(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 975 219 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
26.06.2024 Bulletin 2024/26

(21) Application number: **19930085.6**

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

(51) International Patent Classification (IPC):
H01H 33/666 *(2006.01)* ***H01H 33/38*** *(2006.01)*
H01H 33/59 *(2006.01)* ***H01F 7/06*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01H 33/59; H01F 7/064; H01H 33/38; H01H 33/6662

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

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

(54) **ELECTROMAGNETIC OPERATION DEVICE**

ELEKTROMAGNETISCHE BETÄTIGUNGSVORRICHTUNG

DISPOSITIF D'ACTIONNEMENT ÉLECTROMAGNÉTIQUE

(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

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

(73) Proprietor: **Mitsubishi Electric Corporation**
Tokyo 100-8310 (JP)

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

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

(56) References cited:
WO-A1-2014/141901
JP-A- 2001 332 156
JP-A- 2008 277 140
JP-A- 2008 277 140
US-A1- 2015 371 748

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 3 975 219 B1

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, Japanese Laid-Open Patent Publication No. 2005-197122). US 2015/371748 A1, according to its abstract, states that in the electromagnetic operating device, the driving power supply is composed of two types of power supplies: a capacitor power supply serving as a power supply which is for performing opening/closing operation in a normal time with respect to the vacuum valve; and a DC power supply which is for performing opening/closing operation in an emergency. The capacitor power supply which is for performing opening/closing operation in the normal time includes: capacitors that store electric power to be supplied to the electromagnetic coil; and a control board which controls a current to be supplied from the capacitors to the electromagnetic coil in response to an open-contact or close-contact command to the vacuum valve. Then, the DC power supply which is for performing opening/closing operation in the emergency is to directly supply DC electric power to the electromagnetic coil.

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0003] The technique disclosed in Japanese Laid-Open Patent Publication No. 2005-197122 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 Japanese Laid-Open Patent Publication No. 2005-197122 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.

[0004] 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

[0005] 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, electrically 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, the electromagnetic-operation-unit-side circuit connection means includes a first circuit connection means mechanically 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 mechanically connected to the emergency operation device, and a circuit changing means configured to change a connection destination for the electromagnetic operation unit between the drive power supply unit and the emergency operation device, is provided between the electromagnetic operation unit and the electromagnetic-operation-unit-side circuit connection means.

EFFECT OF THE INVENTION

[0006] 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

[0007]

[FIG. 1] FIG. 1 is an entire configuration diagram showing an electromagnetic operation device according to example 1, which is not part of the present invention, 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 example 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 example 1.
[FIG. 4] FIG. 4 is a configuration diagram of an emergency operation device according to example 2, which is not part of the present invention.
[FIG. 5] FIG. 5 is an entire configuration diagram showing an electromagnetic operation device according to an embodiment of the present invention and the opening/closing device to be operated by the electromagnetic operation device.

DESCRIPTION OF EMBODIMENTS

Example 1

[0008] Hereinafter, example 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 example 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.

[0009] 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.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] In example 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.

[0014] 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.

[0015] Next, an operation in an emergency case will be described. FIG. 2 is a configuration diagram of an emergency operation device according to example 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] Example 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 opening/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.

[0023] 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.

Example 2

[0024] Next, example 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 example 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 dis-

charge by each of the electromagnetic coil capacitors 19a and 19b.

[0025] The power supply unit 201 includes, in addition to the components of the power supply unit 20 in example 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.

[0026] The other components are the same as those in example 1, and thus descriptions thereof will be omitted.

[0027] Example 2 makes it possible to obtain the same advantageous effects as those in example 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 example 1. Consequently, the opening/closing control for the opening/closing device can be more swiftly restarted.

Embodiment of the present invention

[0028] Next, an embodiment according to the invention 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 an embodiment of the invention 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 example 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 example 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.

[0029] 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.

[0030] The other components are the same as those in example 1, and thus descriptions thereof will be omitted.

[0031] The embodiment of the invention 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 nec-

essary 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.

[0032] 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.

