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

(11) EP 2 034 117 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
11.03.2009 Bulletin 2009/11

(21) Application number: **07815054.7**

(22) Date of filing: **07.06.2007**

(51) Int Cl.:
E05F 15/18 *(2006.01)* ***E05D 15/26*** *(2006.01)*
E05D 15/30 *(2006.01)*

(86) International application number:
PCT/JP2007/061517

(87) International publication number:
WO 2007/142284 (13.12.2007 Gazette 2007/50)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(30) Priority: **09.06.2006 JP 2006161037**

(71) Applicant: **Bunka Shutter Co., Ltd.**
Bunkyo-ku
Tokyo 113-8535 (JP)

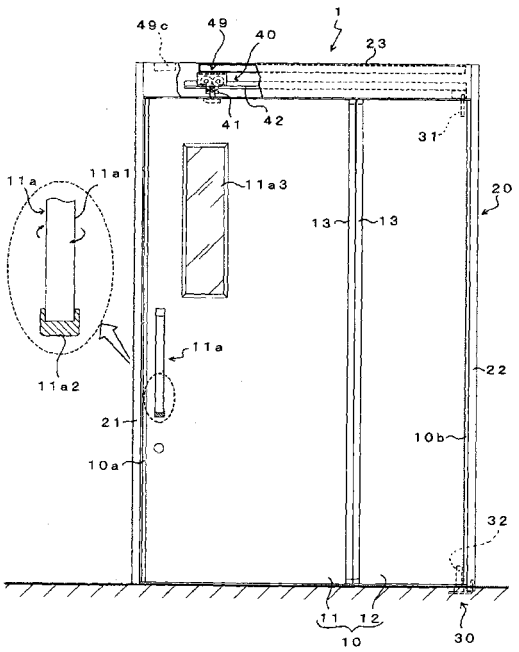
(72) Inventors:
- **ITO, Masato**
  Tokyo 113-8535 (JP)
- **UEDA, Toru**
  Tokyo 113-8535 (JP)

(74) Representative: **Tomkinson, Alexandra**
Bailey Walsh & Co
5 York Place
Leeds LS1 2SD (GB)

(54) DOOR DEVICE

(57) In a view of the conventional circumstance, the present invention is provided, and an object of the present invention is to provide an excellent opening/closing door unit convenient in opening/closing operation, with a space-saving constitution of a drive source.
The opening/closing door unit includes a movement support part 41 provided so as to move in a width direction of an opening part relative to an immobile part; and a door body 11 supported by the movement support part 41 so as to turn in a direction to intersect the opening part and with the opening part opened and closed by the movement and the turn of the door body 11, wherein a linear motor 49 is constituted by providing a stator 49a in the immobile part and providing a movable element 49b in the movement support part 41, and by the linear motor 49, the movement support part 41 is moved in a width direction of the opening part.

FIG.1



EP 2 034 117 A1

Description

Technical Field

[0001] The present invention relates to an opening/closing door unit such as a folding door unit and a balance door unit designed so as to perform opening/closing operation by turning and movement of a door body in a width direction of an opening part, and particularly relates to a preferable opening/closing door unit as a double-opening type folding door unit.

Background Art

[0002] Conventionally, as the kind of invention, patent document 1 discloses a double opening and folding type revolving door including a folding door part (folding type revolving door 3) formed by connecting one door body (master door 5) to the other door body (slave door 4) so as to be turned in both directions; a support member (rotary axis 27) for turnably supporting a door-tail side of the folding door part; and a movement support part (hanger 37) for turnably hanging the door body (master door 5) at a door-end side and moving it in a width direction of an opening part.
In the conventional technique, when the door bodies (the slave door 4 and the master door 5) are manually closed, the closing force is assisted by an energizing force of a spring of a returning means (6).
[0003] Meanwhile, as other conventional technique, according to the invention of patent document 2, a panel moving unit (22) is composed of two pulleys (28); a belt (29) hung over these pulleys; an arm (30) for connecting the belt (29) and a panel (18) ; and a drive unit (not shown) for driving the pulleys (28), and by the panel moving unit (22), the panel (18) is slid in an opening/closing directions.
When a panel drive unit (22) of the patent document 2 is provided in the invention disclosed in the patent document 1, closing operation of the door bodies (the slave door 4 and the master door 5) is possible with lighter force, and the closing operation is possible by switching operation, and if reverse operation of the panel drive unit (22) is performed, similar operation is possible in the opening operation.
[0004] However, as described above, when the panel drive unit (22) described in the patent document 2 is provided in the invention disclosed in the patent document 1, relatively larger space is required for disposing the panel drive unit (22) in an upper side of the door bodies (the slave door 4 and the master door 5).
In addition, according to a structure in which the panel drive unit (22) is provided for the folding type revolving door of the patent document 1, for example, when the door bodies (the slave door 4 and the master door 5) must be manually opened/closed due to electrical power failure, the manual opening/closing force receives a friction force generated between the pulleys (28) and the belt (29), and receives a resistance of the drive unit. Therefore, manual opening/closing operation is not easy.

