when an abnormality occurs in the control board for controlling the opening/closing operation of the opening/closing device, the opening/closing control can be swiftly restarted.

[0024] As an example of a case other than the above emergency case, there is a case where the state after installation is checked. The same advantageous effects are exhibited also in such a case. Specifically, in a case where the opening/closing device has been installed but no control power supply has yet been connected thereto, a check of the state after the installation can be swiftly started.

Embodiment 2

[0025] Next, embodiment 2 will be described with reference to FIG. 4. It is noted that the portions identical or corresponding to those in FIG. 1 to FIG. 3 are denoted by the same reference characters, and descriptions thereof will be omitted. FIG. 4 is a configuration diagram of an emergency operation device according to embodiment 2. An emergency operation device 221 includes: a power supply unit 201; the two electromagnetic coil capacitors 19a and 19b in each of which power from the power supply unit 201 is accumulated; and the control board 18 which controls a current that flows upon electric discharge by each of the electromagnetic coil capacitors 19a and 19b.

[0026] The power supply unit 201 includes, in addition to the components of the power supply unit 20 in embodiment 1, a battery 24 connected in parallel to the manual power generator 22. The power supply unit 201 further includes a power supply changing switch 25 which is a power supply changing means between the manual power generator 22 and the control power supply capacitor 21. The power supply changing switch 25 enables the connection destination for the control board 18 to be changed between the manual power generator 22 and the battery 24. The battery 24 only has to be a DC power supply having an output voltage equal to or higher than a voltage necessary for operation of the control board 18. Examples of the DC power supply include a battery for automobiles, a dry cell, a fuel cell, and the like.

[0027] The other components are the same as those in embodiment 1, and thus descriptions thereof will be omitted.

[0028] Embodiment 2 makes it possible to obtain the same advantageous effects as those in embodiment 1. In addition, in the power supply unit of the emergency operation device, the battery is connected in parallel to the manual power generator, and the power supply

changing switch which changes, between the manual power generator and the battery, the connection destination for the control circuit is provided. Thus, it is possible to make a choice as to whether supply of power to the control board of the emergency operation device is to be performed with the manual power generator or the battery. Therefore, the control circuit can be operated more swiftly than in the case of providing only the manual power generator as in embodiment 1. Consequently, the opening/closing control for the opening/closing device can be more swiftly restarted

Embodiment 3

[0029] Next, embodiment 3 will be described with reference to FIG. 5. It is noted that the portions identical or corresponding to those in FIG. 1 to FIG. 4 are denoted by the same reference characters, and descriptions thereof will be omitted. FIG. 5 is an entire configuration diagram showing an electromagnetic operation device according to embodiment 3 and the opening/closing device to be operated by the electromagnetic operation device. An electromagnetic operation device 300 is different from the electromagnetic operation device 100 according to embodiment 1 in that the electromagnetic-operation-unit-side circuit connection means include: the electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1 which are the first circuit connection means and which correspond to the drive power supply unit 12; and electromagnetic-operation-unit-side circuit connection means 16c1 and 16d1 which are second circuit connection means and which correspond to the emergency operation device 121. The electromagnetic-operation-unit-side circuit connection means 16a1, 16b1, 16c1, and 16d1 are connected in parallel to each other. The electromagnetic-operation-unit-side circuit connection means 16a1 and 16b1 are connected to the drive-power-supply-unit-side circuit connection means 16a2 and 16b2 in the same manner as in embodiment 1, and the electromagnetic-operation-unit-side circuit connection means 16c1 and 16d1 are connected to the emergency-operation-device-side circuit connection means 17a and 17b. It is noted that the electromagnetic-operation-unit-side circuit connection means 16a1 and 16c1 correspond to the opening coil 8a, and the electromagnetic-operation-unit-side circuit connection means 16b1 and 16d1 correspond to the closing coil 8b.