[0033] 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

[0034]

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 (100,300) comprising:

an electromagnetic operation unit (4) connected to a movable side of an opening/closing device (1) and configured to open/close the opening/closing device (1);
a drive power supply unit (12) including

a first power supplying means (13) and
a first control means (14) configured to control supply of power from the first power supplying means (13) to the electromagnetic operation unit (4), to control an opening/closing operation of the opening/closing device (1);

an electromagnetic-operation-unit-side circuit connection means (16a1,16b1,16c1,16d1) provided at an end portion, of a circuit connected to the electromagnetic operation unit (4), that is located on an opposite side to the electromagnetic operation unit (4); and
a drive-power-supply-unit-side circuit connection means (16a2,16b2) provided at an end portion, of a circuit connected to the drive power supply unit (12), that is located on an opposite side to the drive power supply unit (12), the drive-power-supply-unit-side circuit connection means (16a2,16b2) being connected to the electromagnetic-operation-unit-side circuit connection means (16a1,16b1,16c1,16d1) to form a connection circuit that connects the electromagnetic operation unit (4) and the drive power supply unit (12), wherein
the electromagnetic-operation-unit-side circuit connection means (16a1,16b1,16c1,16d1) is, in an emergency case, electrically connected to an emergency operation device (121,221) including

a second power supplying means (20) and
a second control means (18) configured to control supply of power from the second power supplying means (20) to the electromagnetic operation unit (4), to control an opening/closing operation of the opening/closing device (1),

the electromagnetic-operation-unit-side circuit connection means (16a1,16b1,16c1,16d1) includes

a first circuit connection means (16a1,16b1) mechanically connected to the drive-power-supply-unit-side circuit connection means (16a2,16b2),
characterised in that l
the electromagnetic-operation-unit-side circuit connection means (16a1,16b1,16c1,16d1) further includes
a second circuit connection means (16c1,16d1) connected in parallel to the first circuit connection means (16a1,16b1) and mechanically connected to the emergency operation device (121,221), and

a circuit changing means (26) is configured to change a connection destination for the electromagnetic operation unit (4) between the drive power supply unit (12) and the emergency operation device (121,221), is provided between the electromagnetic operation unit (4) and the electromagnetic-operation-unit-side circuit connection means (16a1,16b1,16c1,16d1).

2. The electromagnetic operation device (100,300) according to claim 1, wherein
the second power supplying means (20) includes

a manual power generator (22) and a battery (24) connected in parallel to each other, and
a power supply changing means (25) configured to connect the manual power generator (22) or the battery (24) to the second control means (18).

3. The electromagnetic operation device (100,300) according to claim 1 or 2, wherein

the second power supplying means (20) includes a control power supply capacitor (21), and
the emergency operation device (121,221) further includes a first electromagnetic coil capacitor (19a) and a second electromagnetic coil capacitor (19b) in each of which power from the power supplying means (20) is accumulated, and a monitoring means configured to monitor a level of accumulated power in each of a control power supply capacitor (21) and the electromagnetic coil capacitors (19a,19b).

4. The electromagnetic operation device (100,300) according to any one of claims 1 to 3, wherein
mechanical connection of the electromagnetic-operation-unit-side circuit connection means (16a1, 16b1, 16c1, 16d1) to the drive-power-supply-unit-side circuit connection means (16a2,16b2) can be canceled.

5. The electromagnetic operation device (100,300) according to any one of claims 1 to 4, wherein
out of the electromagnetic-operation-unit-side circuit connection means (16a1,16b1,16c1,16d1) and the drive-power-supply-unit-side circuit connection means (16a2,16b2),