Patent document 1: Japanese Patent Laid Open (JP-A) No.11-236787
Patent document 2: JP-A No.2000-274105

Disclosure of the Invention

Problem to be solved by the Invention

[0005] In view of the conventional circumstances, the present invention is provided, and an object of the present invention is to provide an excellent opening/closing door unit convenient in opening/closing operation, with a space saving constitution of a drive source.

(Means for Solving the Problem)

[0006] In order to solve the problem, a first aspect provides an opening/closing door unit, including: a movement support part provided so as to move in a width direction of an opening part relative to an immobile part; and door bodies supported by the movement support part so as to turn in a direction to intersect the opening part and with the opening part opened and closed by the movement and the turning of the door bodies, wherein a linear motor is constituted by providing a stator in the immobile part and providing a movable element in the movement support part, and by the linear motor, the movement support part is moved in the width direction of the opening part.
[0007] Here, it is preferable to constitute the opening/closing door unit according to the present invention in such a manner that each door body is moved in the width direction of the opening part while being turned to perform opening/closing operation. The opening/closing door unit includes a balance door and a folding door, etc, but does not include a slide door (sliding door) and a revolving door, etc.
[0008] Also, the door body includes both of a hanging type door body which is hung from upper side to perform opening/closing operation, and a door body to perform opening/closing operation along a rail of the lower side. In the case, the former type of the door body is preferable, because easiness of passage is improved with no irregularities required on a floor surface, etc.
[0009] In addition, the immobile part may be a part immobile relative to the movement support part that moves in the width direction of the opening part, and the immobile part includes, for example, a frame member around the door body and a skeleton, being an object in which the opening/closing door unit is installed.
[0010] In addition, the width direction of the opening part is a lateral width direction of the opening part opened and closed by the door body, and is not an axial direction of turning in the door body.
[0011] In addition, preferably the movement support

part is provided so as to move in the width direction of the opening part relative to the immobile part, and supports the door body so as to turn in a direction to intersect the opening part.

As a specific means for moving the movement support part relative to the immobile part in the width direction of the opening part, preferably a rail-like member along the width direction of the opening part is provided at the immobile part side or at the door body side, and the movement support part moves along the rail-like member.

[0012] Preferably the linear motor is a general linear motor designed to impel the movable element by a magnetic field generated from the stator.

Note that the movable element may be constituted of a permanent magnet, and also may be constituted of an electromagnet, and the former case is preferable, because electric wire, etc, can be omitted.

[0013] The movement support part and the linear motor are preferably provided in the upper side of the door bodies. However, it is also possible to provide them in the lower side of the door bodies.

In addition, the position of the linear motor in a thickness direction of the door body is largely spaced from a movement locus of the movement support part, and is arbitrarily set unless an impelling force for moving the movement support part is obtained, and is preferably set at a position on a locus of the movement support part.

[0014] In addition, a second aspect provides an opening/closing door unit, including a sensor for sensing one or both of a state in which the door body performs a predetermined amount of opening operation from a fully-closed position, and a state in which the door body performs a predetermined amount of closing operation from a fully-opened position, wherein according to a sensed signal of the sensor, the linear motor is set in a power supply state from a power non-supply state, to continue the movement of the movement support part.

[0015] Here, preferably the sensor can sense the movable element and a part that moves integrally with the movable element, and the sensor includes, for example, a contact sensor such as a limit switch or a micro switch, and a non-contact sensor such as a proximity switch or a photoelectric switch.

The sensor may be provided in singular or plural numbers. Namely, the sensor for sensing a state in which the door body performs a predetermined amount of opening operation from the fully-closed position, and the sensor for sensing a state in which the door body performs a predetermined amount of closed operation from the fully-opened position, may be the same single sensor or may be plural separate sensors.

