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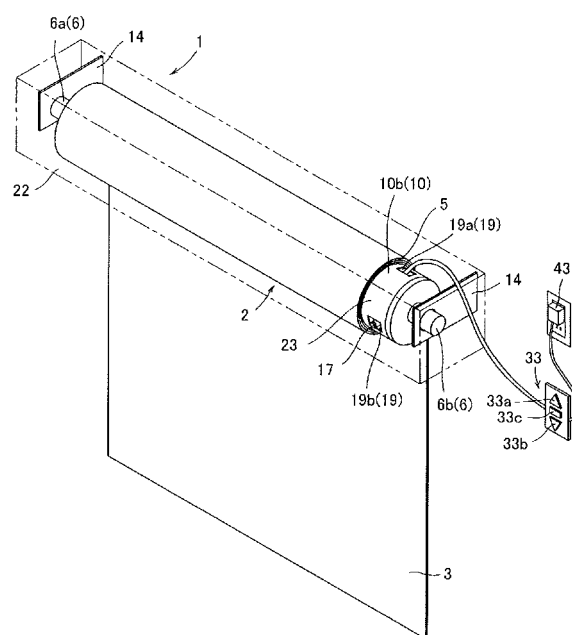
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(54) **Winding drive and winding device incorporating the same**

(57) The present invention aims to provide a winding drive capable of easily setting a stopping position of a wound material and further preventing a shift of the set stopping position and a winding device incorporating the winding drive, which needs fewer electric cables communicating in and out of the device.

The winding device (1) mainly consists of a winding drive (2) and a winding drum (21), the winding drive (2) having a main body (40) and a two-core electric cable (23) for electrically connecting the main body (40) and an external DC power source. The electric cable (23) is provided with a polarity selector switch (33), so that a rotational direction of a driving motor (7) is changed by operating the switch (33). The main body (40) is provided with an operation mode selector switch (17) for switching an operation mode, so that the number of rotations of the driving motor (7) detected in a rotation detecting part (25) is memorized in a memorizing part (26) in a stopping position setting mode and the memorized number of rotations is fed back in a normal mode.

FIG. 1



Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to winding devices for winding curtains, blinds, and the like and to winding drives incorporated in such winding devices. Specifically, the present invention relates to a winding drive that controls rotation of a driving motor housed in a tubular body and to a winding device incorporating the winding drive, and more particularly, capable of easily setting a stopping position of the rotating tubular body.

DESCRIPTION OF THE RELATED ART

[0002] Conventionally, winding devices for pulling up and down a wound material such as a curtain include a hand-operated device utilizing a winding mechanism of a coil spring and an automatic device utilizing a driving force of an electric motor. Some automatic winding devices can set a winding upper limit (open state) and an unwinding lower limit (closed state) of the wound material.

[0003] Patent Document 1 specified below discloses a winding device including an adjusting box 26 designed to set a stopping position of a wound material (not shown), in the adjusting box 26 a winding shaft 16 driven by an electric motor 12 is inserted so as to wind up the wound material and a dog 34 operated in conjunction with rotation of the winding shaft 16 is disposed. The winding device stops winding the wound material by bringing the dog 34 into contact with one of limit switches 38 and 39.

PATENT DOCUMENT

[0004]

Patent Document 1: JP 2006-020 541 A

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005] However, the winding device disclosed in the Patent Document 1 has problems in which it is bothersome to set the winding upper limit and the unwinding lower limit of the wound material and further a set stopping position may shift.

[0006] Specifically, the winding device disclosed in the Patent Document 1 determines a stopping position of the material by adjusting a position of a limit switch arranged in the adjusting box. In order to adjust the position of the limit switch, it is necessary to turn an adjustment knob arranged outside the adjusting box. Turning of the adjustment knob provided outside the box is needed for

positioning of the invisible limit switch housed inside the box.

Consequently, in order to set the position where the material should be stopped, it is necessary to confirm a position of the material by driving of the motor after turning of the adjustment knob, causing the setting work to be bothersome. Particularly, setting of the device on a high place involves high-place work by climbing a ladder or the like. That is bothersome due to time-consuming work and requires risky work.

[0007] Further, such a winding device utilizing a physical mechanism needs a number of components, rendering adjustment among the components in assembly complicated. Additionally, the Patent Document 1 has problems in which the adjustment knob may shift from an initial position and further the stopping position of the material may shift in a case where the adjustment knob is coming loose and turns or fixation of the limit switch becomes unstable. Therefore, the winding device in the known art may need a new setting each time the stopping position shifts.

[0008] On the other hand, the winding device incorporating a motor disadvantageously needs a number of signal lines communicating in and out of the device.

Specifically, because the winding device incorporating a motor is designed to wind and unwind a wound material such as a curtain and a blind, the motor incorporated in the device is required to perform a positive rotation and a negative rotation. Thus, it is necessary to provide signal lines for indicating rotational directions, the signal lines communicating in and out of the device.

Additionally, the device requires an electric supply line for supplying electricity to the motor. Consequently, the winding device incorporating the motor requires an electric cable for electricity supply and signal lines, both which communicate in and out of the device.

Still further, in order to render a setting of a winding upper limit and an unwinding lower limit possible, the device needs a signal line for the setting and communicating in and out of the device, further increasing the number of electric cables.

[0009] An object of the present invention made in view of the problems and drawbacks in the conventional art described above is therefore to provide a winding drive capable of easily setting a stopping position of a wound material and further preventing a shift of the set stopping position and a winding device incorporating the winding drive, which needs fewer electric cables communicating in and out of the device.

MEANS TO SOLVE THE PROBLEM

[0010] In order to solve the problems and drawbacks described above, the present invention discloses a winding drive including a main body and a pair of electrical wires for electrically connecting the main body to an external DC power source; wherein the main body has a tubular body, a driving motor, a driven member, and a

controller, the driving motor and the controller being housed in the tubular body, the driving motor being designed to rotate upon supply of a direct current from the electrical wires and transmitting a rotational force of the motor to the driven member, thereby rotating the driven member; wherein the pair of electrical wires are provided with a polarity selector switch outside the main body, the polarity selector switch being operated so as to change a polarity of the direct current flowing through the electrical wires, thereby changing a rotational direction of the driving motor; wherein the controller has a rotation number detector for directly or indirectly detecting information of the number of rotations of the driving motor and a memory for memorizing the information detected by the rotation number detector and selectively executes one selected from a stopping position setting mode operation and a normal mode operation; and wherein the main body is provided with an operation mode selector switch, which switches between the stopping position setting mode operation and the normal mode operation, so that the memory memorizes the information detected by the rotation number detector in the stopping position setting mode operation, and that the driving motor is stopped based on the information having been memorized in the memory after rotation of the driving motor in the normal mode operation.

[0011] The tubular body may serve as the driven member. By this configuration, rotation of the tubular body allows a wound material to be wound.

Alternatively, the driven member may be an output member extending from an end of the tubular body, the output member having an outer diameter larger at least in part than that of the tubular body. By this configuration, the winding drive in this embodiment can be housed in a tubular winding drum, with which the output member is engaged, so that rotation of the output member rotates the winding drum to wind a wound material.

[0012] In the winding drive in this embodiment, the tubular body houses the rotation number detector for directly or indirectly detecting information of the number of rotations of the driving motor and the memory for memorizing the detected information. Herein, the term "directly" denotes a direct detection of the number of rotations of the driving motor and includes, for example, the detection by a rotation number detecting sensor mounted on a rotational shaft of the motor.

In contrast, the term "indirectly" denotes the detection by a rotation number detecting sensor mounted on a member, to which the rotation of the driving motor is transmitted, such as the tubular body and the output member. In this way, the direct or indirect detection of the number of rotations of the driving motor identifies the number of rotations of the tubular body or the output member, to which the rotation is transmitted, thereby identifying a position of an end of a wound material. Conversely, that identifies the number of rotations of the driving motor necessary to allow the end of the wound material to reach a target position.

The winding drive in this embodiment manually activates and deactivates the driving motor in the stopping position setting mode operation.

Information such as the number of rotations between activation and deactivation of the driving motor is detected by the rotation number detector and is memorized by the memory.

That makes the memory to memorize the information of the number of rotations of the driving motor for allowing the end of the wound material to reach the target position. The setting is completed by a series of procedures described above.

The winding drive in this embodiment performs a daily operation with an operation mode changed to the normal mode.

In the normal mode operation, the driving motor is stopped at the number of rotations having been memorized in the memory after rotation of the motor. In other words, when the end of the wound material reaches the target position, the driving motor is stopped.

The winding drive in this embodiment eliminates a complicated component configuration and controls the stopping position of the tubular body or the output member with a simple one because the stopping position thereof is not set by a physical mechanism. Therefore, a setting of the stopping position thereof involves no burdensome work. Further, the stopping position thereof having been set in the stopping position setting mode operation is fed back to the normal mode operation, and whereby the highly-practical winding drive can be provided.

The winding drive in this embodiment rotates the driving motor housed in the tubular body using an external DC power source, having a pair of electrical wires electrically connecting the main body to the external DC power source. The driving motor rotates upon supply of a direct current through the electrical wires. Herein, the electrical wires are provided with the polarity selector switch, which is operated so as to change a polarity of the direct current flowing through the electrical wires, thereby changing a rotational direction of the driving motor.

Thus, the winding drive in this embodiment eliminates a signal line for commanding a rotational direction, so as to have fewer electric cables communicating in and out of the drive.

[0013] In this embodiment, the main body may have a switch for activating and deactivating the driving motor by manual manipulation or based on signals generated by manual manipulation, the switch being operated so as to deactivate the driving motor after having activated the motor, for making the memory to memorize the information detected by the rotation number detector in the stopping position setting mode operation.

[0014] By this configuration, the stopping position is set by operating the switch for activating and deactivating the driving motor. In this configuration, there is no need to insert a signal line for setting the stopping position because the switch for activating and deactivating the driving motor is disposed at the main body,

[0015] In this embodiment, the winding drive may be designed to manually stop power supply after manually energizing to the driving motor so as to activate the driving motor in the stopping position setting mode operation, for making the memory to memorize the information detected by the rotation number detector.

[0016] By this configuration, when the end of the wound material reaches the predetermined or target position, the power supply is to be manually stopped. Further, the memory memorizes information detected by the rotation number detector taking an opportunity of manual stopping of the power supply, and whereby there is no need of a signal line to give the opportunity.

[0017] In this embodiment, the tubular body may house one selected from a battery and a capacitor, wherein the memory memorizes the information detected by the rotation number detector using the one selected from the battery and the capacitor as a power source in the stopping position setting mode operation.

[0018] By this configuration, the battery or the capacitor is housed in the tubular body, thereby supplying power to the memory even though the power supply to the driving motor is stopped. Thus, the number of rotations is memorized even with manual stopping of the power supply in the stopping position setting mode.

[0019] In this embodiment, the driving motor may be designed to execute a positive rotation and a negative rotation, wherein the rotation number detector detects the numbers of rotations of the positive and negative rotations of the driving motor in the stopping position setting mode operation, each of the numbers being memorized in the memory, so that, in the normal mode operation, the positive rotation of the driving motor makes the driving motor to stop at the number of positive rotations having been memorized in the memory and that the negative rotation of the driving motor makes the driving motor to stop at the number of negative rotations having been memorized in the memory.

[0020] By this configuration, the driving motor rotates in positive and negative directions, and thus, the memory memorizes the numbers of rotations in the respective directions.

[0021] In this embodiment, the driving motor may be designed to execute a positive rotation and a negative rotation in the stopping position setting mode operation, wherein the memory memorizes the number of rotations calculated as a difference between the numbers of positive rotations and negative rotations.

[0022] By this configuration, the stopping position is finely tuned because the driving motor executes a positive rotation and a negative rotation in the stopping position setting mode operation.

[0023] The winding drive in this embodiment may further include a corrector for correcting the stopping position of the driving motor, so that, in the normal mode operation, when the driving motor stops at the number of rotations higher than or less than the number of rotations having been memorized in the stopping position

setting mode operation, the corrector corrects the number to the memorized number.

[0024] By this configuration, in the normal mode operation, in a case where the driving motor stops at the number of rotations higher than the number set in the stopping position setting mode, the number is corrected to the set number. Thus, the driving motor is prevented from rotating beyond the set number because of inertia of the wound material. Consequently, it is possible to prevent the output member from shifting too far from the stopping position due to shifts of the position by each action in the normal mode operation.

[0025] It is recommended in the winding drive in this embodiment that the rotation number detector has at least two Hall elements so as to detect a rotational direction.

[0026] The winding drive in this embodiment may further include a mode selector designed to switch between the normal mode operation and the stopping position setting mode operation.

[0027] This configuration protects the setting of the stopping position from being changed unless the mode selector is manually switched. In other words, only switching to the stopping position setting mode allows the drive to be easily ready to set the stopping position, thereby facilitating the setting.

[0028] In this embodiment, the driving motor may have a permanent magnet and a coil, the coil being shunted by manual stopping of a power supply.

[0029] By this configuration, rotation of the coil or the magnet produces an electromotive force in the coil, so that the driving motor functions as an electromagnetic brake.

[0030] The winding drive in this embodiment may further include a power recognition means for detecting the manual stopping of a power supply, so that, when the coil is shunted by the manual stopping of a power supply, energization between the power recognition means and the coil is shut off.

[0031] This configuration avoids false detection of the power recognition means by shutting off energization between the power recognition means and the coil when the coil is shunted by the manual stopping of power supply. In other words, the coil produces an electromagnetic force when the coil is shunted by the manual stopping of power supply, so that the power recognition means is prevented from false detection.

[0032] The winding drive in this embodiment may have a configuration that the output member is engaged with the tubular body, which rotates via the output member by rotation of the motor.

[0033] Another aspect of the present invention relates to a winding device including the winding drive described above and a wound material to be wound around the tubular body, the tubular body serving as the driven member.

[0034] This configuration facilitates a setting of the stopping position of the wound material and feeds back

the set setting position, thereby providing a highly-practical winding device.

[0035] Still another aspect of the present invention relates to a winding device including the winding drive described above and a winding drum for winding a wound material, the winding drive being housed in the winding drum, so that a rotational force of the driving motor is transmitted to the winding drum via the output member. In the winding device according to this aspect, the driven member is an output member extending from an end of the tubular body, the output member having an outer diameter larger at least in part than that of the tubular body.

[0036] This configuration facilitates a setting of the stopping position of the wound material and feeds back the set setting position, thereby providing a highly-practical winding device. Further, the winding drum can be changed in size so as to use a larger wound material to be wound around the drum.

ADVANTAGEOUS EFFECT OF THE INVENTION

[0037] The winding device and the winding drive in the present invention manually stop a power supply to the driving motor in the stopping position setting mode, so as to memorize the number of rotations of the driving motor, thereby facilitating a setting of the stopping position of the output member.