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

Patentansprüche

1. Elektromagnetische Betätigungseinrichtung (100,300) aufweisend:

eine elektromagnetische Betätigungseinheit (4), die mit einer beweglichen Seite einer Öffnungs-/Schließeinrichtung (1) verbunden ist und konfiguriert ist, die Öffnungs-/Schließeinrichtung (1) zu öffnen/schließen;
eine Antriebsleistungsversorgungseinheit (12) aufweisend ein erstes Leistungsversorgungsmittel (13) und ein erstes Steuerungsmittel (14), konfiguriert, um die Versorgung der Leistung von dem ersten Leistungsversorgungsmittel (13) zu der elektromagnetischen Betätigungseinheit (4) zu steuern, um eine Öffnungs-/Schließoperation der Öffnungs-/Schließeinrichtung (1) zu steuern;
ein elektromagnetische-Betätigungseinheit-seitiges Schaltungsanschlussmittel (16a1,16b1,16c1,16d1), bereitgestellt an einem Endabschnitt einer Schaltung, die mit der elektromagnetischen Betätigungseinheit (4) verbunden ist, und die auf einer gegenüberliegenden Seite zu der elektromagnetischen Betätigungseinheit (4) liegt; und
ein Antriebsleistungsversorgungseinheit-seitiges Schaltungsanschlussmittel (16a2,16b2), bereitgestellt an einem Endabschnitt einer Schaltung, die mit der Antriebsleistungsversorgungseinheit (12) verbunden ist, und die auf einer gegenüberliegenden Seite zu der Antriebsleistungsversorgungseinheit (12) liegt, wobei das Antriebsleistungsversorgungseinheit-seitige Schaltungsanschlussmittel (16a2,16b2) mit dem elektromagnetischen-Betätigungseinheit-seitigen Schaltungsanschlussmittel (16a1,16b1,16c1,16d1) verbunden ist, um eine Verbindungsschaltung zu bilden, die die elektromagnetische Betätigungseinheit (4) und die Antriebsleistungsversorgungseinheit (12) verbindet, wobei
das elektromagnetische-Betätigungseinheit-seitige Schaltungsanschlussmittel

(16a1,16b1,16c1,16d1) in einem Notfall elektrisch mit einer Notbetätigungseinrichtung (121,221) verbunden ist, die aufweist
ein zweites Leistungsversorgungsmittel (20) und
ein zweites Steuerungsmittel (18), konfiguriert, um die Versorgung der Leistung von dem zweiten Leistungsversorgungsmittel (20) zu der elektromagnetischen Betätigungseinheit (4) zu steuern, um eine Öffnungs-/Schließoperation der Öffnungs-/Schließeinrichtung (1) zu steuern,
wobei die elektromagnetische-Betätigungseinheit-seitige Schaltungsanschlussmittel (16a1,16b1,16c1,16d1) ein erstes Schaltungsanschlussmittel (16a1,16b1) aufweist, mechanisch verbunden mit dem Antriebsleistungsversorgungseinheit-seitigen Schaltungsanschlussmittel (16a2,16b2),
dadurch gekennzeichnet, dass die elektromagnetische-Betätigungseinheit-seitige Schaltungsanschlussmittel (16a1,16b1,16c1,16d1) des Weiteren aufweist ein zweites Schaltungsanschlussmittel (16c1,16d1), parallel verbunden mit dem ersten Schaltungsanschlussmittel (16a1,16b1) und mechanisch verbunden mit der Notbetätigungseinrichtung (121,221), und
ein Schaltungsänderungsmittel (26) konfiguriert ist, um ein Verbindungsziel für die elektromagnetische Betätigungseinheit (4) zwischen der Antriebsleistungsversorgungseinheit (12) und der Notbetätigungseinrichtung (121,221) zu ändern, bereitgestellt zwischen der elektromagnetischen Betätigungseinheit (4) und dem elektromagnetischen-Betätigungseinheit-seitigen Schaltungsanschlussmittel (16a1,16b1,16c1,16d1).

2. Elektromagnetische Betätigungseinrichtung (100,300) nach Anspruch 1, wobei
das zweite Leistungsversorgungsmittel (20) aufweist

einen manuellen Stromgenerator (22) und eine Batterie (24), die parallel zueinander verbunden sind, und
ein Leistungsversorgungsänderungsmittel (25), konfiguriert, um den manuellen Stromgenerator (22) oder die Batterie (24) mit dem zweiten Steuerungsmittel (18) zu verbinden.