[0016] In addition, according to a third aspect, plural door bodies are continuously connected to each other in the width direction of the opening part, and out of these plural door bodies, one of the adjacent door bodies is connected to the other one so as to turn in both directions, then the door body at a door-end side is supported by the movement support part, and the door body at a door-tail side is turnably supported to the immobile part, thereby constituting a double-opening type folding door part.

[0017] In addition, according to a aspect, the movable element is provided so as to protrude from the movement support part toward a moving direction at the time of a closing operation of the door body.

[0018] In addition, according to a fifth aspect, when the door body is fully-closed, the fully-closed state is maintained by a drive force of the linear motor.

[0019] In addition, according to a sixth aspect, a controller part of the linear motor is disposed, outside of a moving range of the movement support part.

[0020] Here, the controller part includes a control circuit having a function of controlling the linear motor part, and electric wiring is formed over the stator.

[0021] In addition, according to a seventh aspect, when the door member is set at the fully-closed position or the fully-opened position, the stator is disposed closer to a center side in the moving range of the movement support part, so that the stator and the movable element are not opposed to each other.

[0022] Namely, according to the seventh aspect, a length of the stator becomes shorter than the length of the moving range of the movement support part, and the stator is disposed closer to the center side in the moving range of the movement support part.

[0023] According to an eighth aspect, when the movement support member is positioned in a predetermined range during closing operation of the door member, power control is applied to the linear motor so as to decrease a speed of the movable element.

[0024] Here, out of the moving range of the movement support member, the predetermined range is a specific range set at the side of a direction in which the movement support member moves along with the closing operation of the door member.

As a preferable specific example, out of the moving range of the movement support member, the predetermined range is set in a range slightly on the front side of a part where the door member during closing operation is almost fully-closed.

[0025] In addition, a power control of the linear motor for decreasing a speed of the movable element includes a means for lowering a voltage of a power supply to the linear motor and lowering a frequency of the power supply.

[0026] In addition, a ninth aspect provides the opening/closing door unit according to any one of claims 1 to 8, wherein when the door member reaches a predetermined position in the predetermined range, a damper unit is provided to further decrease the speed of the movable element.

[0027] Here, the damper unit has a structure of decreasing the speed of the movable element, and the damper unit may be constituted in such a way that the movable element or a member integral with the movable element is elastically received by a repulsive force of an energizing member and a compressive fluid, and the

door-tail side of the door body is incorporated in a pivotably-supporting part that supports the door-tail side, and turn of the door body is alleviated by the energizing force, etc, of the energizing member.
Further, as the damper unit, it is also possible to simply give resistance to the movement of the movable element by friction, etc.