[0030] Circuit changing switches 26 which are circuit changing means are provided between the electromagnetic operation unit 4 and the electromagnetic-operation-unit-side circuit connection means 16a1, 16b1, 16c1, and 16d1. The circuit changing switches 26 are, for example, manual changing switches and change, between the drive power supply unit 12 and the emergency operation device 121, the connection destination for the electromagnetic operation unit 4. Thus, the state of mechanical connection between the electromagnetic-operation-unit-side circuit connection means 16a1 and the drive-power-

supply-unit-side circuit connection means 16a2, the state of mechanical connection between the electromagnetic-operation-unit-side circuit connection means 16b1 and the drive-power-supply-unit-side circuit connection means 16b2, the state of mechanical connection between the electromagnetic-operation-unit-side circuit connection means 16c1 and the emergency-operation-device-side circuit connection means 17a, and the state of mechanical connection between the electromagnetic-operation-unit-side circuit connection means 16d1 and the emergency-operation-device-side circuit connection means 17b, are maintained both in a normal case and an emergency case.

[0031] The other components are the same as those in embodiment 1, and thus descriptions thereof will be omitted.

[0032] Embodiment 3 makes it possible to obtain the same advantageous effects as those in embodiment 1. In addition, the electromagnetic-operation-unit-side circuit connection means include the first circuit connection means corresponding to the drive power supply unit and the second circuit connection means corresponding to the emergency operation device, and the circuit changing switches provided between the electromagnetic operation unit and the electromagnetic-operation-unit-side circuit connection means enable the connection destination for the electromagnetic operation unit to be changed between the drive power supply unit and the emergency operation device. Thus, in an emergency case, the connection destination for the electromagnetic operation unit only has to be changed from the drive power supply unit to the emergency operation device by the circuit changing switches, and it is not necessary to separate the drive-power-supply-unit-side circuit connection means from the electromagnetic-operation-unit-side circuit connection means in order to connect the electromagnetic-operation-unit-side circuit connection means and the emergency-operation-device-side circuit connection means. Therefore, connection of the emergency operation device is easy, and the opening/closing control for the opening/closing device can be more swiftly restarted.

[0033] Although the disclosure is described above in terms of various exemplary embodiments and implementations, it should be understood that the various features, aspects, and functionality described in one or more of the individual embodiments are not limited in their applicability to the particular embodiment with which they are described, but instead can be applied, alone or in various combinations to one or more of the embodiments of the disclosure.

[0034] It is therefore understood that numerous modifications which have not been exemplified can be devised without departing from the technical scope of the present disclosure. For example, at least one of the constituent parts may be modified, added, or eliminated. At least one of the constituent parts mentioned in at least one of the preferred embodiments may be selected and combined with the constituent parts mentioned in another

preferred embodiment.

DESCRIPTION OF THE REFERENCE CHARACTERS

[0035]

1 opening/closing device
 4 electromagnetic operation unit
 8a opening coil
 8b closing coil
 12 drive power supply unit
 13 DC power supply
 14, 18 control board
 15a, 15b, 19a, 19b electromagnetic coil capacitor
 161 electromagnetic-operation-unit-side connection circuit
 162 drive-power-supply-unit-side connection circuit
 17 emergency-operation-device-side connection circuit
 16a1, 16b1, 16c1, 16d1 electromagnetic-operation-unit-side circuit connection means
 16a2, 16b2 drive-power-supply-unit-side circuit connection means
 17a, 17b emergency-operation-device-side circuit connection means
 20, 201 power supply unit
 21 control power supply capacitor
 22 manual power generator
 24 battery
 25 power supply changing switch
 26 circuit changing switch
 100, 300 electromagnetic operation device
 121, 221 emergency operation device

Claims

1. An electromagnetic operation device comprising:

an electromagnetic operation unit connected to a movable side of an opening/closing device and configured to open/close the opening/closing device;
 a drive power supply unit including

a first power supplying means and
 a first control means configured to control supply of power from the first power supplying means to the electromagnetic operation unit, to control an opening/closing operation of the opening/closing device;

an electromagnetic-operation-unit-side circuit connection means provided at an end portion, of a circuit connected to the electromagnetic operation unit, that is located on an opposite side to the electromagnetic operation unit; and
 a drive-power-supply-unit-side circuit connec-

tion means provided at an end portion, of a circuit connected to the drive power supply unit, that is located on an opposite side to the drive power supply unit, the drive-power-supply-unit-side circuit connection means being connected to the electromagnetic-operation-unit-side circuit connection means to form a connection circuit that connects the electromagnetic operation unit and the drive power supply unit, wherein the electromagnetic-operation-unit-side circuit connection means is, in an emergency case, connected to an emergency operation device including

a second power supplying means and
 a second control means configured to control supply of power from the second power supplying means to the electromagnetic operation unit, to control an opening/closing operation of the opening/closing device.