3. Elektromagnetische Betätigungseinrichtung (100,300) nach Anspruch 1 oder 2, wobei

das zweite Leistungsversorgungsmittel (20) einen Steuerungsleistungskondensator (21) aufweist, und
die Notbetätigungseinrichtung (121,221) des Weiteren aufweist einen ersten elektromagnetischen Spulenkondensator (19a) und einen zweiten elektromagnetischen Spulenkondensator (19b), in denen jeweils Leistung von dem Leistungsversorgungsmittel (20) gespeichert wird, und ein Überwachungsmittel, konfiguriert, um das Niveau der gespeicherten Leistung in jedem Steuerungsleistungskondensator (21) und den elektromagnetischen Spulenkondensatoren (19a,19b) zu überwachen.

4. Elektromagnetische Betätigungseinrichtung (100,300) nach einem der Ansprüche 1 bis 3, wobei die mechanische Verbindung des elektromagnetische-Betätigungseinheit-seitigen Schaltungsanschlussmittels (16a1,16b1,16c1,16d1) zu dem Antriebsleistungsversorgungseinheit-seitigen Schaltungsanschlussmittel (16a2,16b2) aufgehoben werden kann.

5. Elektromagnetische Betätigungseinrichtung (100,300) nach einem der Ansprüche 1 bis 4, wobei

aus dem elektromagnetische-Betätigungseinheit-seitigen Schaltungsanschlussmittel (16a1,16b1,16c1,16d1) und dem Antriebsleistungsversorgungseinheit-seitigen Schaltungsanschlussmittel (16a2,16b2),
ein Mittel einen Stecker oder eine Buchse aufweist, und
ein anderes Mittel eine Buchse oder einen Stecker verbunden mit dem Stecker oder der Buchse aufweist.

Revendications

1. Dispositif d'actionnement électromagnétique (100, 300) comprenant :

une unité d'actionnement électromagnétique (4) connectée à un côté mobile d'un dispositif d'ouverture/de fermeture (1) et configurée pour ouvrir/fermer le dispositif d'ouverture/de fermeture (1) ;
une unité d'alimentation électrique d'entraînement (12) comportant

un premier moyen d'alimentation électrique (13) et
un premier moyen de commande (14) configuré pour commander une alimentation de puissance du premier moyen d'alimentation électrique (13) à l'unité d'actionnement électromagnétique (4), pour commander une ouverture/fermeture du dispositif d'ouverture/de fermeture (1) ;

un moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique prévu au niveau d'une portion d'extrémité, d'un circuit connecté à l'unité d'actionnement électromagnétique (4), qui est situé sur un côté opposé à l'unité d'actionnement électromagnétique (4) ; et

un moyen de connexion de circuit (16a2, 16b2) côté unité d'alimentation électrique d'entraînement prévu au niveau d'une portion d'extrémité, d'un circuit connecté à l'unité d'alimentation électrique d'entraînement (12), qui est situé sur un côté opposé à l'unité d'alimentation électrique d'entraînement (12), le moyen de connexion de circuit (16a2, 16b2) côté unité d'alimentation électrique d'entraînement étant connecté au moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique pour former un circuit de connexion qui connecte l'unité d'actionnement électromagnétique (4) et l'unité d'alimentation électrique d'entraînement (12),

le moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique étant, en cas d'urgence, connecté électriquement à un dispositif d'actionnement d'urgence (121, 221) comportant

un deuxième moyen d'alimentation électrique (20) et

un deuxième moyen de commande (18) configuré pour commander une alimentation de puissance du deuxième moyen d'alimentation électrique (20) à l'unité d'actionnement électromagnétique (4), pour commander une ouverture/fermeture du dispositif d'ouverture/de fermeture (1).

le moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique comportant

un premier moyen de connexion de circuit (16a1, 16b1) connecté mécaniquement au moyen de connexion de circuit (16a2, 16b2) côté unité d'alimentation électrique d'entraînement, **caractérisé en ce que** le moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique comporte en outre

un deuxième moyen de connexion de circuit (16c1, 16d1) connecté en parallèle au premier moyen de connexion de circuit (16a1, 16b1) et connecté mécaniquement au dispositif d'actionnement d'urgence (121, 221), et

un moyen de changement de circuit (26) étant configuré pour changer une destination de connexion pour l'unité d'actionnement électromagnétique (4) entre l'unité d'alimentation électrique d'entraînement (12) et le dispositif d'actionnement d'urgence (121, 221), étant prévu entre l'unité d'actionnement électromagnétique (4) et le moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique.