Further, the winding device and the winding drive in the present invention require only the electric cable for power as the electrical wires connecting inside to outside of the tubular body. Consequently, the winding device and the winding drive in the present invention have a simple external wiring.

Still further, the winding device and the winding drive in the present invention stop after having correcting the number of rotations in the normal mode, thereby preventing a shift of the stopping position of the output member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038]

- Fig. 1 is a perspective view of a winding device of an embodiment of the present invention;
- Fig. 2 is a cross section showing an inside of a winding drum in Fig. 1;
- Fig. 3 is a cross section showing an inside of a tubular body in Fig. 2;
- Fig. 4 is a cross section taken along a line A -A in Fig. 2 and showing schematically a relationship between a rotating magnet and a stationary magnet;
- Fig. 5 is a block diagram showing a control of the winding device of an embodiment of the present invention;
- Fig. 6 is a schematic circuit diagram of the winding device of an embodiment of the present invention, showing the winding device been ener-

gized;

- Fig. 7 is a schematic circuit diagram of the winding device of an embodiment of the present invention, showing the winding device not energized;
- Fig. 8 is a flow chart of a setting of a winding upper limit and setting of an unwinding lower limit in a stopping position setting mode operation;
- Fig. 9 is a flow chart showing a control in a normal mode operation;
- Fig. 10 is a perspective view of a winding device of another embodiment of the present invention;
- Fig. 11 is a schematic circuit diagram of the winding device in Fig. 10;
- Fig. 12 is a schematic circuit diagram of a winding device of still another embodiment of the present invention;
- Fig. 13 is a schematic circuit diagram of a winding device of yet another embodiment of the present invention;
- Fig. 14 is a schematic circuit diagram of a winding device of yet still another embodiment of the present invention, showing a driving motor been activated;
- Fig. 15 is a schematic circuit diagram of the winding device in Fig. 14, showing the driving motor been deactivated; and
- Fig. 16 is a cross section of a modified embodiment of the winding device of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0039] Now, preferred embodiments of the present invention will be described in detail below, making reference to the accompanying drawings.

An embodiment described below illustrates a winding device 1 including a winding drive 2 incorporated in a winding drum 21. The winding device 1 combining the winding drum 21 and the winding drive 2 and being designed to make the winding drive 2 to rotate the winding drum 21 meets a requirement constituting a winding drive of the present invention because the winding drum 21 has a shape of tubular body.

[0040] The winding device 1 in this embodiment is to be hung on a window of a building, so as to block all or a part of light incoming from outside through the window by closing a covering (wound material) such as a curtain and a blind and to cut off outside for preventing people outside from being able to see inside a room.

The winding device 1 mainly consists of the winding drum 21 shown in Figs. 1 and 2, the winding drive 2 (Fig. 3) housed in the winding drum 21, around which a wound material 3 such as a curtain is wound, and a box 22 for covering up the entire components.

[0041] The box 22 is, as shown in Fig. 1, a housing made of a material such as metal and resin and being open at two adjacent faces (bottom face and rear face) extending in a longitudinal direction, and has a size

enough to cover the whole winding drum 21 and a part of the winding drive 2 extending from the drum 21. In other words, the box 22 has a longitudinal length (horizontal length) longer than that of the winding drum 21 and a depth length and a height (vertical length) longer than a diameter of the drum 21. The depth length and the height of the box 22 must be longer than a diameter of the wound material 3 having been wound around the winding drum 21, because the diameter of the winding drum 21 and the wound material becomes longer than the diameter of the drum 21.

[0042] The winding drum 21 is a roller (tubular body) around which the wound material 3 is to be wound. The winding drum 21 houses the winding drive 2 described below and has lids 10a and 14b at its both ends as shown in Fig. 2. One lid 10a has an outer diameter substantially equal to an inner diameter of the winding drum 21 and includes a bearing 18, through which a fixing shaft 6a is inserted. The winding drum 21 rotates relative to the fixing shaft 6a via the bearing 18. Shortly, the fixing shaft 6a is prevented from rotation even though the winding drum 21 rotates.

[0043] The other lid 10b also works as a lid of the winding drive 2 and has a mounting part 31 and an extending part 32. A bearing 20 is arranged around the mounting part 31. The extending part 32 has openings 19a and 19b formed at a side face forming the part 32 and a fixing shaft 6b formed at a face forming the part 32 and perpendicular to the side face. The winding drum 21 rotates relative to the lid 10b via the bearing 20. Shortly, the fixing shaft 6b is prevented from rotation even though the winding drum 21 rotates. Herein, the fixing shafts 6a and 6b are positioned on a central axis of the winding drum 21.

[0044] The fixing shafts 6a and 6b are fixed to fixing brackets (Fig. 1) 14 fixed to a building, so as to fix the winding drum 21 on a window frame or the like. Thus, the winding drum 21 is rotatively fixed relative to the building via the fixing shafts 6 (6a and 6b).

[0045] As described above, the lid 10b works as the lid of the winding drive 2, with its distal end fitted in an end of a tubular body 5 of the drive 2. Therefore, the lid 10b is a member belonging to a main body 40 of the winding drive 2 and is united with the tubular body 5 of the drive 2,

[0046] As shown in Fig. 2, an electric cable 23 for electricity supply (described below) is inserted through the opening 19a of the lid 10b. In this embodiment, the electric cable 23 has a pair of electrical wires, being a two-core cable for power supply. This embodiment eliminates a so-called signal line.

There is provided an operation mode selector switch 17 positioned at the opening 19b, with a part of the switch 17 extending outwardly from inside of the winding drum 21. The switch 17 is disposed at the main body 40 of the winding drive 2. The switch 17 employed in this embodiment, which is a sliding switch or a pushing switch, is designed to switch an upper stopping position setting mode, a lower stopping position setting mode, and a nor-

mal mode.

[0047] The winding drive 2 is housed in the winding drum 21 as shown in Fig. 2 and constituted by the tubular body 5 housing a driving motor 7, a control board 8, and a reducer 9 as shown in Fig. 3. Further, an output member 4 extends from an end of the tubular body 5.

[0048] The driving motor 7 employs a DC motor provided with known brushes 48 and is constituted by permanent magnets 50 and a coil 51 as shown in Fig. 6.

In this embodiment, as shown in Fig. 3, the driving motor 7 has a rotational shaft 11 extending from its both ends. At one end of the shaft 11, there are provided a bipolar rotating magnet 12 as shown in Fig. 4 and a stationary magnet 13 having two polarities so as to surround the rotating magnet 12. The stationary magnet 13 is positioned outside of the rotating magnet 12 and inside of the tubular body 5. Such a configuration presents a resistance to a rotation of the driving motor 7. Specifically, the rotating magnet 12 and the stationary magnet 13 form a cogging force generating a braking effect. Herein, the stationary magnet 13 is fixed to an inner wall of the tubular body 5.

Further, there are provided two Hall elements 16 described below, which detect a magnetic field generated by the rotating magnet 12, thereby enabling the number of rotations of the driving motor 7 to be recognized as a pulse signal,

[0049] At the other end of the shaft 11, there is provided the reducer 9, via which the shaft 11 is connected to the output member 4.

The reducer 9 is constituted by known planet gears 15, thereby reducing a rotation of the rotational shaft 11 connected to a center of the planet gears 15 and transmitting the rotation to the output member 4. Specifically, in the winding drive 2 in this embodiment, the reducer 9 is constituted by the planet gears 15 each having substantially the same configuration and arranged in two rows in an axial direction of the tubular body 5, thereby enabling reduction of a rotation of the driving motor 7 and stable transmission of the rotation to the output member 4.

[0050] The output member 4 is designed to transmit a rotational force of the driving motor 7 to the winding drum 21, with a part (inner cylinder arranged part 35) of the output member 4 arranged within the tubular body 5 and the rest part (outer cylinder attached part 36) arranged outside of the tubular body 5. Specifically, the inner cylinder arranged part 35 is connected to the reducer 9 without contacting with the tubular body 5, so that the tubular body 5 is prevented from a rotation with the output member 4 by a rotation of the reducer 9. Shortly, the tubular body 5 is prevented from a rotation even though the output member 4 rotates.

[0051] The outer cylinder attached part 36 has an outer diameter slightly larger than that of the tubular body 5, so as to be fitted in an inside of the winding drum 21 with the output member 4 arranged within the winding drum 21. Thus, the winding drum 21 is rotated along with the output member 4. Consequently, the rotation of the driv-

ing motor 7 at a reduced speed is transmitted to the output member 4, thereby rotating the winding drum 21 at the reduced speed.

[0052] The control board 8 is a substantially rectangular plate and is equipped with a control IC. The control board 8 is positioned near a central axis of the tubular body 5 and across the driving motor 7 from the reducer 9, being secured to the tubular body 5 so as not to rotate with the driving motor 7. Further, as shown in Fig. 2, the electric cable 23 is to be connected to an external power source is connected to the control board 8.

The electric cable 23 is provided with a remote control switch (polarity selector switch) 33, which is attached to a wall of a building. Further, in this embodiment, the electric cable 23 is connected to a DC power source 43, which supplies a direct current to the cable 23. Herein, in this embodiment, the DC power source 43 employs an AC/DC adapter being convertible from an AC power source to a DC power source.

[0053] The remote control switch 33 has a wound position 33a, an unwound position 33b, and an energization stopping position 33c, thereby vertically pulling up and down the wound material 3 attached to the tubular body 5. The switch 33 functions as a polarity selector switch that changes a polarity of a direct current flowing in the electric cable 23, so as to positively or negatively rotate the driving motor 7, and further switches ON/OFF of a power supply.

[0054] The control board (controller) 8 includes the two Hall elements 16 being opposed to the rotating magnet 12 and is configured to process information received by the Hall elements 16. Specifically, as shown in Fig. 5, the control board 8 includes a rotation detecting part 25 for detecting a signal received by the Hall elements 16, a memorizing part (memory) 26 for memorizing a rotation detected by the rotation detecting part 25, a comparing and correcting part 27 for comparing the numbers of rotations detected by the rotation detecting part 25 and memorized in the memorizing part 26, and a motor controlling part 28 for controlling the driving motor 7 upon reception of signals compared in the comparing and correcting part 27.

[0055] The Hall elements 16 each are designed to transmit a rotation of the driving motor 7 to the rotation detecting part 25 as a pulse signal. An arrangement of the two Hall elements allows detection of a biphasic pulse signal having different phases. In other words, the arrangement of the two Hall elements 16 enables detection of a rotating direction (positive and negative rotations) of the rotating magnet 12. Consequently, the number of rotations and a rotational direction of the driving motor 7 are detected by the rotating magnet 12, the stationary magnet 13, the two Hall elements 16, and the rotation detecting part 25.

[0056] The memorizing part 26 is configured to memorize the number of rotations and the rotational direction detected by the rotation detecting part 25 in an upper stopping position setting mode operation and in a lower

stopping position setting mode operation. Specifically, the memorizing part 26 calculates the number of rotations detected by the rotation detecting part 25 and memorizes the calculated number and a rotational direction.

Further, the role of the memorizing part 26 is changed by operation of the operation mode selector switch 17. The number of rotations and a rotational direction of the driving motor 7 are memorized in the stopping position setting mode, while a signal of the memorized number of rotations and the memorized rotational direction are outputted in a normal mode.

[0057] Specifically, the number of rotations and the rotational direction of the motor 7 are memorized in the memorizing part 26 in the stopping position setting mode, and the driving motor 7 rotates by the number of rotations memorized in the memorizing part 26 in a direction depending on a polarity of electric power supplied from the power source in the normal mode.

Herein, in order to memorize the number of rotations of the motor 7 to be set with respect to each rotational direction, it is possible to change a setting of a winding upper limit (anticlockwise, positive rotation) and an unwinding lower limit (clockwise, negative rotation) of the wound material 3.

[0058] Further, the memorizing part 26 is equipped with an electricity storing part 30, which incorporates an electrolytic capacitor 24 (Fig. 6) or a battery. The electricity storing part 30 normally stores electricity during power supply from the external power source and instantaneously discharges when the power supply is stopped. Shortly, when the power is turned off by the switch 33 switched to the energization stopping position 33c, the part 30 discharges.

Herein, the control board 8 includes a power recognition part 29 for recognizing existence or nonexistence of power supply. The power recognition part 29 is connected to the electricity storing part 30 and outputs a recognition signal indicating whether or not power is supplied, thereby enabling a quick discharge by the electricity storing part 30.

[0059] The comparing and correcting part 27 is connected to the rotation detecting part 25 and the memorizing part 26 and configured to compare the number of rotations and a direction of rotation in the normal mode operation and those memorized in the stopping position setting mode.

Specifically, a signal received by the Hall elements 16 in the normal mode operation is detected by the rotation detecting part 25 and compared with the number of rotations and a rotational direction up to the stopping position that are memorized in the comparing and correcting part 27. Upon reaching the number of rotations memorized in the part 27, the part 27 generates a signal for deactivating the driving motor 7.

Herein, in the normal mode operation, under the forces of inertia and gravity of the wound material 3 acting onto the driving motor 7, the number of rotations of the motor 7 detected by the rotation detecting part 25 may be rec-

ognized to be higher than or less than the memorized number of rotations, but the comparing and correcting part 27 quickly generates a signal to correct it to the number of rotations and the rotational direction that are memorized in the part 27.

[0060] The signal having been generated in the part 27 is outputted to the motor controlling part 28, thereby slightly rotating the driving motor 7. That prevents a shift of the stopping position of the wound material 3 provided in the winding drive 2 in this embodiment.

Shortly, the motor controlling part 28 gives a rotation order to the driving motor 7 upon reception of a signal having been treated in the rotation detecting part 25, the memorizing part 25, and the comparing and correcting part 27.

[0061] Next, an assembly configuration and an internal and external electrical wiring of the winding device 1 in this embodiment will be described below.

[0062] The winding device 1 is, as shown in Fig. 1, constituted by housing a combination in the box 4, the combination mainly consisting of the winding drive 2 housed in the winding drum 21 around which the wound material 3 is wound, with the fixing shaft 6 projecting from the lids 10 at the both ends of the winding drum 21 fixed to the brackets 14 attached to a building.

The two-core electric cable 23 is pulled out through the opening 19a and 19b formed in the extending part 32 of the lid 10b. That means a pair of electrical wires, which forms the electric cable 23, extends from the main body 40 of the winding device 1.

Further, the operation mode selector switch 17 is disposed at the extending part 32 of the lid 10b. Specifically, the electric cable 23 is inserted in the opening 19a, while the operation mode selector switch 17 partly projects out of the opening 19b.