2. The electromagnetic operation device according to claim 1, wherein a state of mechanical connection of the electromagnetic-operation-unit-side circuit connection means to the drive-power-supply-unit-side circuit connection means is canceled when the electromagnetic-operation-unit-side circuit connection means is connected to the emergency operation device.

3. The electromagnetic operation device according to claim 1, wherein

the electromagnetic-operation-unit-side circuit connection means includes

a first circuit connection means connected to the drive-power-supply-unit-side circuit connection means and
 a second circuit connection means connected in parallel to the first circuit connection means and connected to the emergency operation device, and

a circuit changing means configured to change a connection destination for the electromagnetic operation unit is provided between the electromagnetic operation unit and the electromagnetic-operation-unit-side circuit connection means.

4. The electromagnetic operation device according to any one of claims 1 to 3, wherein the second power supplying means includes

a manual power generator and a battery connected in parallel to each other, and
 a power supply changing means configured to connect the manual power generator or the bat-

tery to the second control means.

5. The electromagnetic operation device according to any one of claims 1 to 4, wherein
out of the electromagnetic-operation-unit-side circuit connection means and the drive-power-supply-unit-side circuit connection means, 5

one means comprises a plug or a receptacle, and 10
another means comprises a receptacle or a plug connected to the plug or the receptacle.