2. Dispositif d'actionnement électromagnétique (100, 300) selon la revendication 1,
le deuxième moyen d'alimentation électrique (20) comportant

un générateur de puissance manuel (22) et une batterie (24) connectés en parallèle l'un à l'autre, et

un moyen de changement d'alimentation électrique (25) configuré pour connecter le générateur de puissance manuel (22) ou la batterie (24) au deuxième moyen de commande (18).

3. Dispositif d'actionnement électromagnétique (100, 300) selon la revendication 1 ou 2,

le deuxième moyen d'alimentation électrique (20) comportant un condensateur d'alimentation électrique de commande (21), et

le dispositif d'actionnement d'urgence (121, 221) comportant en outre un premier condensateur à bobines électromagnétiques (19a) et un deuxième condensateur à bobines électromagnétiques (19b) dans chacun desquels une puissance provenant du moyen d'alimentation électrique (20) est accumulée, et un moyen de surveillance configuré pour surveiller un niveau de puissance accumulée dans chacun d'un condensateur d'alimentation électrique de commande (21) et des condensateurs à bobines électromagnétiques (19a, 19b).

4. Dispositif d'actionnement électromagnétique (100, 300) selon l'une quelconque des revendications 1 à 3,
une connexion mécanique du moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique au moyen de connexion de circuit (16a2, 16b2) côté unité d'alimentation électrique d'entraînement pouvant être annulée.

5. Dispositif d'actionnement électromagnétique (100, 300) selon l'une quelconque des revendications 1 à 4,
parmi le moyen de connexion de circuit (16a1, 16b1, 16c1, 16d1) côté unité d'actionnement électromagnétique et le moyen de connexion de circuit (16a2, 16b2) côté unité d'alimentation électrique d'entraî-

nement,

un moyen comprenant une fiche ou un réceptacle, et
un autre moyen comprenant un réceptacle ou une fiche connecté(e) à la fiche ou au réceptacle.