[0063] Inside the tubular body 5, as shown in Fig. 2, the output member 4, the reducer 9, the driving motor 7, the stationary magnet 13 and the rotating magnet 12, and the control board 8 are arranged in order from the lid 10a side. To describe sequentially and specifically, the output member 4 is positioned at a certain distance from the lid 10a.

The output member 4 is connected to the reducer 9 with the outer cylinder attached part 36 attached to a predetermined position of the winding drum 21 and the inner cylinder arranged part 35 arranged within the tubular body 5 without contacting with the tubular body 5. Therefore, the output member 4 makes the winding drum 21 to rotate integrally therewith and rotates relative to the tubular body 5.

[0064] The reducer 9, which includes the rotating shaft 11 in line with the central axis of the tubular body 5, is connected to the output member 4 at one end of the rotating shaft 11 and is provided with the bipolar rotating magnet 12 at the other end across the driving motor 7. The rotating magnet 12 is surrounded by the bipolar stationary magnet 13.

[0065] Further, the control board 8 stretches from the

vicinity of the rotating magnet 12 in a direction to the lid 10b, being arranged in parallel to the central axis of the tubular body 5. The control board 8 has the two Hall elements 16 adjacent to the rotating magnet 12. The Hall elements 16 receive a pulse signal of rotation of the driving motor 7 from the rotating magnet 12. The control board 8 further has the operation mode selector switch 17 at a side opposed to the Hall elements 16. The switch 17 has an operating part at the opening 19b of the lid 10b.

[0066] Next, the electrical wiring of inside and outside of the winding device 1 will be described below, making reference to Fig. 6.

The winding device 1 uses only the two-core electric cable 23 communicating in and out thereof. Within the winding drive 2, the electric cable 23 is connected to the power recognition part 29 of the control board 8. The electric cable 23 is further connected to the brushes 48 of the driving motor 7 via switching relays 52 and 53.

The switching relays 52 and 53 are configured to switch between a circuit for connecting the brushes 48 and the two-core electric cable 23 and a circuit for shunting the two brushes 48.

Specifically, the relays 52 and 53 each have three contacting points A, B, and C, thereby switching between a state connecting the contacting points A and B and another state connecting the contacting points A and C.

[0067] In this embodiment, the contacting points A of the relays 52 and 53 are connected to the brushes 48 of the driving motor 7 respectively.

The contacting point B of the relay 52 is connected to one conductor or core 23a of the electric cable 23, while the contacting point B of the relay 53 is connected to the other conductor or core 23b of the electric cable 23. The contacting points C of the relays 52 and 53 are electrically connected to each other.

[0068] In this embodiment, the relays 52 and 53 complete the circuit connecting the brushes 48 and the cable 23 when the power recognition part 29 of the control board 8 detects supply of normal voltage.

On the other hand, the relays 52 and 53 are switched to break the circuit connecting the brushes 48 and the cable 23 and shunt the coil 51 of the driving motor 7 when the recognition part 29 stops detecting supply of normal voltage.

[0069] Outside of the winding device 1, the electric cable 23 is connected to a DC power source 60 via the remote control switch 33.

The switch 33 is a switch in which two switches 62 and 63 operate with each other and which disconnects both electrical wires simultaneously.

The two switches 62 and 63 each have contacting points A, B, C, and D, connecting the contacting point A to the other one selected from the contacting points B, C, and D.

[0070] The contacting point A of the switch 62 is connected to an anode of the DC power source 60, while the contacting point B of the switch 63 is connected to a cathode of the DC power source 60.

The contacting point B of the switch 62 and the contacting

point D of the switch 63 are connected to the core 23a of the electric cable 23. The contacting point D of the switch 62 and the contacting point B of the switch 63 are connected to the core 23b of the electric cable 23.

[0071] As described above, the switches 62 and 63 operate with each other, so that switching of the switch 33 reverses a polarity of the DC power source 60 and a connecting relationship between the cores 23a and 23b, and whereby a polarity of electricity supplied to the driving motor 7 is changed.

Further, the switch 33 is put in a neutral position so as to shut off an electric current applied to the driving device 1.

The switch 33, as described above, has the winding upper position 33a, the unwinding lower position 33b, and the energization stopping position 33c, so that an alignment of the switch 33 to the respective positions makes the switches 62 and 63 to be switched associated with each other within the switch 33.

[0072] The winding device 1 in this embodiment feeds back a stopping position of the wound material 3, which has been set in the stopping position setting mode, in the normal mode operation, thereby enabling a control to stop the material 3 at the predetermined stopping position.

[0073] Next, operations of the stopping position setting mode and the normal mode in the winding device 1 in this embodiment will be described below, making reference to a flow chart shown in Fig. 8.

[0074] The winding device 1 in this embodiment needs a manual operation in each mode. In the stopping position setting mode, each switch of the remote control switch 33 is operated so as to adjust the wound material 3 to a desired position, where the remote control switch 33 is shifted to the energization stopping position 33c to stop supplying power so as to set the stopping position.

In the normal mode, the switch 33 is operated so as to deactivate the driving motor 7 at the stopping position having been memorized in the stopping position setting mode. Hereafter, this control will be described in detail below.

Stopping position setting

[0075] In order to set a stopping position in the winding device 1 in this embodiment, the remote control switch 33 has been previously shifted to the energization stopping position 33c so as to stop electricity supply to the control board 8 and the driving motor 7, and then the operation mode selector switch 17 is to be switched.

That is because the driving motor 7 rotates regardless of the selected operation mode when the control board 8 and the driving motor 7 are energized in the circuit of the winding device 1, being unable to set an exact stopping position.

[0076] The winding device 1 in this embodiment confirms a status of the operation mode selector switch 17 in steps 1, 2, and 3.

Specifically, in the steps 1, 2, and 3, it is determined whether the operation mode selector switch 17 is in the upper stopping position setting mode, the lower stopping position setting mode, or the normal mode. When the selector switch 17 is in the upper stopping position setting mode, the process proceeds to a Step 4 for waiting energization to the control board 8.

When an operator operates the switch 33 so as to shift the switch 33 to the winding position 33a or the unwinding position 33b, the control board 8 within the winding drive 2 is energized.

[0077] Upon detection of normal voltage supply by the power recognition part 29 of the control board 8, the switching relays 52 and 53 complete the circuit connecting the brushes 48 and the electric cable 23.

Then, as shown in Fig. 6, the circuit supplying power from the DC power source 60 to the driving motor 7 is completed, thereby activating the driving motor 7.

The driving motor 7 rotates in a direction determined by a switched position of the remote control switch 33. In this embodiment, the switch 33 changes a polarity of the DC power source 60 and a connecting relationship between the cores 23a and 23b of the electric cable 23, thereby changing a direction of a direct current supplied to the winding drive 2.

As described above, in this embodiment, when the power recognition part 29 detects normal voltage supply, the relays 52 and 53 are switched to complete the circuit connecting the brushes 48 and the electric cable 23, and whereby the rotational direction of the driving motor 7 is determined by a current direction determined by the remote control switch 33. Specifically, the driving motor 7 rotates in a positive direction when the switch 33 is shifted to the winding position 33a and in a negative direction when the switch 33 is shifted to the unwinding position 33b (Step 5).

[0078] The driving motor 7 continues to rotate as long as the position of the switch 33 is maintained.

Thereby, the wound material 3 such as a curtain wound around the winding drum 21 is unwound down or wound up, so that an end of the curtain moves up and down. At this time, the rotation detecting part 25 of the control board 8 detects the number of rotations of the driving motor 7. The number of rotations is detected as A-time rotations in a positive direction and B-time rotations in a negative direction together with a rotational direction.

[0079] When the end of the curtain comes to an appropriate height, an operator operates the switch 33 so as to shift the switch 33 to the energization stopping position 33c. Then, electricity supply to the winding drive 2 is stopped and naturally the driving motor 7 stops. Further, in this embodiment, when the power recognition part 29 of the control board 8 detects no normal voltage supply with electricity supply to the winding drive 2 stopped, the switching relays 52 and 53 are switched and shunt the coil 51 of the driving motor 7.

A rotation of the coil 51 or the magnet 50 generates an electromotive force to the coil 51, thereby exerting a brak-

ing force to the rotation of the coil 51 according to Fleming's right-hand and left-hand rules. Therefore, the driving motor 7 functions as an electromagnetic brake, which prevents an excessive movement of the curtain.

[0080] Though the rotation of the coil 51 or the magnet 50 generates an electromotive force to the coil 51, the electromotive force is prevented from coming to the power recognition part 29 of the control board 8 because the circuit connecting the brushes 48 and the electric cable 23 is broken. Therefore, the part 29 has no risk of malfunction.

[0081] When the switch 33 is manually operated so as to stop supplying electricity to the winding drive 2 (Step 6), the power recognition part 29 recognizes that power supply is shut off, and whereby the number of rotations of the driving motor 7 is memorized in the memorizing part 26 (Steps 7 and 8).

At this time, though an electric current to be supplied to the winding drive 2 has been already shut off, this embodiment includes the electricity storing part 30, so that the memorizing part 26 performs memorization powered by discharge from the part 30. The electricity storing part 30 discharges (Step 7) and the memorizing part 26 memorizes the number of rotations of the driving motor 7 (Step 8). The setting is finished once with the stopping position of the wound material 3 memorized (Step 9).

[0082] If the end of the wound material 3 could not be stopped at the desired position due to any cause such as an error in operation of the remote control switch 33, a new setting could be substantially possible in such a manner that energization to the control board 8 in the winding drive 2 is restarted and the processes following the Step 4 are repeated by shifting the switch 33 to the winding position 33a or the unwinding position 33b by an operation of the switch 33 again.

[0083] The above description is about the setting of the upper stopping position, in which the operation mode selector switch 17 is in the upper stopping position setting mode, but the same processes can be done for a setting of the lower stopping position.

In order to set the lower stopping position, the selector switch 17 is shifted to the lower stopping position setting mode.

When the selector switch 17 is in the lower stopping position setting mode, the process waits energization to the control board 8 in a Step 9.

[0084] Upon detection of normal voltage supply by the power recognition part 29 of the control board 8, the switching relays 52 and 53 complete the circuit connecting the brushes 48 and the electric cable 23, so as to rotate the driving motor 7 (Step 10).

[0085] An operator shifts the switch 33 to the energization stopping position 33c at the time when the end of the curtain is brought down to an appropriate height. Then, electricity supply to the winding drive 2 is stopped and naturally the driving motor 7 stops, while the number of rotations of the driving motor 7 is memorized with powered by discharge of the electricity storing part 30 (Steps

12 and 13).

[0086] After completion of the winding upper limit setting and the unwinding lower limit setting as described above, the selector switch 17 is manually shifted to the normal mode operation so as to render the memorizing part 26 non-rewritable, and whereby the settings of the upper and the lower limits are fixed.

In a daily winding or unwinding operation, the number of rotations having been memorized in the memorizing part 26 is fed back. Specifically, in the normal mode operation, the wound material 3 stops at the stopping position having been set as the winding upper limit when the switch 33 is shifted to the winding position 33a, whereas the wound material 3 stops at the stopping position having been set as the unwinding lower limit when the switch 33 is shifted to the unwinding position 33b. Hereafter, a control of the driving motor 7 in the normal mode will be described in detail below.

[0087] According to a flow chart in Fig. 9, whether the selector switch 17 is shifted to the normal mode is confirmed. In the normal mode, in the steps 2 and 3, the process awaits energization to the winding drive 2 and determines to rotate the driving motor 7 in the winding direction or in the unwinding direction according to a current direction. Specifically, the power recognition part 29 detects which of the cores 23a and 23b of the electric cable 23 is plus and which thereof is minus.

In either case, only if an operator operates the switch 33 so as to shift the switch 33 to the winding position 33a or to the unwinding position 33b, the control board 8 in the winding drive 2 is energized, thereby rotating the driving motor 7 in a predetermined direction according to the current direction.

[0088] In the normal mode, as well as in the previously described stopping position setting mode, upon detection of normal voltage supply by the power recognition part 29 of the control board 8, the switching relays 52 and 53 complete the circuit connecting the brushes 48 and the electric cable 23.

Then, as shown in Fig. 6, the circuit supplying power from the DC power source 60 to the driving motor 7 is completed, thereby activating the driving motor 7.

The driving motor 7 rotates in a direction determined by a current direction determined by a switched position of the remote control switch 33. Specifically, the driving motor 7 rotates in a positive direction when the switch 33 is shifted to the winding position 33a and in a negative direction when the switch is shifted to the unwinding position 33b (Steps 3 and 8).

[0089] Herein, while the wound material 3 is being wound up, for example, the number of winding rotations is detected by the rotation detecting part 25 and compared with the number of rotations having been memorized in the winding upper limit setting by the comparing and correcting part 27 (Step 4). At the moment the both numbers of rotations correspond with each other, the driving motor 7 is deactivated (Step 5).

Specifically, the switching relays 52 and 53 are switched

so as to break the circuit connecting the brushes 48 and the electric cable 23 and shut off an electric current to be supplied to the driving motor 7. Further, the coil 51 of the driving motor 7 is shunted.

As a consequence, a braking force is exerted on the rotation of the coil 51, thereby avoiding an excessive movement of the curtain.

[0090] Also while the wound material 3 is being unwound down, for example, the number of unwinding rotations is detected by the rotation detecting part 25 and compared with the number of rotations having been memorized in the unwinding lower limit setting by the comparing and correcting part 27 (Step 9). At the moment the both numbers of rotations correspond with each other, the driving motor 7 is deactivated (Step 10).

[0091] Herein, in the normal mode operation, the number of rotations having been memorized in the memorizing part 26 is fed back, as described above, for the control to deactivate the driving motor 7 at the memorized number of rotations. However, under the influence such as the forces of inertia and gravity of the wound material 3, the driving motor 7 might rotate by more than or less than the memorized number of rotations. Yet, the winding device 1 equipped with the winding drive 2 in this embodiment corrects the number of rotations even in such a case, thereby preventing a shift of the stopping position.

[0092] More specifically, in the Step 4 or 9, upon recognition of a case in which the detected number of rotations is different from the memorized number of winding or unwinding rotations, whether the detected number of the winding or unwinding rotations is higher than the memorized number or not is firstly confirmed (Steps 11 and 14). After having passed the Step 3 and when it is determined in the Step 11 that the detected number is higher than the memorized number, which means the material 3 is excessively wound up for the stopping position, a slight unwinding control is executed (Step 12). In contrast, when it is determined in the Step 11 that the detected number is less than the memorized number, a further winding control is executed (Step 13). Then, the winding device 1 stops after having passed the steps 4 and 5 described above.

[0093] Meanwhile, after having passed the Step 8 and when it is determined in the Step 14 that the detected number is higher than the memorized number, which means the material 3 is excessively unwound down for the stopping position, a slight winding control is executed (Step 15). In contrast, when it is determined in the Step 14 that the detected number is less than the memorized number, a further unwinding control is executed (Step 16). Then, the winding device 1 stops after having passed the steps 4 and 5.