15

20

25

30

35

40

45

50

55

FIG. 1

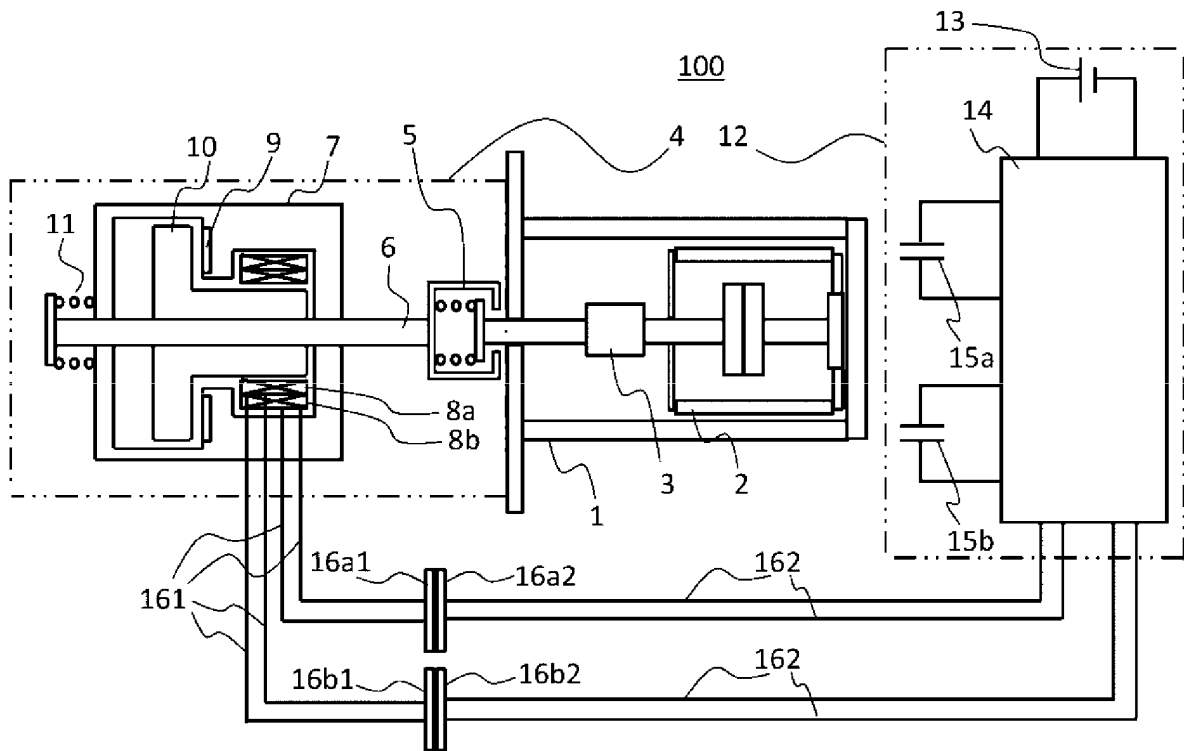


FIG. 2

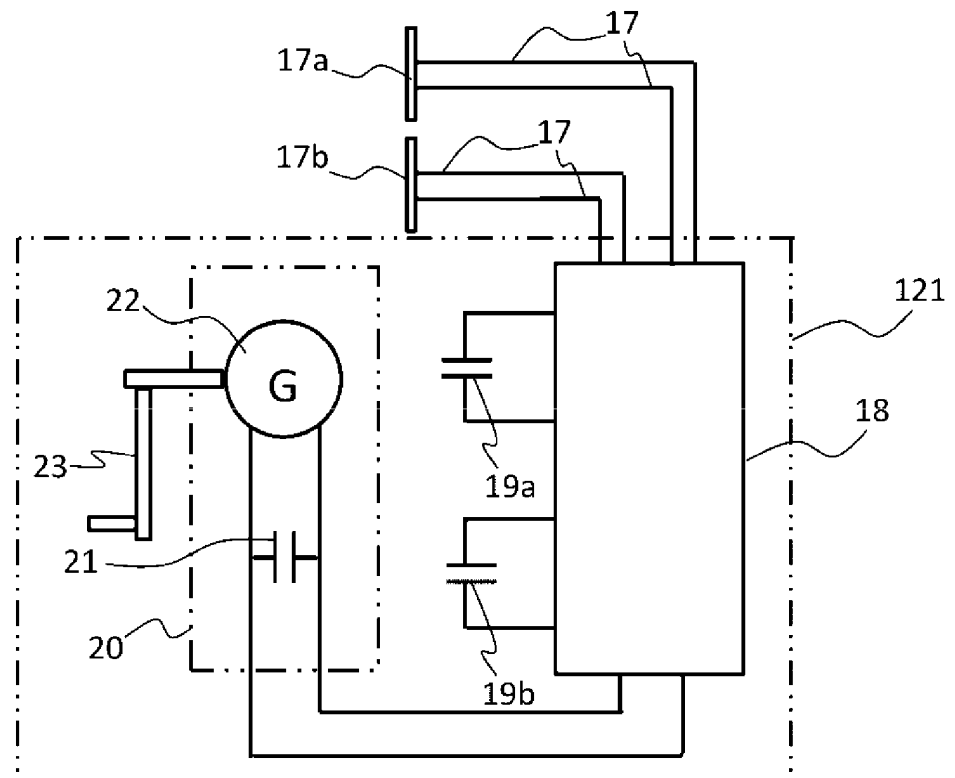


FIG. 3

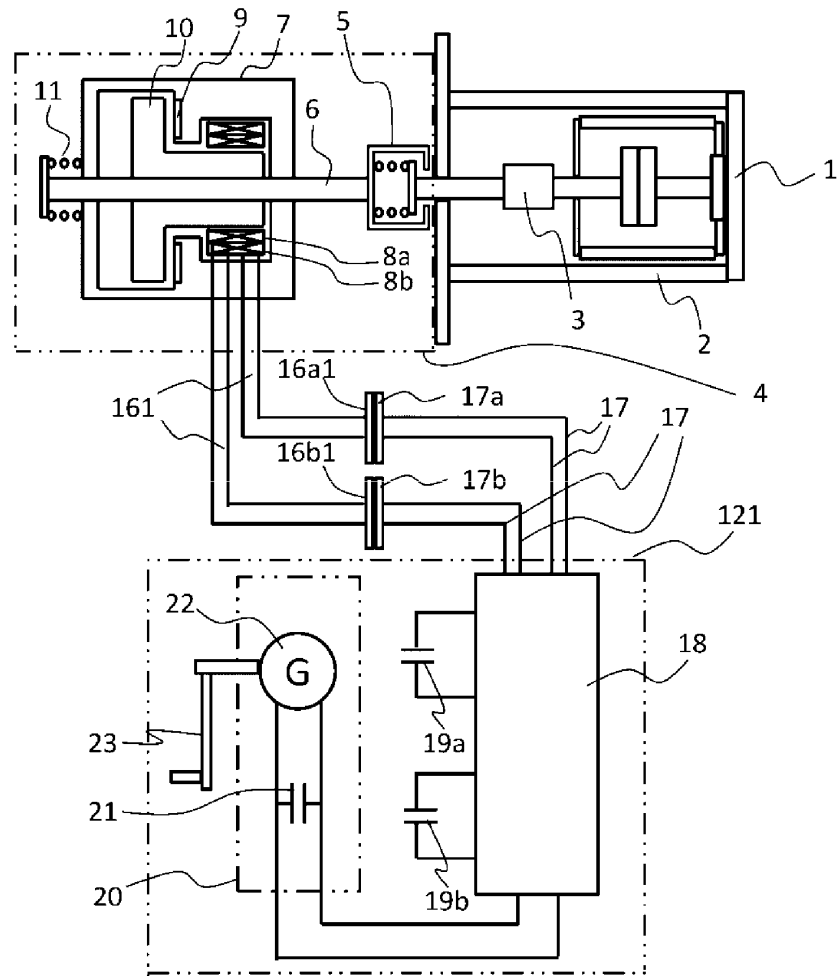


FIG. 4

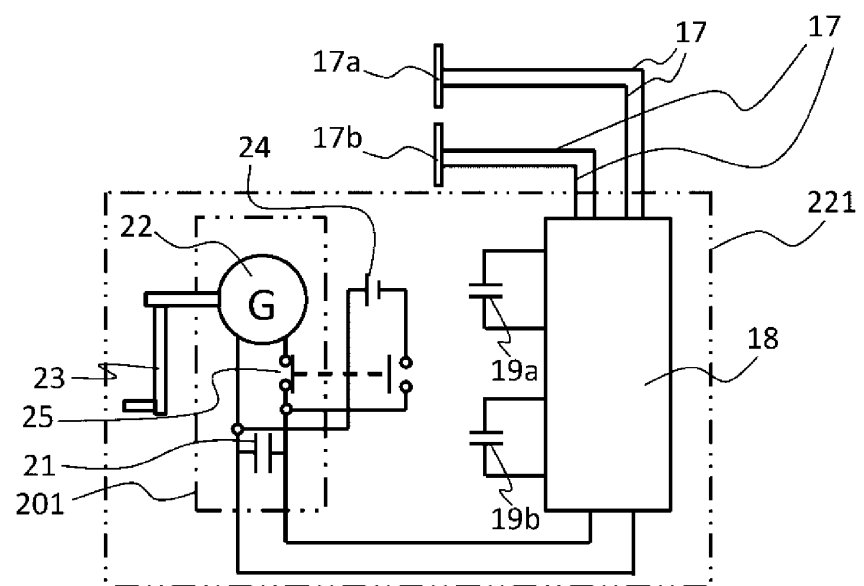
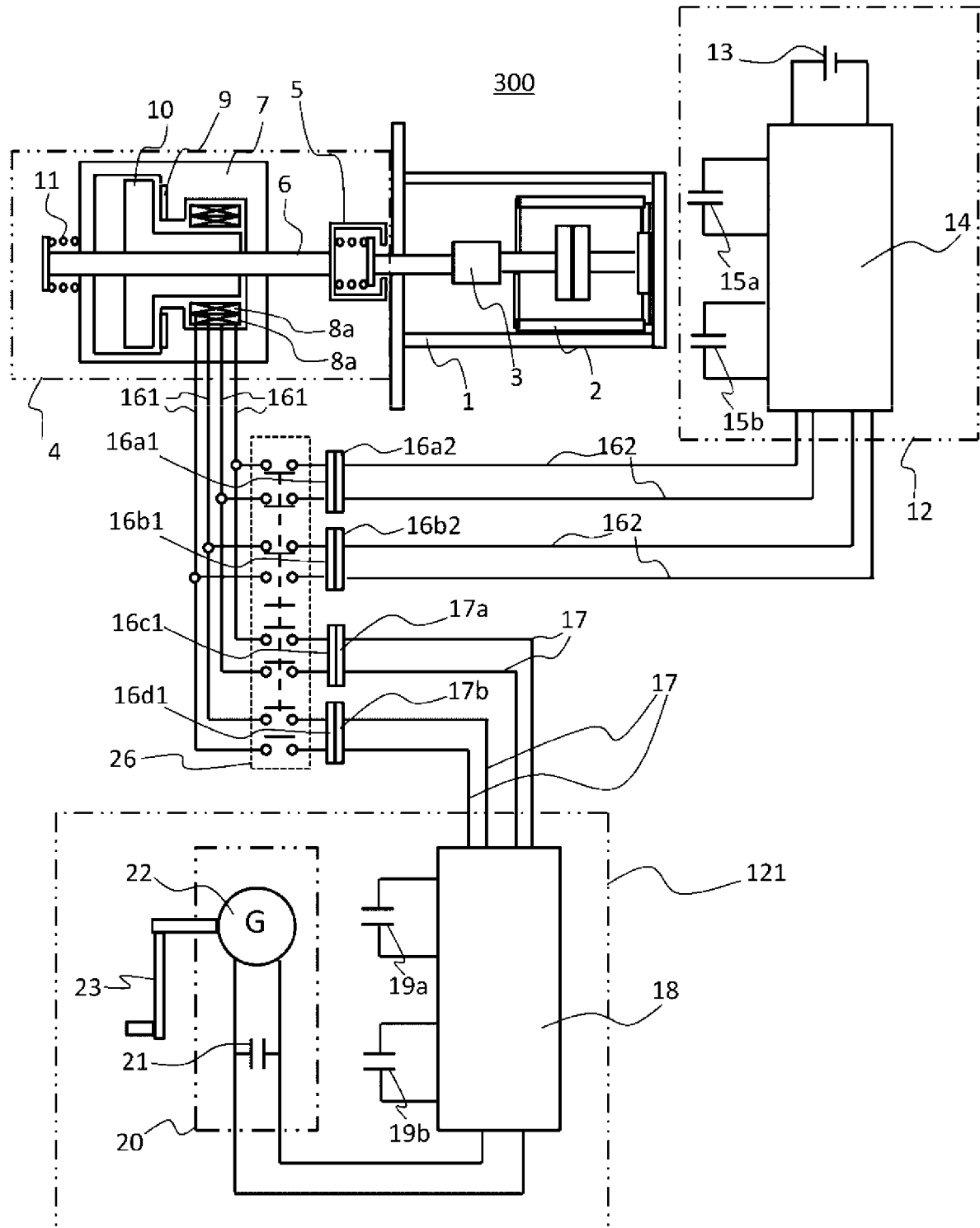


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2019/020265

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. H01H33/666 (2006.01) i, H01H33/38 (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. H01H33/666, H01H33/38

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 1971-2019

Registered utility model specifications of Japan 1996-2019

Published registered utility model applications of Japan 1994-2019

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	WO 2014/141901 A1 (MITSUBISHI ELECTRIC CORP.) 18	1-3, 5
Y	September 2014, paragraphs [0022]-[0046], fig. 1, 2 & US 2015/0371748 A1, paragraphs [0045]-[0092], fig. 1, 2 & HK 1212811 A1 & EP 2975617 A1 & CN 105009233 A	4
Y	JP 2008-277140 A (MITSUBISHI ELECTRIC CORP.) 13	4
	November 2008, paragraphs [0008]-[0014], [0018], fig. 1-3, 8 (Family: none)	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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

27.06.2019

Date of mailing of the international search report

09.07.2019

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2005197122 A [0003]