FIG. 1

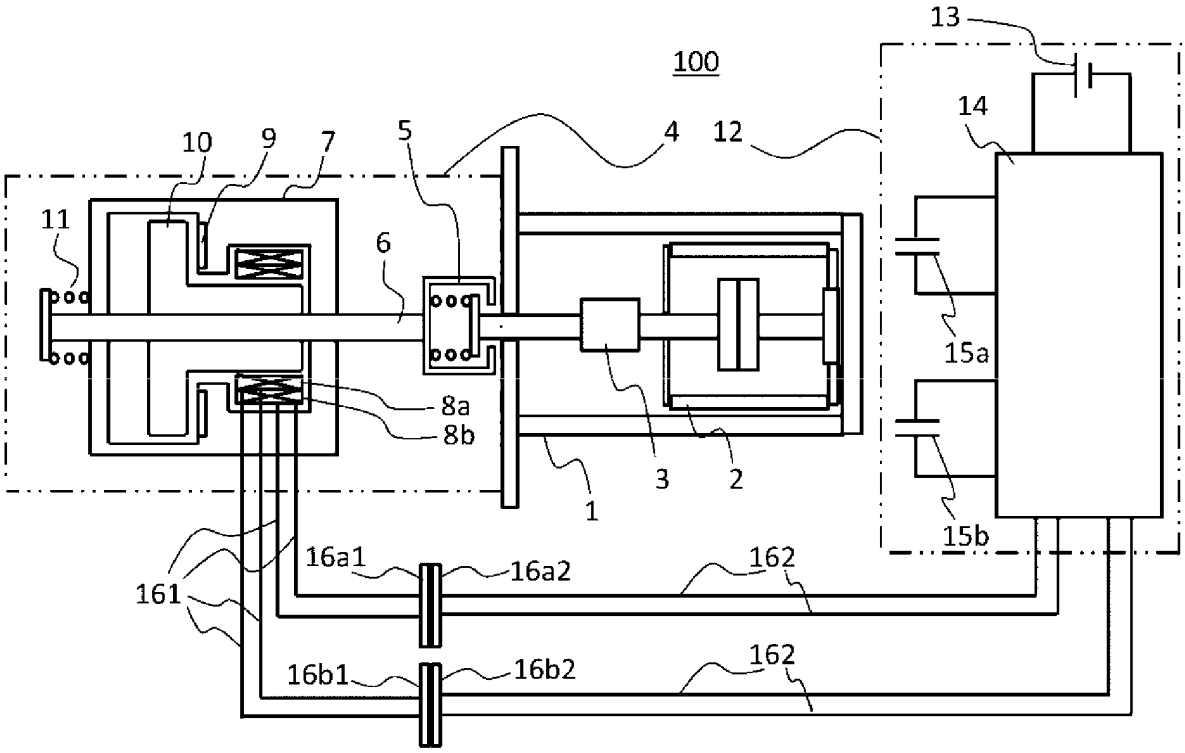

100
13
14
12
4
5
10
9
7
11
6
8a
8b
3
2
1
15a
15b
161
16a1
16a2
162
16b1
16b2
162

FIG. 2

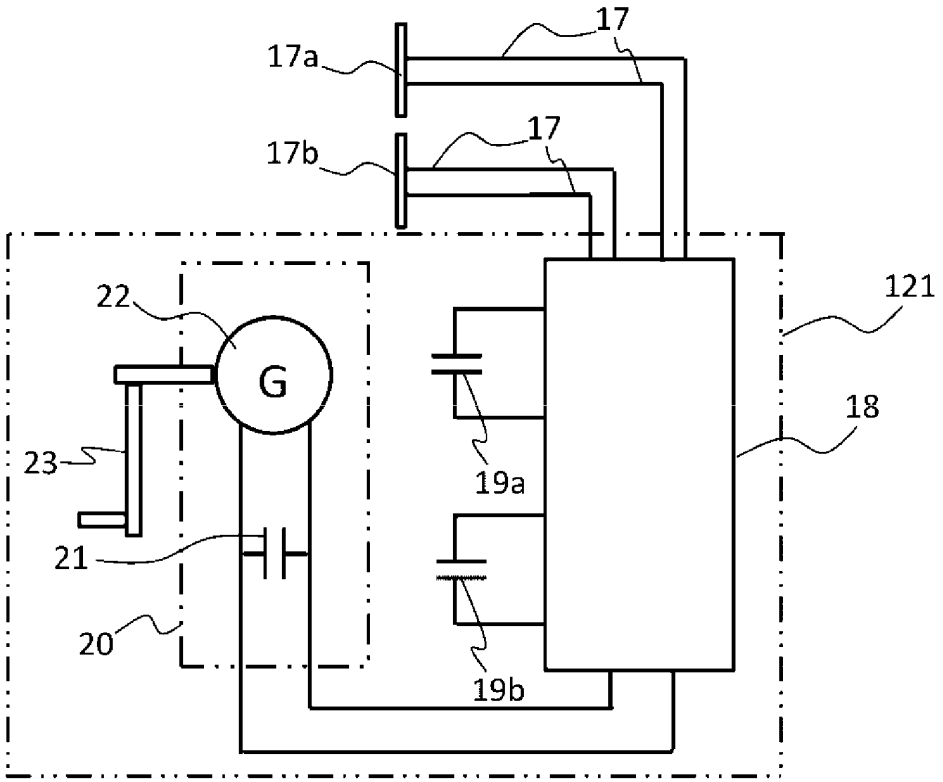