[0094] The normal mode operation, as the above-mentioned control, has a configuration in which the control to correct the number of rotations is executed with the detected number of winding or unwinding rotations usually compared with the number having been memorized in the memorizing part 26, but the present invention is not

limited thereto.

For example, in the normal mode operation, the winding drive 2 may output a command to rotate the motor 7 by the memorized number at the moment when the winding switch 33a or the unwinding switch 33b of the remote control switch 33 is manually pressed, so as to deactivate the motor 7.

Upon stopping of the motor 7, the comparing and correcting part 27 compares the detected number of rotations of the deactivated driving motor 7 with the number of rotations of the driving motor 7 having been memorized in the stopping position setting mode. Thereafter, if there are some errors in comparison, the device 1 may output a signal for correction and execute the correction.

[0095] As described above, in the normal mode operation, though the number of rotations having been memorized in the memorizing part 26 is fed back, the driving motor 7 might rotate by more than or less than the memorized number under the influence such as the force of inertia and gravity of the wound material 3. Yet, in the present invention, the control board 8 has the comparing and correcting part 27, so that the number of rotations of the driving motor 7 is corrected.

Being connected to the rotation detecting part 25 and the memorizing part 26, the comparing and correcting part 27 receives the number of rotations of the motor 7 detected by the rotation detecting part 25 as a pulse signal and compares the detected number with the number of rotations having been memorized in the memorizing part 26. That corrects the number to the memorized number and deactivates the motor 7 even if the detected number of rotations of the driving motor 7 differs from the memorized number under the above-mentioned influence.

[0096] The winding drive 2 incorporated in the winding device 1 in this invention dispenses with complicated components and configuration and controls a stopping position of the output member with simple components and configuration because the control board 8 housed in the tubular body 5 sets the stopping position of the wound material 3.

Shortly, the winding device 1 in this embodiment easily sets the winding upper limit and the unwinding lower limit without a complicated operation by switching the operation mode selector switch 17 to the stopping position setting mode and switching the switch 33 to the energization stopping position 33c for turning off the power at the position to stop the wound material 3.

That avoids risk involved in the operation of the winding device 1 attached at a high place because only the selector switch 17 is to be switched at the high place. Further, even if the driving motor 7 stops by the number of rotations higher than or less than the set number of rotations of the driving motor 7, the comparing and correcting part 27 corrects the number to the set number as the set number is fed back in the normal mode operation, thereby preventing a shift of the stopping position of the wound material 3.

[0097] The remote control switch 33 is used to set the

winding position 33a and the unwinding position 33b in the above-mentioned embodiment, but a switch other than the remote control switch 33 may be provided for setting.

Fig. 10 is a perspective view of a winding device 70 provided with another switch 71 for setting. Fig. 11 shows a circuit thereof.

Herein, the same numerals are assigned to the same components with those in the foregoing embodiment, for eliminating a duplicated explanation.

The winding device 70 shown in Fig. 10 is constituted by the winding drive 2 housed in the winding drum 21, as well as in the foregoing embodiment. In the winding drive 2 employed in this embodiment, there is provided the switch 71 for setting attached to the lid 10b. In other words, the switch 71 for setting is disposed at the main body 40 of the winding drive 2.

The switch 71 is a push-button switch maintaining ON/OFF state of a contacting point mechanically and switching ON and OFF by each push.

[0098] The switch 71 is, as shown in Fig. 11, positioned in an introductory part of electric power of the winding drive 2 so as to stop power supply to the power recognition part 29 of the control board 8 and the driving motor 7 when the switch 71 is turned off.

[0099] The present embodiment also employs the remote control switch 33 attached to a wall of a building, the switch 33 mechanically maintaining ON/OFF state of a contacting point. Specifically, as shown in Fig. 10, there are provided three buttons 60a, 60b, and 60c, which are pushed so as to shift the switch 33 to the winding position, the unwinding position, and the energization stopping position, respectively. Once being pushed, the pushed button 60a, 60b, or 60c is mechanically self-holding, whereby this state is not changed until another button is pushed. Shortly, for example, once the button 60a for winding up is pushed, a contacting point maintains energization in a winding direction, and when the button 60c for energization stopping is pushed, this state is terminated.

[0100] Now, a procedure for setting a stopping position in the winding device 70 will be described in detail below, making reference to the foregoing flow chart shown in Fig. 8.

In the winding device 70, the switch 71 is turned on for setting a stopping position.

As well as in the foregoing setting, the operation mode selector switch 17 is to be switched with energization to the control board 8 and the driving motor 7 stopped by shifting the remote control switch 33 to the energization stopping position 60c,

[0101] A status of the selector switch 17 is confirmed in the steps 1, 2, and 3. When the selector switch 17 is in the upper stopping position setting mode, for example, the process proceeds to the Step 4 for waiting energization to the control board 8.

When an operator operates the switch 33 so as to shift the switch 33 to the winding position 60a or to the unwinding position 60b, the control board 8 in the winding

drive 2 is energized, and as well as in the foregoing embodiment, the switching relays 52 and 53 complete the circuit connecting the brushes 48 and the electric cable 23, so that the circuit supplying power to the driving motor 7 from the DC power source 60 is completed, and whereby the driving motor 7 rotates.

Then, the wound material 3 such as a curtain wound around the winding drum 21 is unwound or wound, so that the end of the curtain moves up and down. At this time, the rotation detecting part 25 of the control board 8 detects the number of rotations of the driving motor 7. The number of rotations is detected as A-time rotations in a positive direction and B-time rotations in a negative direction together with a rotational direction.

[0102] An operator pushes the switch 71 disposed in the winding device 70 only once without operating the switch 33 when the end of the material 3 comes roughly to a target height.

As described above, since the switch 71 switches ON and OFF by each push, only one-time push of the switch 71 breaks the contracting point, thereby stopping power supply to the power recognition part 29 of the control board 8 and the driving motor 7.

Then, the driving motor 7 stops and the number of rotations of the motor 7 is memorized in the memorizing part 26 (Steps 7 and 8). At this time, though an electric current to be supplied to the winding drive 2 has been already shut off, this embodiment includes the electricity storing part 30, so that the memorizing part 26 performs memorization powered by discharge from the part 30. The electricity storing part 30 discharges (Step 7) and the memorizing part 26 memorizes the number of rotations of the driving motor 7 (Step 8). The setting is finished once with the stopping position of the wound material 3 memorized (Step 9).

[0103] Following is how to fine-tune a height of the end of the wound material 3 by pushing twice the switch 71. The switch 71 is pushed once at a state in the Step 5 or 10 in the flow chart in Fig. 8. With self-holding at the winding position or the unwinding position, the remote control switch 33 is ready to be energized while waiting. Then, at this state, another push of the switch 71 connects the contacting point of the switch 71, thereby restarting power supply to the power recognition part 29 of the control board 8 and the driving motor 7. Herein, this second push executes a so-called inching motion that power supply is turned ON/OFF at regular intervals while pushing.

Upon release of the second push, the power supply to the part 29 and the motor 7 is shut off, then the electricity storing part 30 discharges (Step 7), and the memorizing part 26 memorizes the number of rotations of the motor 7 (Step 8).

Shortly, pushes of the switch 71 twice repeat the operations following the Step 4 shown in the flow chart in Fig. 8, whereby a new setting is substantially done. That means the electricity storing part 30 discharges (Step 7) and the memorizing part 26 memorizes the corrected

number of rotation of the driving motor 7 (Step 8). Thereafter, these operations are repeated and the setting is finished when the end of the wound material 3 reaches the desired height.

[0104] In the embodiment shown in Fig. 11, the switch 71 is positioned in the introductory part of power of the winding drive 2 so as to stop power supply to the power recognition part 29 of the control board 8 and the driving motor 7 when the switch 71 is turned off, but it is possible to employ another configuration, as shown in Fig. 12, in which a switch 72 for setting is changed to another position and turns on and off only the driving motor 7.

[0105] The winding drive 2 shown in Fig. 12 takes the same procedure as the foregoing embodiment by fine-tuning the set position by pushing the switch 72. However, the corrected number of rotations is memorized in the memorizing part 26 every time the switch 72 is turned off in the foregoing embodiment, whereas the number of rotations is memorized in the memorizing part 26 by shifting the switch 33 to the energization stopping position at last in the present embodiment.

[0106] This embodiment has a configuration in which the switch 72 turns on and off only the driving motor 7. Thus, with the switch 33 energized, the power recognition part 29 normally detects power, so that the memorizing operation is not executed even if the switch 72 is turned off.

In contrast, when the switch 72 is turned on, the driving motor 7 receives power supply via the switch 33, so as to rotate in a direction corresponding to a shifted position of the switch 33.

[0107] Therefore, with the circuit configuration in this embodiment, the driving motor 7 is activated little by little every time the switch is turned on. When the end of the wound material 3 reaches the desired stopping position, the switch 33 is shifted to the energization stopping position, so as to stop the power supply to the power recognition part 29 and memorize the number of rotations of the motor 7 in the memorizing part 26.

[0108] Further, another switch having a switching function similar to the remote control switch 33 can be disposed at a part supplying power only to the driving motor 7 instead of or in addition to the switch 72, thereby rotating the driving motor 7 in either positive and negative directions in setting.

This configuration allows the driving motor 7 to rotate positively and negatively in the stopping position setting mode operation. The memorizing part 26 memorizes the number of rotations calculated as a difference between the numbers of positive rotations and negative rotations.

[0109] The above-mentioned embodiments each are provided with the two relays 52 and 53 in the circuit supplying power to the driving motor 7, but as a circuit shown in Fig. 13, it is possible to employ one relay 73 for switching between the circuit connecting the brushes 48 and the electric cable 23 and the circuit shunting between the two brushes 48.

[0110] In each of the above-mentioned embodiments,

the number of rotations of the driving motor 7 is memorized in the memorizing part 26 taking an opportunity of shut off of power supply, but the memorization may be done simultaneously with deactivation of the motor 7 after activation of the motor 7 by operating the switching relays 52 and 53 by the control board 8 based on a signal outputted to the board 8 with a switch.

[0111] Specifically, in circuits shown in Figs. 14 and 15, a motor operating switch 45 is connected to the control board 8. The motor operating switch 45 is ON only while an operation such as push is being done, so that the switch 45 is OFF when an operator releases the switch. The switch 45 can be attached to the lid 10b that is at the same position as that in the above-mentioned winding device 70 shown in Fig. 10.

The control board 8 switches the relays 52 and 53 for a certain short period of time like a pulse when the switch 45 is turned on, so as to complete the circuit connecting the brushes 48 and the electric cable 23, as shown in Fig. 14, for a certain short period of time like a pulse. Thus, push of the switch 45 once rotates the driving motor 7 at a certain rotating angle, thereby slightly unwinding or winding the wound material 3 such as a curtain wound around the winding drum 21.

In a case of keeping pushing the switch 45, the circuit connecting the brushes 48 and the electric cable 23 is kept completed, and the motor 7 keeps rotation all that time, thereby continuously unwinding or winding the material 3.

When the switch 45 is released, the relays 52 and 53 are switched, thereby breaking the circuit connecting the brushes 48 and the electric cable 23. That shunts the coil 51, and then the motor 7 is deactivated (Fig. 15).

[0112] The number of rotations of the driving motor 7 is memorized in the memorizing part 26 taking an opportunity of shunting of the coil 51 by breaking the circuit connecting the brushes 48 and the electric cable 23, which occurs by switching of the relays 52 and 53 as shown in Fig. 15 after having turned on the switch 45 once.

[0113] In this embodiment, power required for memorizing the number of rotations of the motor 7 in the memorizing part 26 is supplied from the external DC power source 43 because a current supplied to the winding drive 2 is maintained.

[0114] The above-mentioned embodiments each have the configuration in which the output member 4 transmits a rotation to the winding drum 21, but the present invention is not limited thereto and may have a configuration in which the tubular body 5 housing the driving motor 7, the control board 8, and the reducer 9 rotates itself as a driven member powered by the driving motor 7.

[0115] The above-mentioned embodiments each have the configuration in which the Hall elements 16 are positioned adjacent to the rotating magnet 12 so as to directly detect a rotation of the driving motor 7, but the present invention is not limited thereto and may have a configuration, for example, in which the Hall elements 16

are arranged at a position where rotations of the planet gear 15 and/or the tubular body 5 are detected so as to indirectly detect a rotation of the driving motor 7.

[0116] The above-mentioned embodiments each have the configuration in which the operation mode selector switch 17 is positioned at the opening 19 formed in the lid 10, but the present invention is not limited thereto and may have a configuration, for example, in which a mode is readily switched with a remote control. Specifically, but not shown, there may be provided a signal receiving part for receiving a signal and disposed outside of the tubular body 5 and a signal transmitter, so that a signal is outputted from the signal transmitter, thereby switching a mode without contact.

[0117] The above-mentioned embodiments each have the configuration in which there are the two Hall elements 16, but the present invention is not limited thereto and may have more than two Hall elements.

[0118] The above-mentioned embodiments each employ the bipolar rotating magnet 12, but the present invention is not limited thereto and may employ a tetrapolar rotating magnet.

[0119] The above-mentioned embodiments each employ the DC motor having the brushes 48 for the driving motor 7, but the present invention is not limited thereto and may also employ a brushless motor.

List of Reference Signs

[0120]

1	winding device
2	winding drive
3	wound material
4	output member
5	tubular body
6	fixing shaft
6a	fixing shaft
6b	fixing shaft
7	driving motor
8	control board
9	reducer
10a	lid
10b	lid
11	shaft
12	rotating magnet
13	stationary magnet
14	fixing brackets
15	planet gears
16	Hall elements
17	operation mode selector switch
18	bearing
19a	opening
19b	opening
20	bearing
21	winding drum
22	box
23	electric cable

23a	core
23b	core
24	capacitor
25	rotation detecting part
5 26	memorizing part (memory)
27	comparing and correcting part
28	motor controlling part
29	power recognition part
30	electricity storing part
10 31	mounting part
32	extending part
33	remote control switch (polarity selector switch)
33a	winding position
33b	unwinding position
15 33c	energization stopping position
35	inner cylinder arranged part
36	outer cylinder attached part
40	main body
43	DC power source
20 45	switch
48	brushes
50	permanent magnets
51	coil
52	switching relay
25 53	switching relay
60	DC power source
60a	button (for winding position)
60b	button (for unwinding position)
60c	button (for energization stopping position)
30 62	switch
63	switch
70	winding device
71	switch
72	switch
35 73	relay

Claims

40 1. A winding drive comprising:

- a main body (40); and
- a pair of electrical wires (23) for electrically connecting the main body (40) to an external DC power source (43),
- wherein the main body (40) has a tubular body (5), a driving motor (7), a driven member, and a controller (8), the driving motor (7) and the controller (8) being housed in the tubular body (5), the driving motor (7) being designed to rotate upon supply of a direct current from the electrical wires (23) and transmitting a rotational force of the motor (7) to the driven member, thereby rotating the driven member,
- wherein the pair of electrical wires (23) are provided with a polarity selector switch (33) outside the main body (40), the polarity selector switch (33) being operated so as to change a polarity

of the direct current flowing through the electrical wires (23), thereby changing a rotational direction of the driving motor (7),

- wherein the controller (8) has a rotation number detector (16) for directly or indirectly detecting information of the number of rotations of the driving motor (7) and a memory (26) for memorizing the information detected by the rotation number detector (16) and selectively executes one selected from a stopping position setting mode operation and a normal mode operation, and

- wherein the main body (40) is provided with an operation mode selector switch (17), which switches between the stopping position setting mode operation and the normal mode operation,

so that the memory (26) memorizes the information detected by the rotation number detector (16) in the stopping position setting mode operation, and that the driving motor (7) is stopped based on the information having been memorized in the memory (26) after rotation of the driving motor (7) in the normal mode operation.