17a
17
17b
17
121
22
G
18
23
19a
21
20
19b

FIG. 3

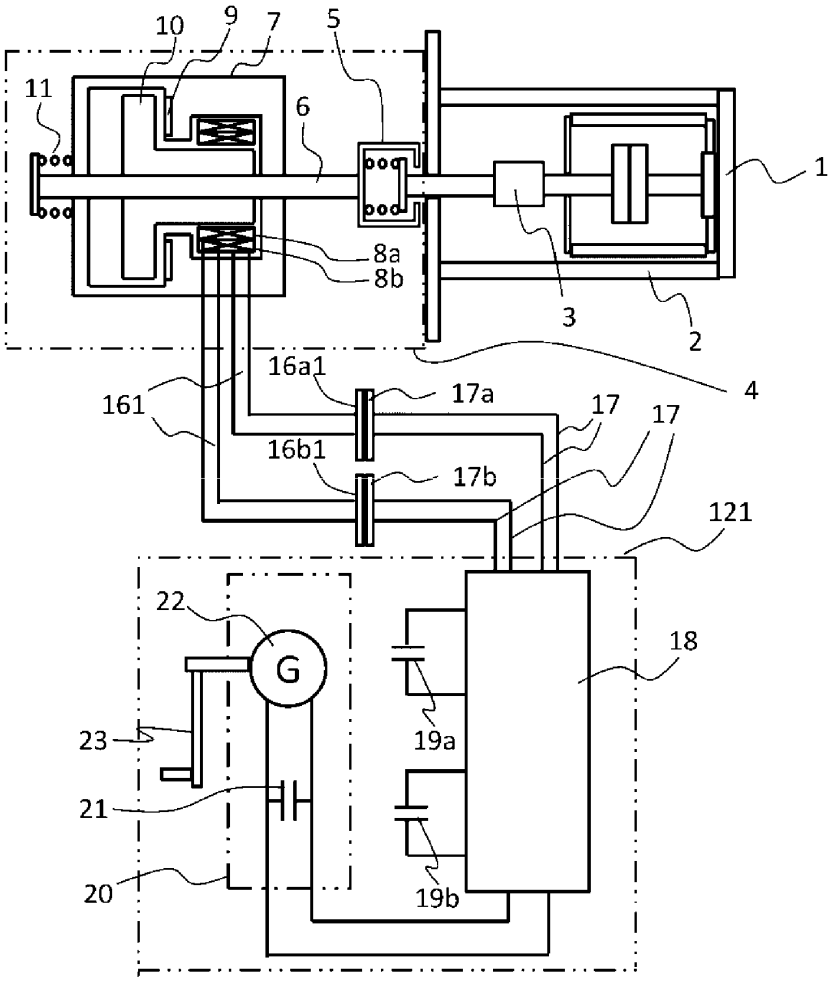

10
9
7
5
11
6
1
8a
8b
3
2
4
16a1
17a
161
17
17
16b1
17b
121
22
G
18
19a
23
21
19b
20