2. The winding drive as defined in claim 1, wherein the tubular body (5) serves as the driven member.
3. The winding drive as defined in claim 1 or 2, wherein the driven member is an output member (4) extending from an end of the tubular body (5), the output member (4) having an outer diameter larger at least in part than that of the tubular body (5).
4. The winding drive as defined in anyone of the preceding claims, the main body (40) having a switch (33) for activating and deactivating the driving motor (7) by manual manipulation or based on signals generated by manual manipulation, the switch (33) being adapted to be operated so as to deactivate the driving motor (7) after having activated the motor (7), for making the memory (26) to memorize the information detected by the rotation number detector (16) in the stopping position setting mode operation.
5. The winding drive as defined in anyone of the preceding claims, wherein the winding drive (2) is adapted to manually stop power supply after manually energizing to the driving motor (7) so as to activate the driving motor (7) in the stopping position setting mode operation, for making the memory (26) to memorize the information detected by the rotation number detector (16).
6. The winding drive as defined in anyone of the preceding claims,

wherein the tubular body (5) houses one selected from a battery and a capacitor (24), and wherein the memory (26) memorizes the information detected by the rotation number detector (16) using the one selected from the battery and the capacitor (24) as a power source in the stopping position setting mode operation.

7. The winding drive as defined in anyone of the preceding claims, wherein the driving motor (7) is adapted to execute a positive rotation and a negative rotation, respectively, wherein the rotation number detector (16) is adapted to detect the numbers of rotations of the positive and negative rotations of the driving motor (7) in the stopping position setting mode operation, each of the numbers being memorized in the memory (26), so that, in the normal mode operation, the positive rotation of the driving motor (7) makes the driving motor (7) to stop at the number of positive rotations having been memorized in the memory (26) and that the negative rotation of the driving motor (7) makes the driving motor (7) to stop at the number of negative rotations having been memorized in the memory (26).
8. The winding drive as defined in anyone of the preceding claims, wherein the driving motor (7) is adapted to execute a positive rotation or a negative rotation in the stopping position setting mode operation, wherein the memory (26) is adapted to memorize the number of rotations calculated as a difference between the numbers of positive rotations and negative rotations.
9. The winding drive as defined in anyone of the preceding claims, further comprising a corrector (27) for correcting the stopping position of the driving motor (7), so that, in the normal mode operation, when the driving motor (7) stops at the number of rotations higher than or less than the number of rotations having been memorized in the stopping position setting mode operation, the corrector (27) is adapted to correct the number to the memorized number.
10. The winding drive as defined in anyone of the preceding claims, the rotation number detector (16) having at least two Hall elements so as to detect a rotational direction.
11. The winding drive as defined in anyone of the preceding claims, further comprising a mode selector designed to switch between the normal mode operation and the stopping position setting mode operation.

12. The winding drive as defined in anyone of the preceding claims,
the driving motor (7) having a permanent magnet (50) and a coil (51), the coil (51) being shunted by manual stopping of a power supply. 5
13. The winding drive as defined in claim 12,
further comprising a power recognition means (29) for detecting the manual stopping of a power supply, so that, when the coil (51) is shunted by the manual stopping of a power supply, energization between the power recognition means (29) and the coil (51) is shut off. 10
14. A winding device, comprising: 15

the winding drive (2) as defined in anyone of the preceding claims and a wound material (3) to be wound around the tubular body (5). 20
15. A winding device, comprising:

the winding drive (2) as defined in anyone of the preceding claims and a winding drum (21) for winding a wound material (3), 25
wherein the winding drive (2) is housed in the winding drum (21), so that a rotational force of the driving motor (7) is transmitted to the winding drum (21) via the output member (4). 30
- 35
- 40
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- 50
- 55

FIG. 1

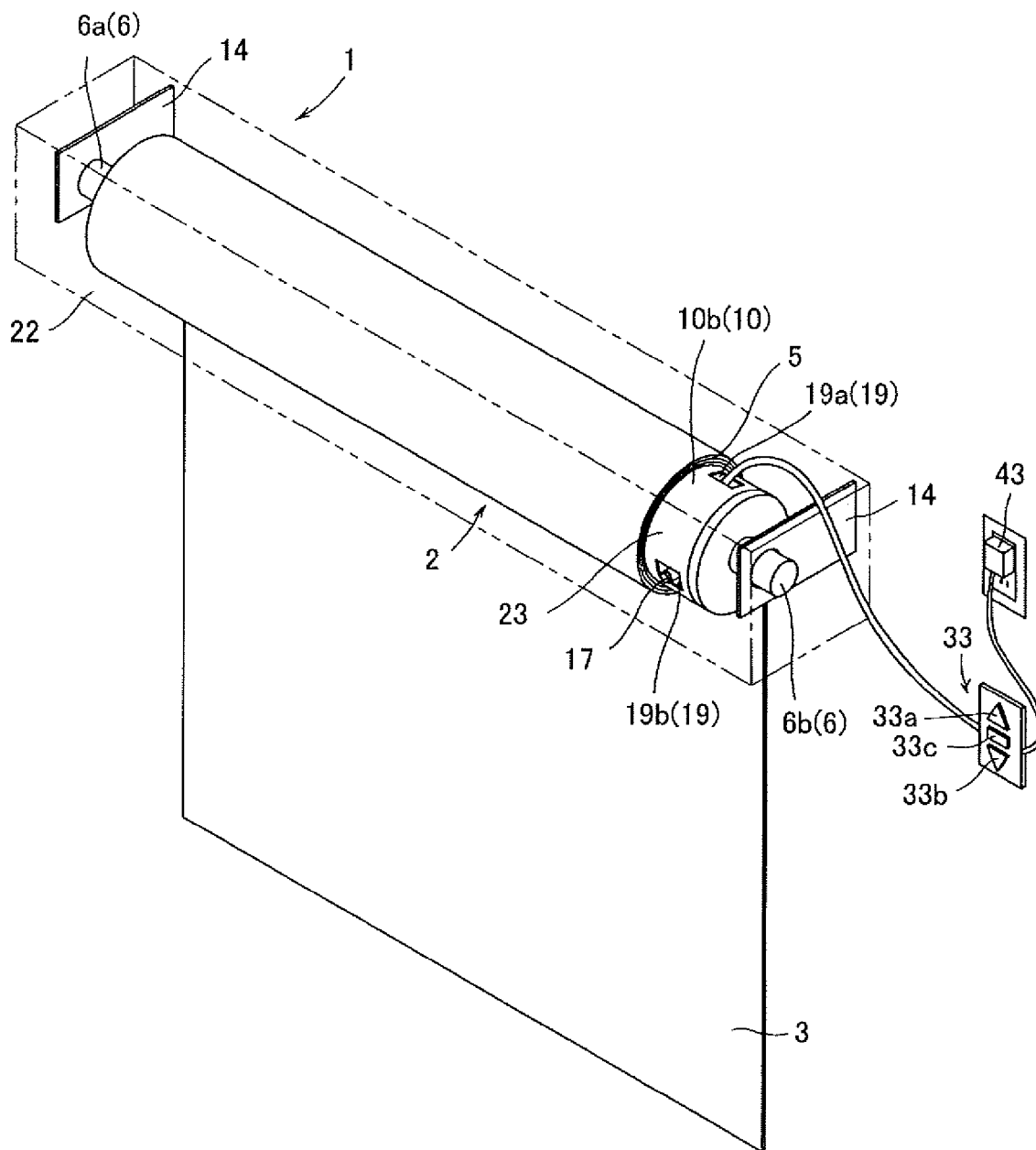


FIG. 2

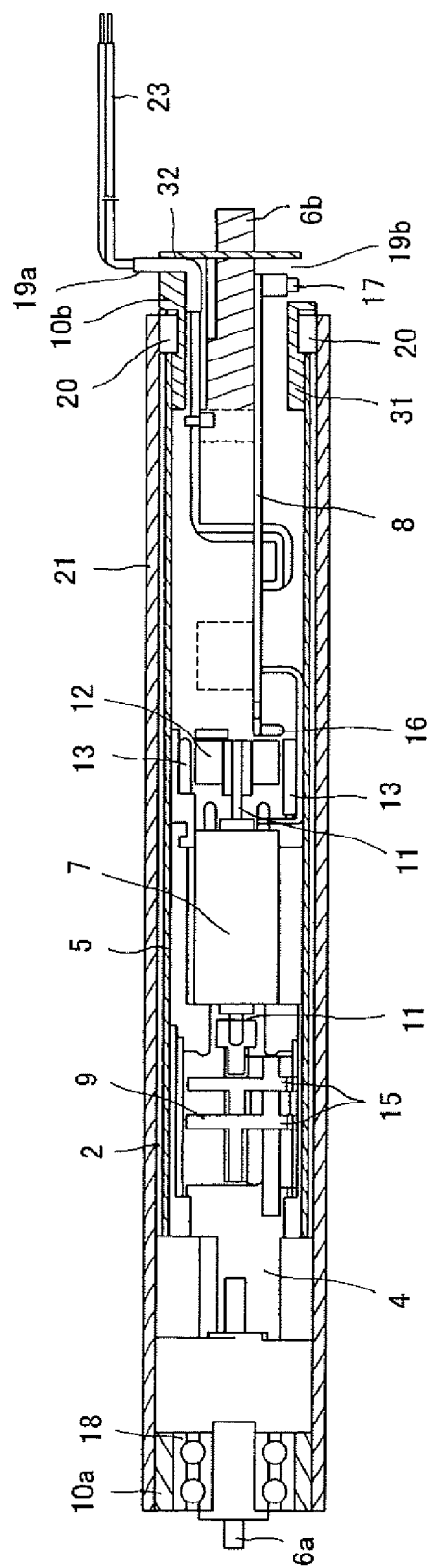


FIG. 3

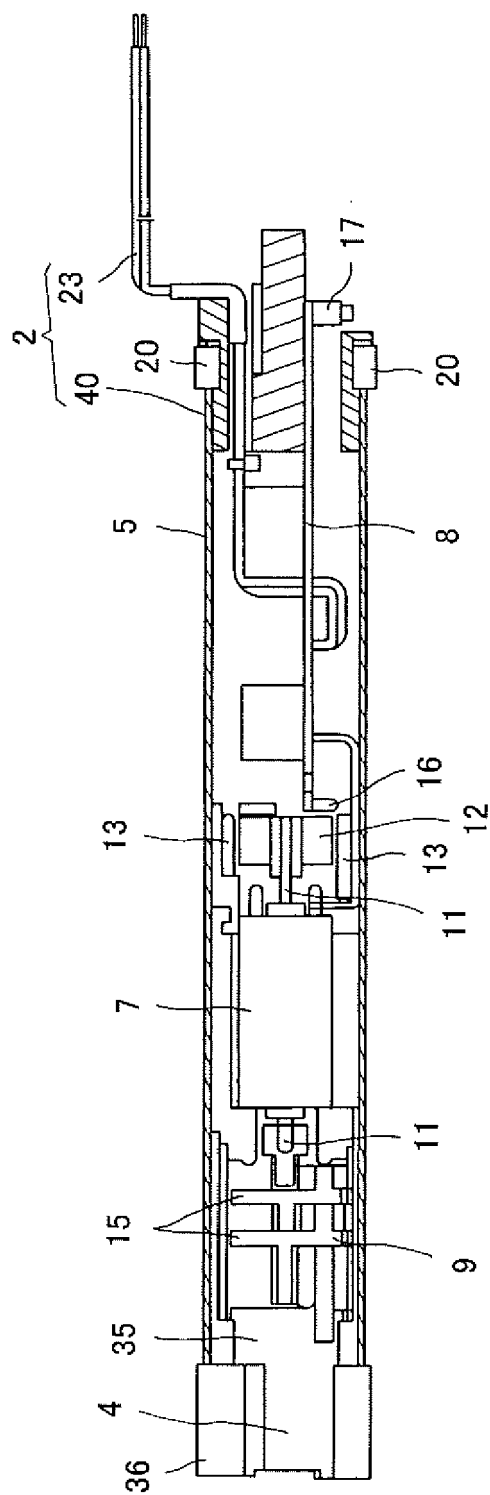


FIG. 4

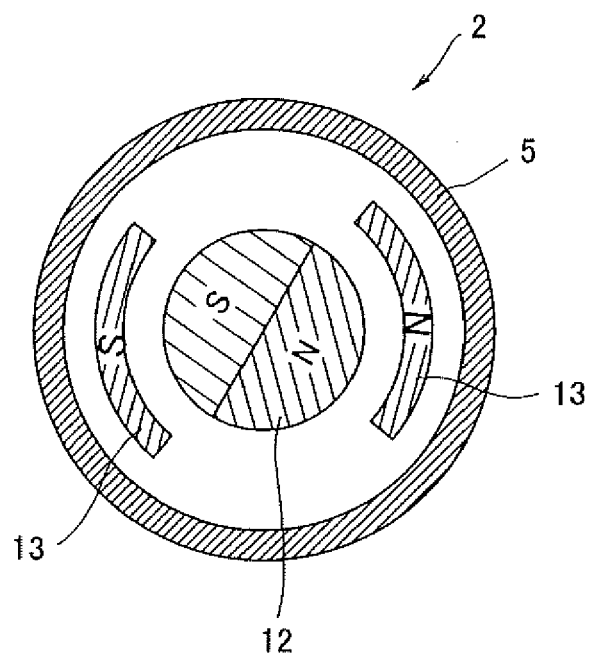


FIG. 5

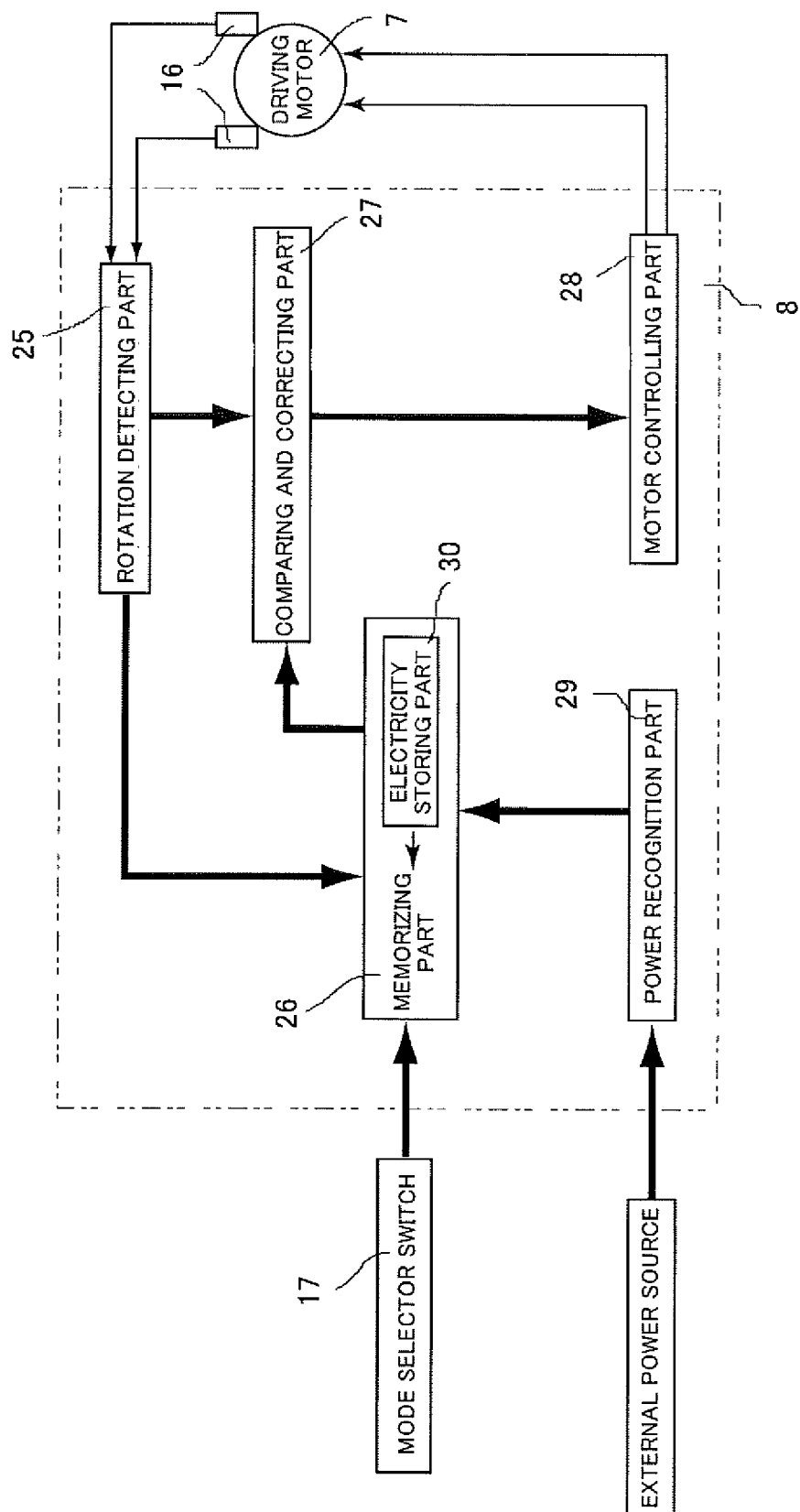


FIG. 6

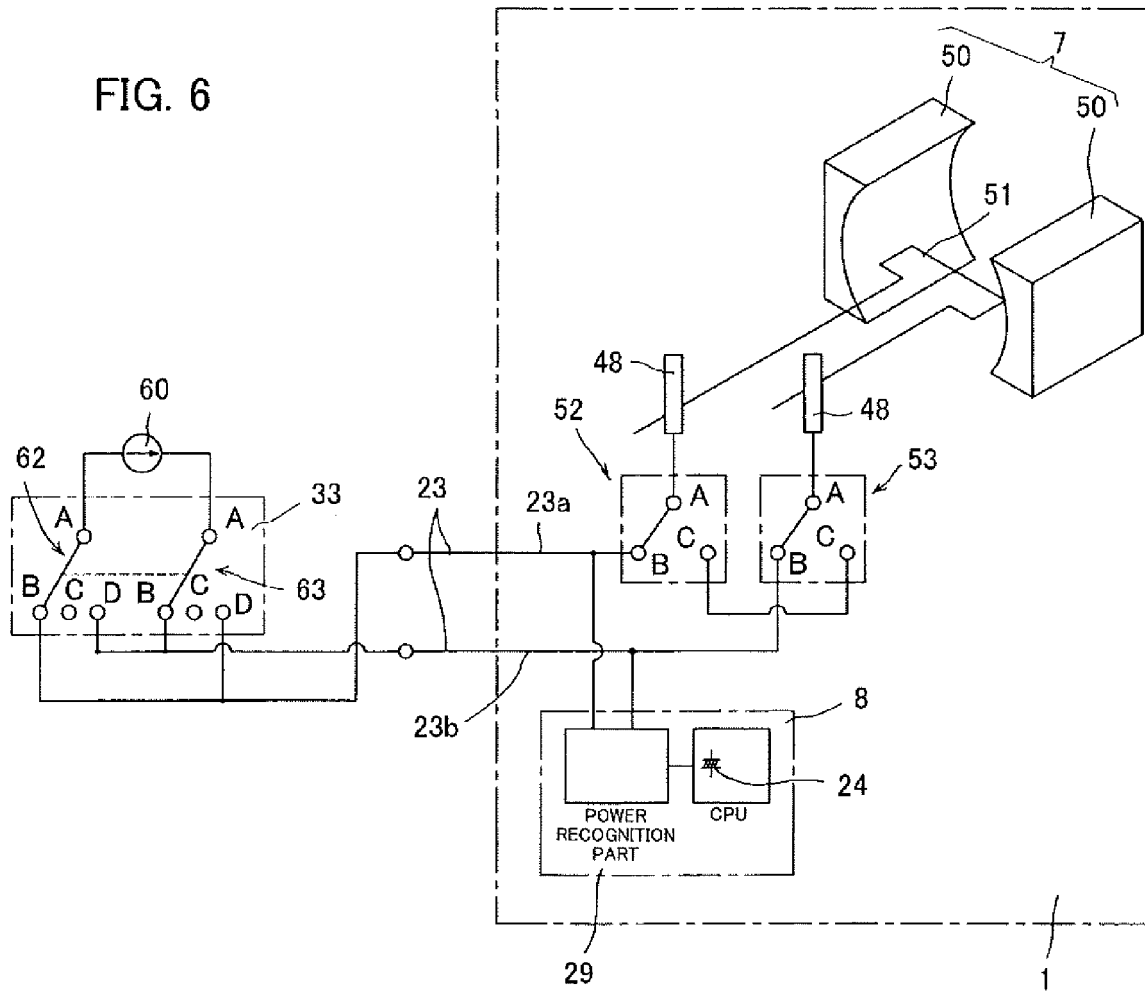