FIG. 4

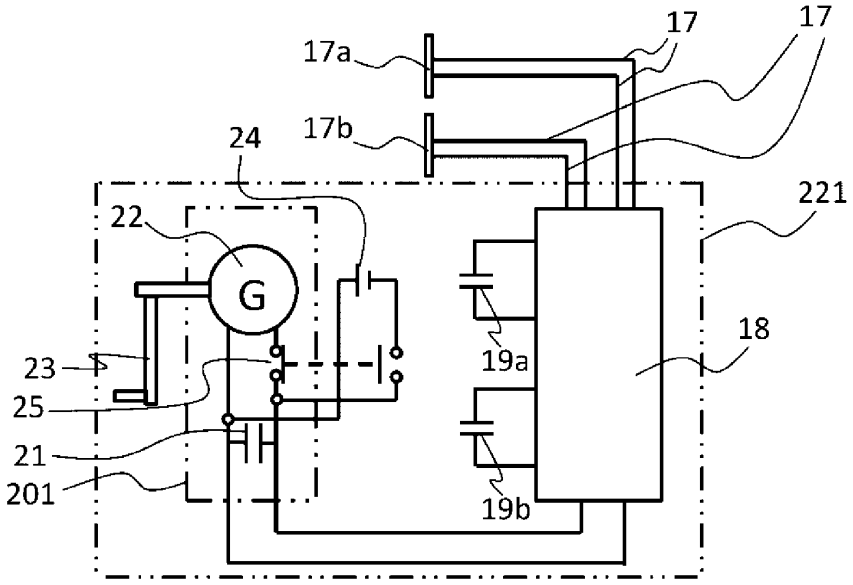
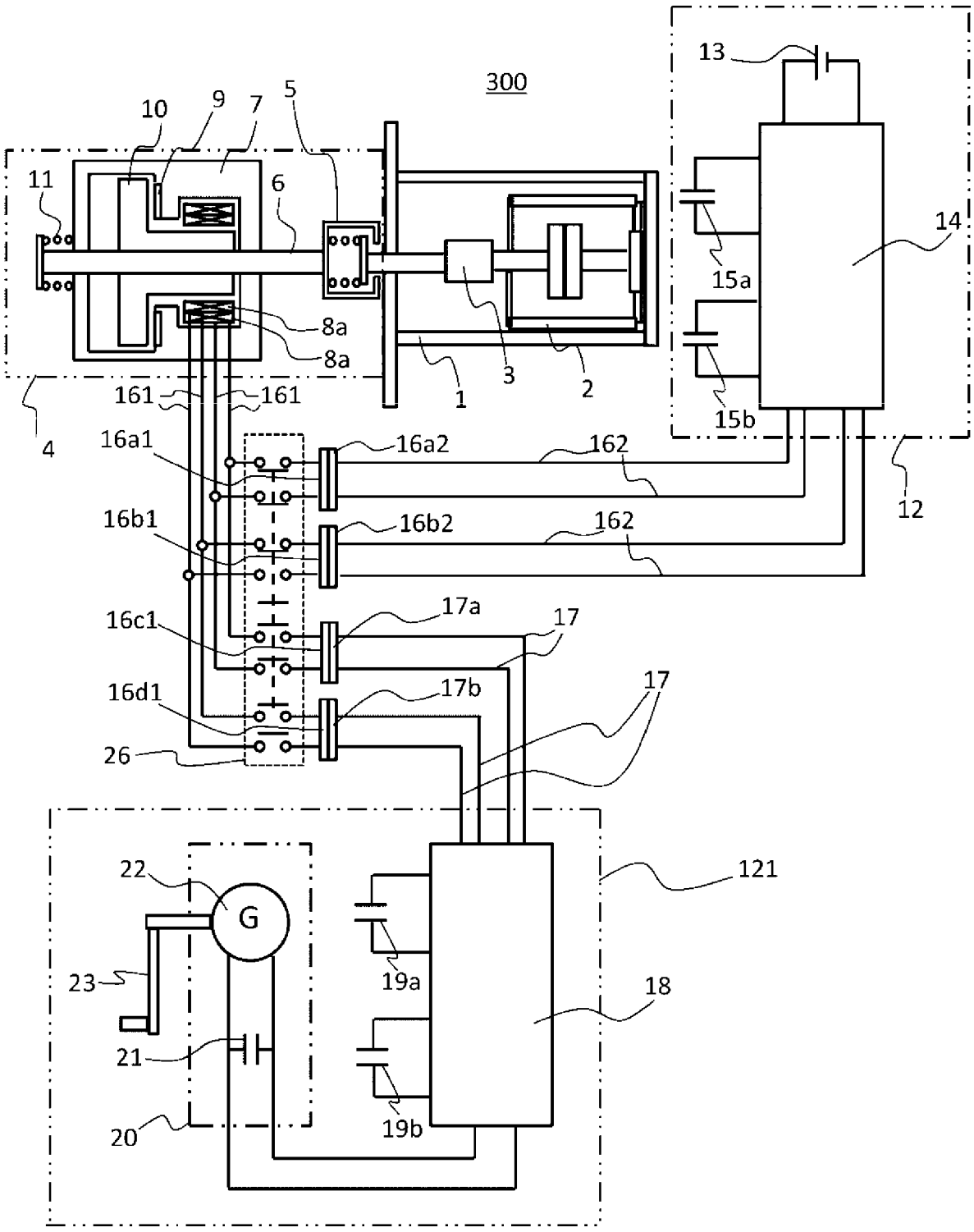

17a
17
17
17b
24
221
22
G
18
19a
23
25
21
201
19b

FIG. 5


300
13
14
15a
15b
12
10
9
7
5
11
6
8a
8a
3
2
1
4
161
161
16a1
16a2
162
16b1
16b2
162
16c1
17a
17
16d1
17b
17
26
121
22
G
23
21
20
19a
19b
18

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 **[0002] [0003]**
- US 2015371748 A1 **[0002]**