FIG. 7

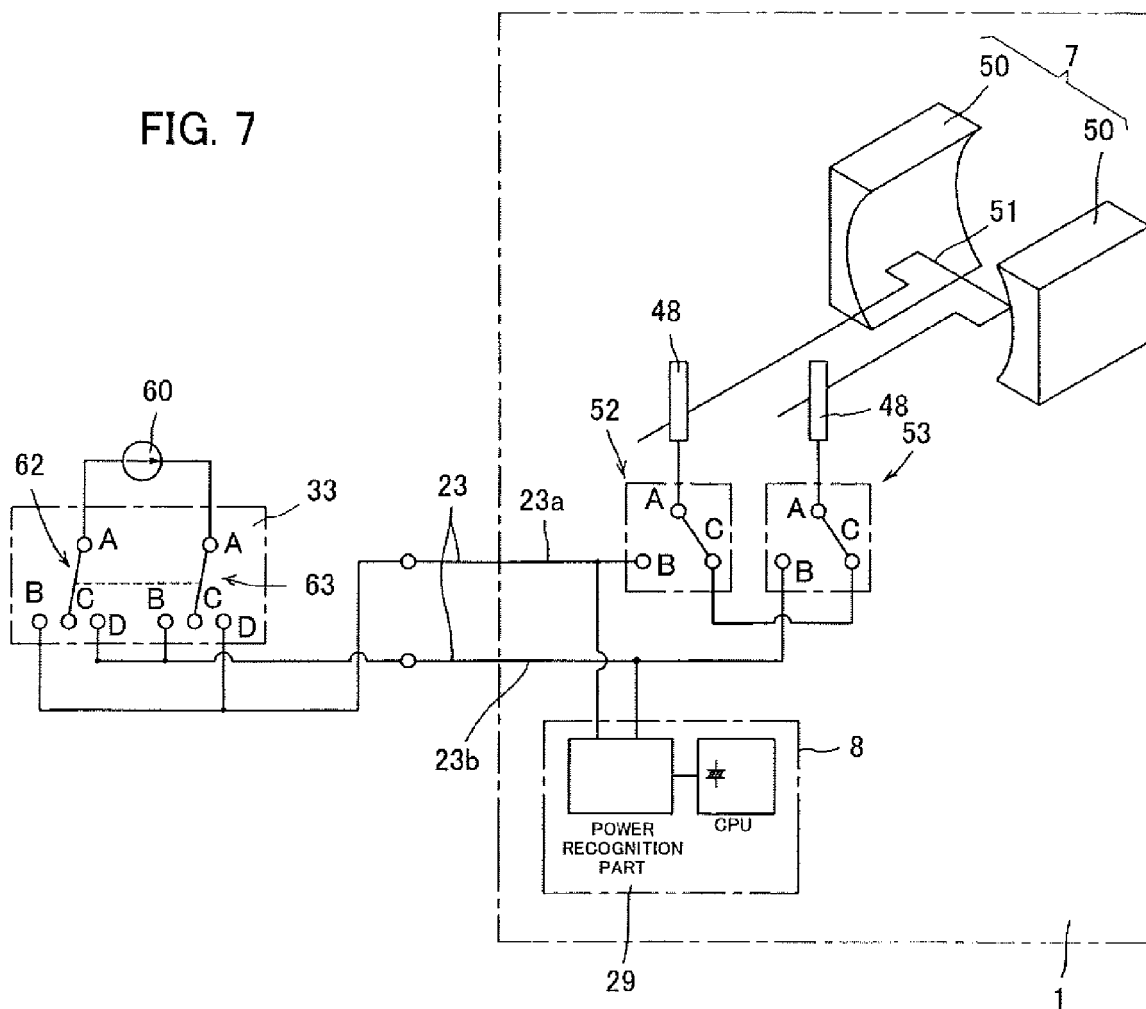


FIG. 8

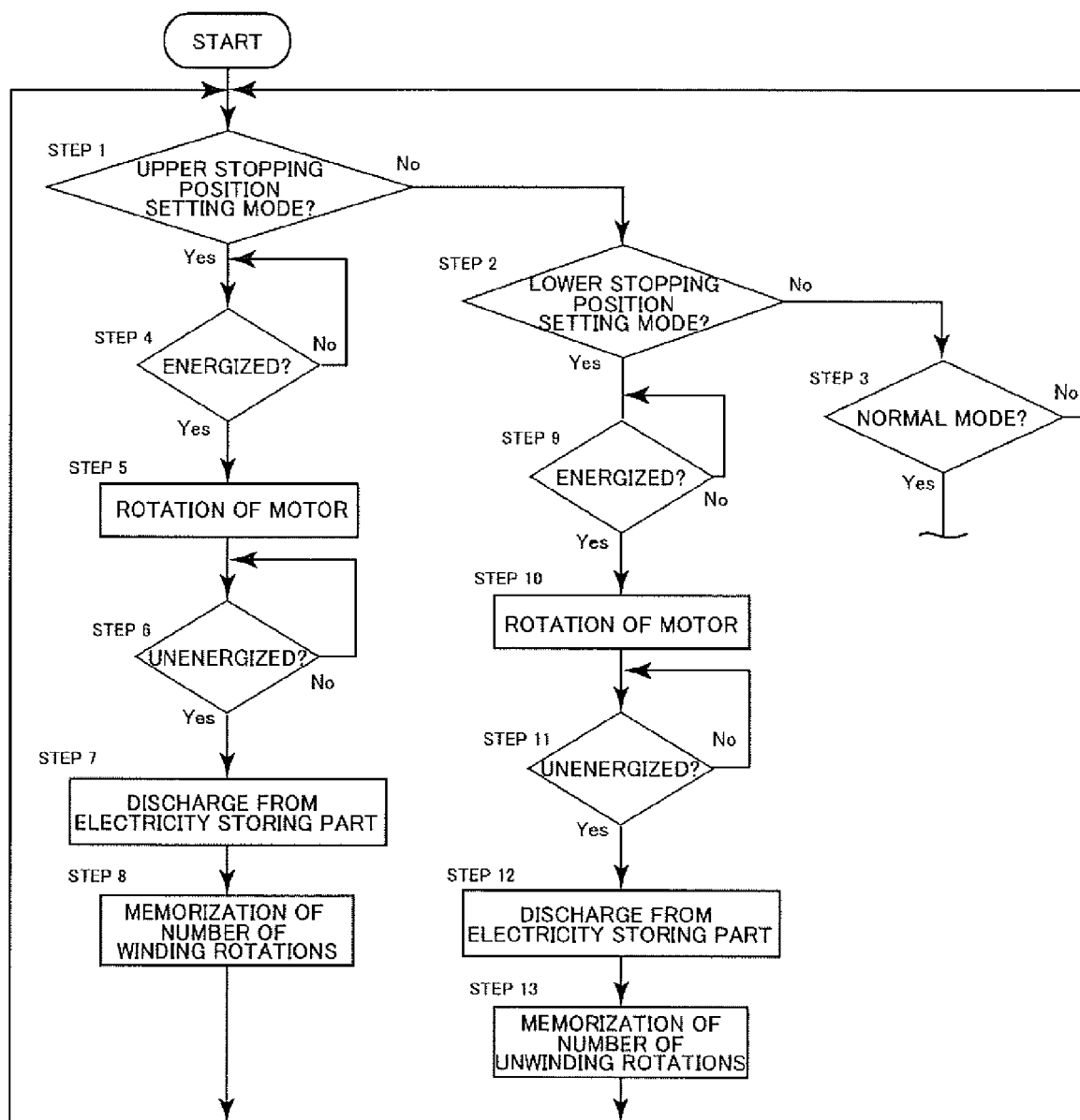


FIG. 9

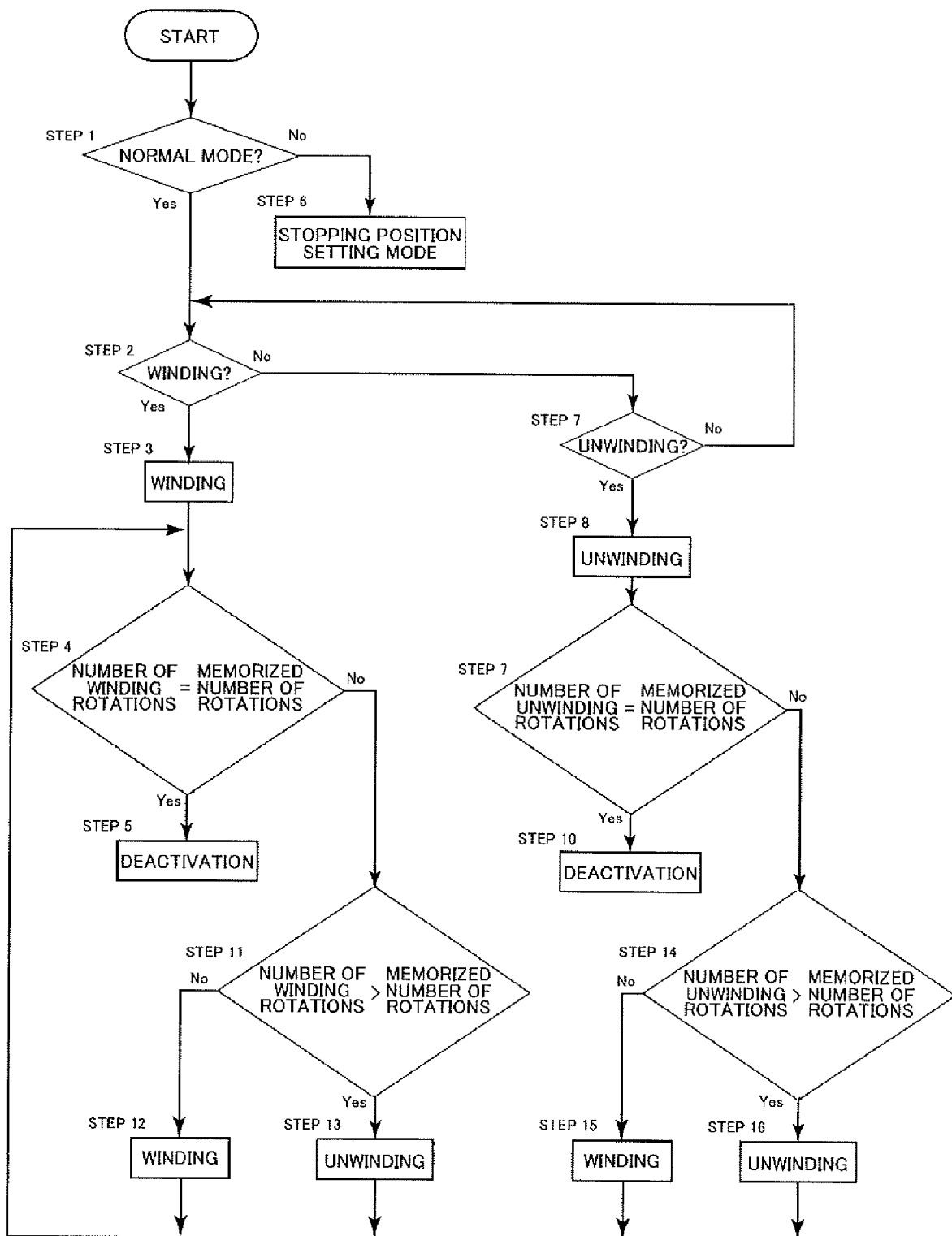


FIG. 10

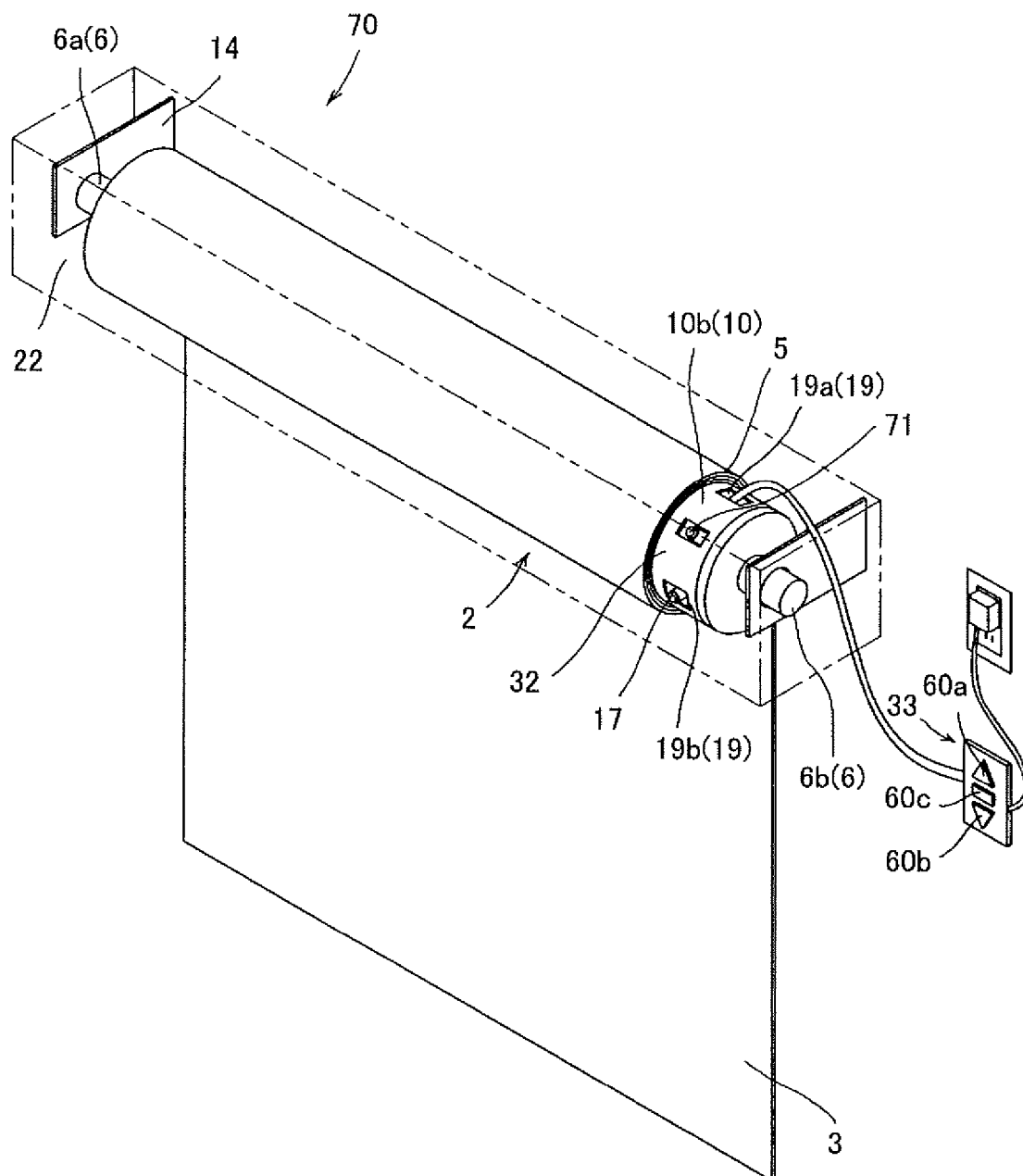


FIG. 11

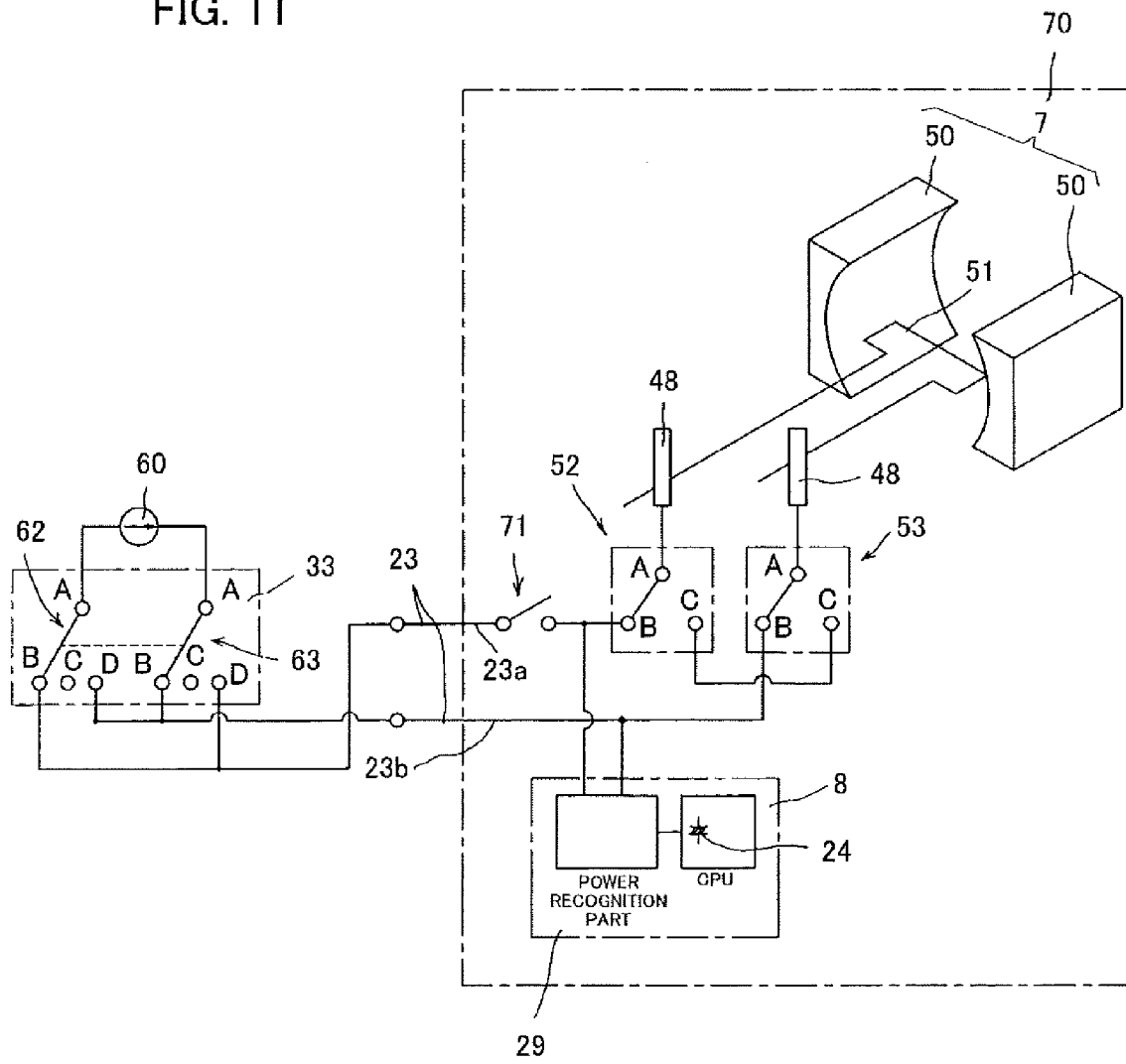


FIG. 12

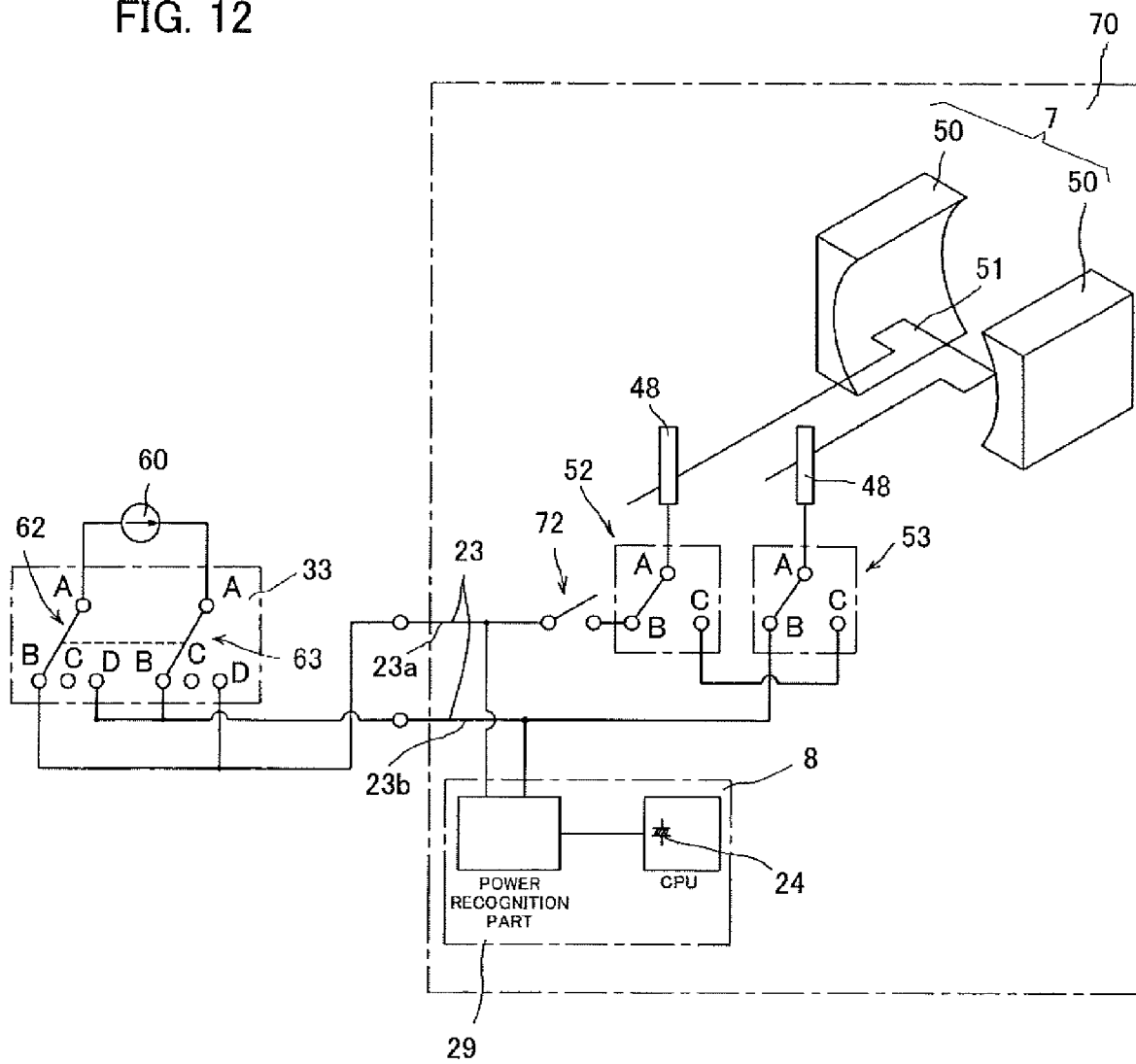


FIG. 13

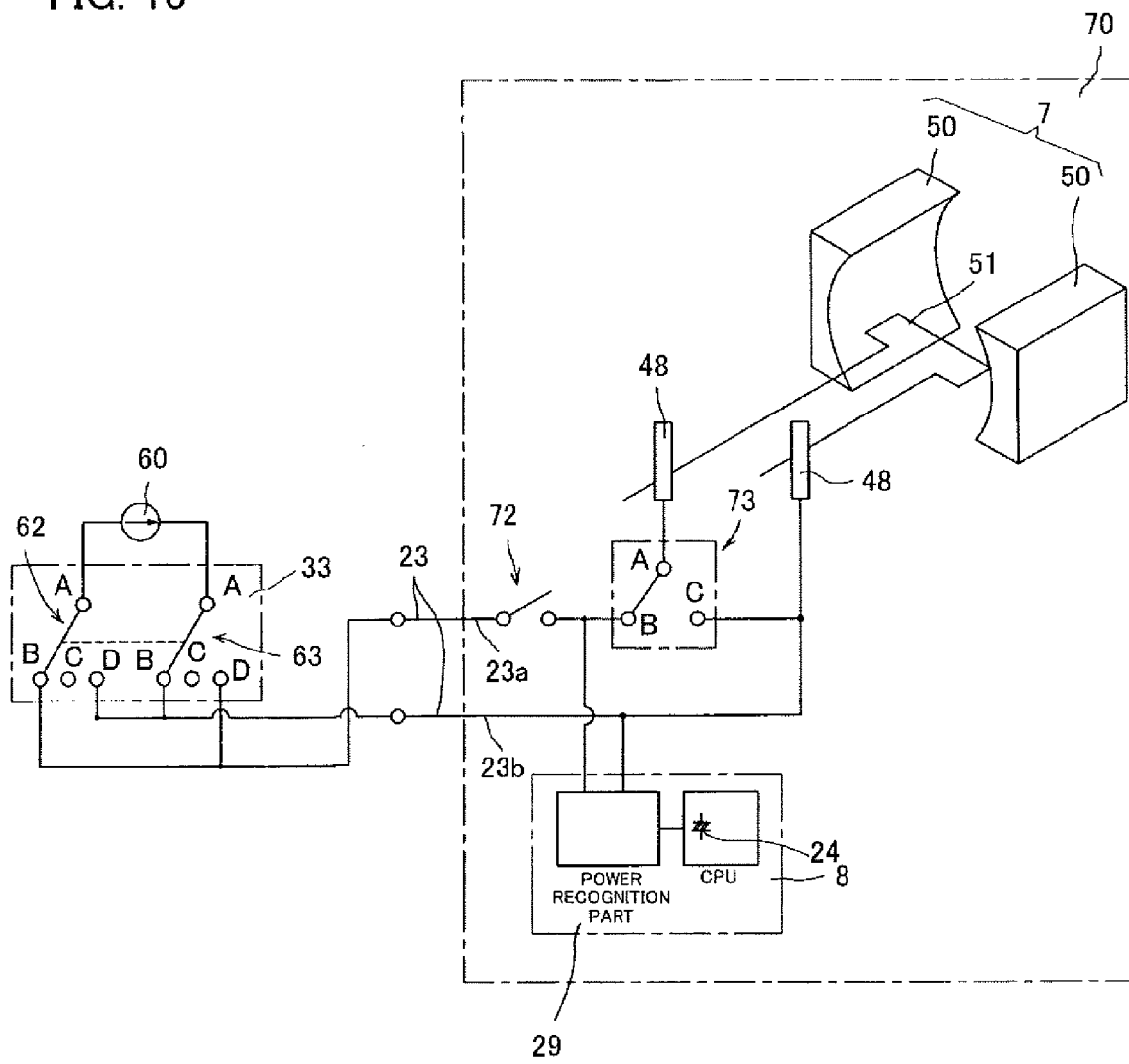


FIG. 14

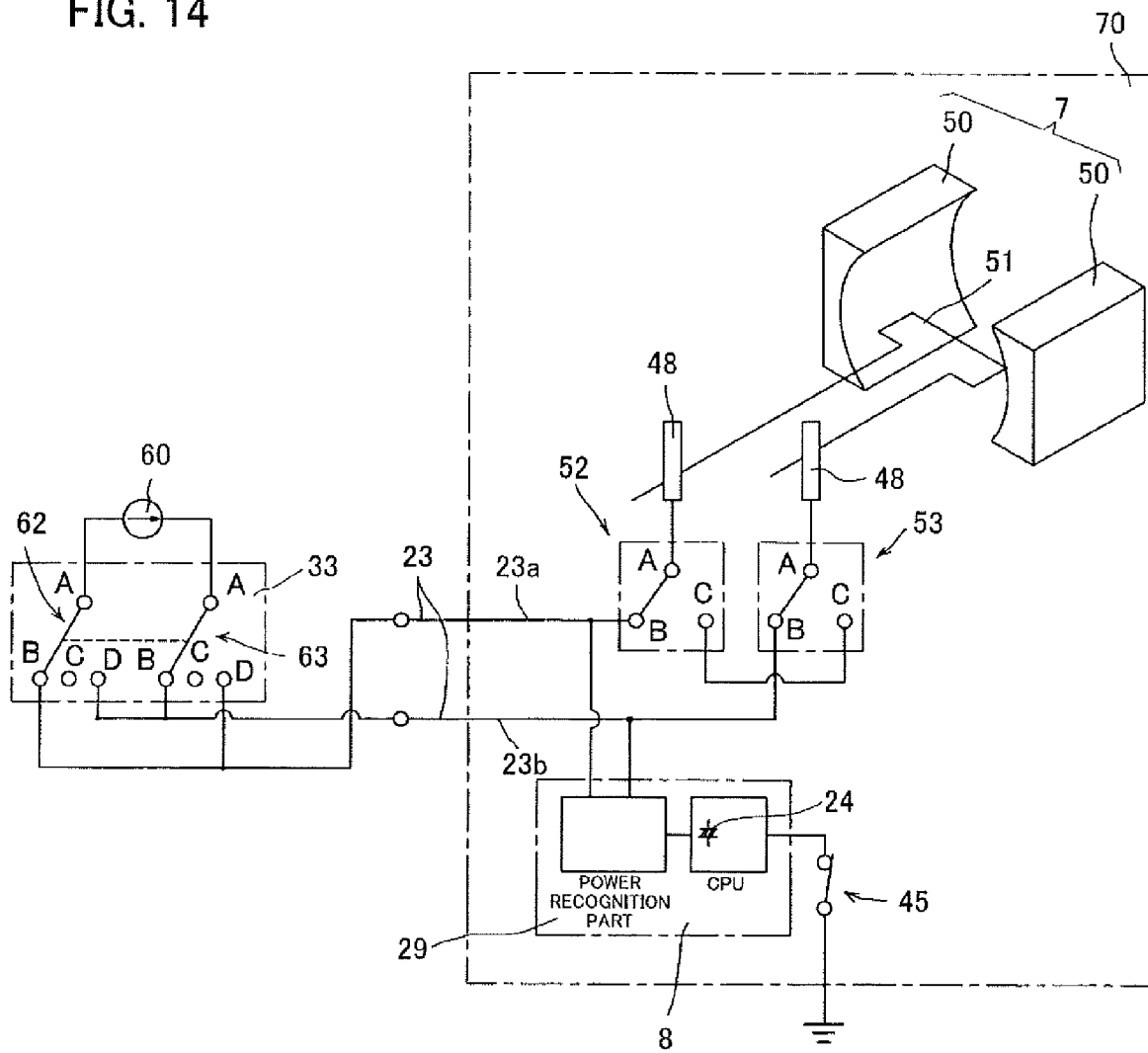


FIG. 15

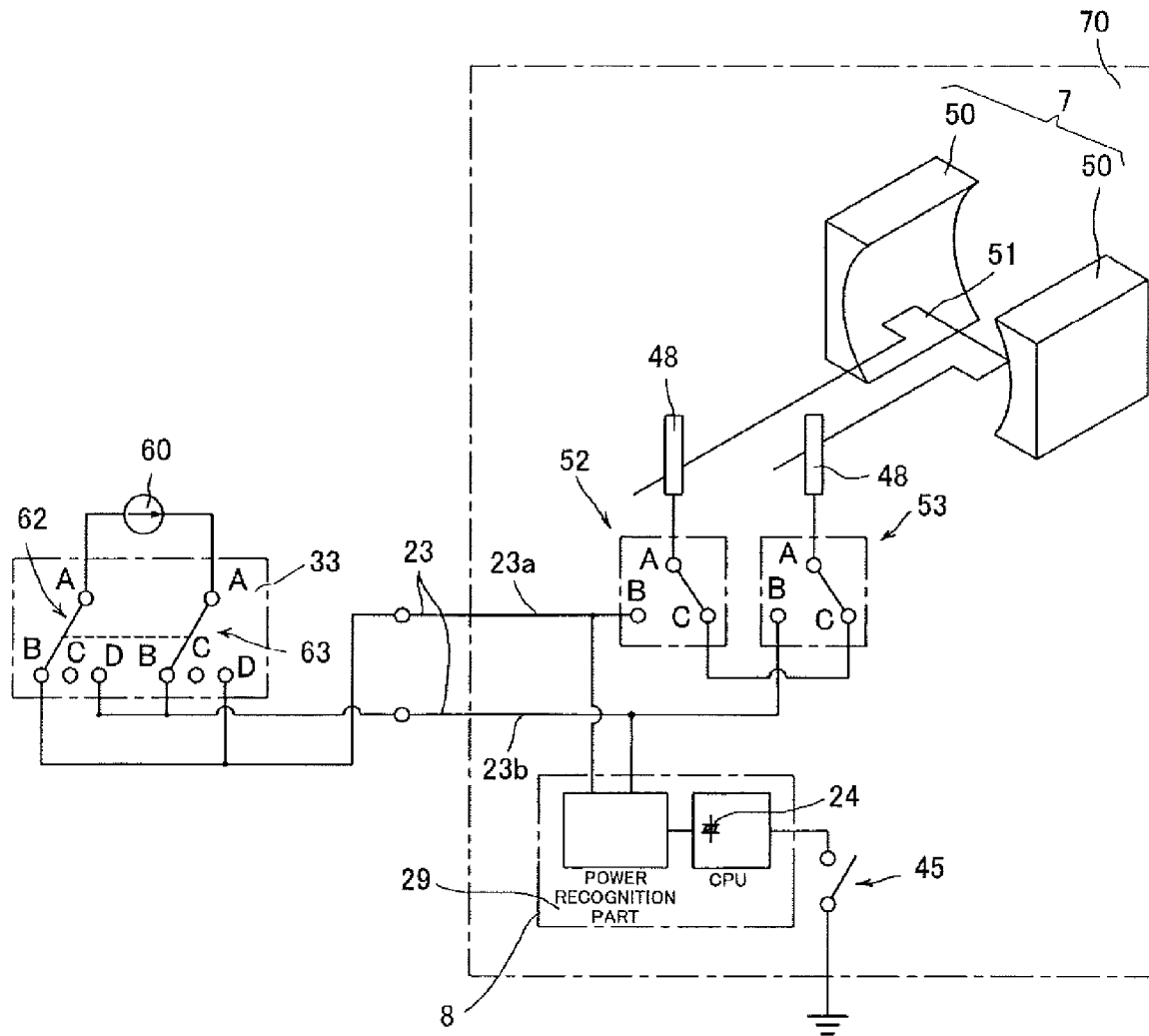
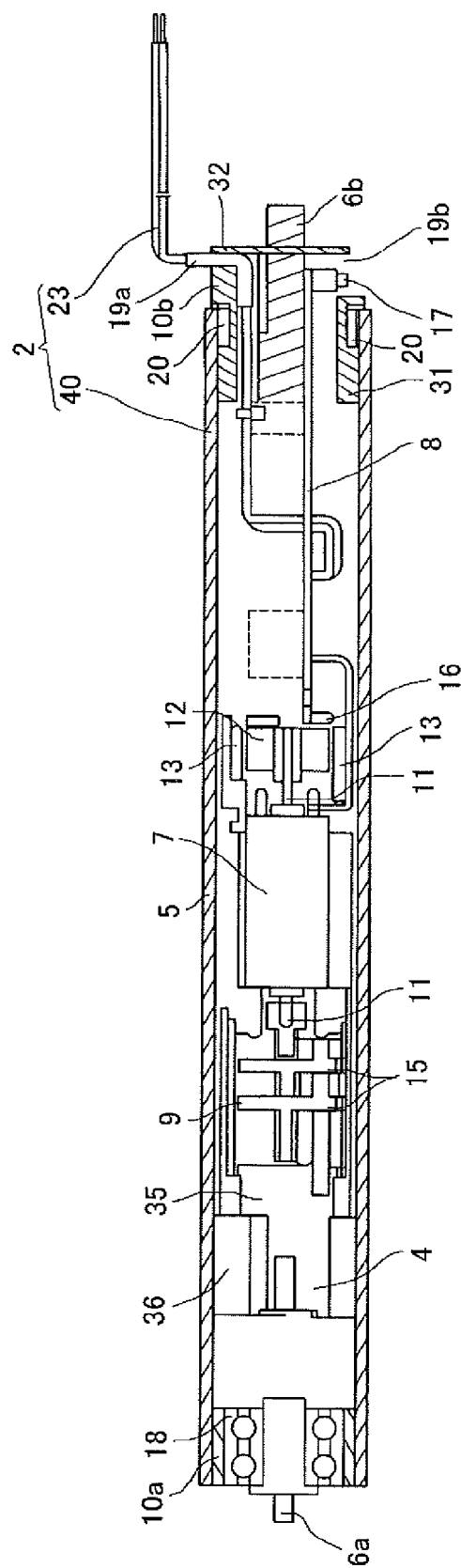


FIG. 16



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006020541 A [0004]