Effect of the Invention

[0028] The present invention is constituted as described above, and therefore an action effect as described below is exhibited.
According to the first aspect, by moving the movement support part by the linear motor, the door body performs opening/closing operation. Therefore, it is sufficient to provide a small space for including the drive mechanism, compared with a conventional technique including pulleys, the belt, and the drive unit, etc, and eventually, the size of the opening/closing door unit can be reduced.
Also, for example, even when the power supply to the linear motor is shut off due to power failure, etc, the door body can be opened/closed by relatively lighter manual opening/closing force.
In addition, for example, even when the door body during closing operation is manually stopped, the manual stop operation can be easily performed.
Further, even if the door body during closing operation abuts on an object, etc, that passes through the opening part, an impact under abutment can be relatively relieved.
Therefore, with a space-saving constitution of a drive source, an opening/closing door unit convenient in the opening/closing operation can be provided.
[0029] Further, according to the second aspect, by performing a predetermined amount of opening operation by manually operating the door body at a fully-closed position, or by performing a predetermined amount of closing operation by manually operating the door body at a fully-opened position, the operation of the door body thereafter can be continued by a drive of the linear motor, even if the operation is canceled.
Namely, according to the present invention, by the operation of slightly manually opening the door body at the fully-closed position, the door body can be automatically opened, and by the operation of slightly manually closing the door body at the fully-opened position, the door body can be automatically closed.
[0030] Further, according to the third aspect, with the space-saving constitution of the drive source, convenience in the opening/closing operation can be improved.
[0031] Further, according to the fourth aspect, in the fully-opened state of the door body, the movable element and the stator are not disposed in a part at the door-tail side, and therefore maintainability can be improved.
[0032] Further, according to the fifth aspect, there is no necessity for including a lock structure, etc, for maintaining the fully-opened state of the door body, and therefore closing performance at the time of full-closing the door body can be favorably secured by the drive force of the linear motor.
[0033] Further according to the sixth aspect, it is possible to prevent the movement of the movement support part in the width direction of the opening part, from being interrupted by a controller part.
[0034] Further, according to the seventh aspect, the stator and the movable element are not opposed to each other, when the door body is set at the fully-opened position or the fully-closed position. Therefore even if power is supplied to the linear motor, a stop state of the movement support part (in other words, the stop state of the door body) can be maintained.
When the door body performs slightly opening operation from the fully-closed position, or performs slightly closing operation from the fully-opened position, the stator and the movable element are set in a relation of being opposed to each other, by the movement of the movement support part accompanying such operations of the door body. Therefore, by continuously moving the movement support part by the drive force of the linear motor, the closing operation or the opening operation of the door body can be performed.
Therefore, according to the present invention, the sensor for sensing slightly opening operation of the door body at the fully-closed position and the sensor for sensing slightly closing operation of the door body at the fully-opened position are not separately provided, and the door body slightly opened manually can be automatically opened as it is, and the door body slightly closed manually can be automatically closed as it is.
[0035] Further, according to the eighth aspect, when the door body approaches the fully-opened position, the speed of the movable element is decreased by power control of the linear motor, and with the decrease of the speed of the movable element, the moving speed of the movable element at the door-end side of the door body is adjusted to a suitable speed.
Namely, usually, the moving speed of the movable element at the door-end side of the door member during closing operation is accelerated as the door member approaches the fully-closed position, by composite motion of a motion in the width direction of the opening part and a turning motion. However, according to the present invention, acceleration of the speed at the door-end side as described above can be prevented, and consequently it is possible to prevent the door body during closing operation from exceeding the fully-closed position (in the case of the double-opening type), or possible to prevent the door body from strongly colliding with an abutting body at the fully-closed position (in the case of single-opening type), and further it is possible to alleviate an impact when the door body abuts on an object, etc.
[0036] Further, according to the ninth aspect, the impact of the door member at the time of the fully-closed state can be effectively prevented by the damper unit.

(Brief Description of the Drawings)

[0037]

Fig. 1 is a front view illustrating an example of an opening/closing door unit according to the present invention, and illustrating an essential cutout part;
Fig. 2 is a block diagram of the essential part of the opening/closing door unit, Fig. 2(a) illustrates a state in which a folding door part is almost fully-closed, and Fig. 2 (b) illustrates a state in which the folding door part is almost fully-opened;
Fig. 3 is a view illustrating an operation of the folding door part in the opening/closing door unit viewed from the upper side;
Fig. 4 is a block diagram of the essential part illustrating other example of the opening/closing door unit according to the present invention, Fig. 4(a) illustrates a state in which the folding door part is almost fully-closed, and Fig. 4 (b) illustrates a state in which the folding door part is almost fully-opened;
Fig. 5 is a block diagram of the essential part illustrating other example of the opening/closing door unit according to the present invention, Fig. 5(a) illustrates a state in which the folding door part is almost fully-closed, and Fig. 5(b) illustrates a state in which the folding door part is almost fully-opened;
Fig. 6 is a block diagram of the essential part illustrating other example of the opening/closing door unit according to the present invention, Fig. 6(a) illustrates a state in which the folding door part is almost fully-closed, and Fig. 6 (b) illustrates a state in which the folding door part is almost fully-opened;
Fig. 7 is a block diagram of the essential part illustrating other example of the opening/closing door unit according to the present invention, Fig. 7(a) illustrates a state in which the folding door part is almost fully-closed, and Fig. 7 (b) illustrates a state in which the folding door part is almost fully-opened;
Fig. 8 is a flowchart explaining a control operation for making the folding door part perform closing operation, in the opening/closing door unit; and
Fig. 9 is a block diagram of the essential part illustrating other example of the opening/closing door unit according to the present invention, Fig. 9(a) illustrates a state in which the folding door part is almost fully-closed, and Fig. 9(b) illustrates a state in which the folding door part is almost fully-opened.

Best Mode for Carrying out the Invention

[0038] Embodiments of the present invention will be described hereunder, based on the drawings.
The opening/closing door unit according to the present invention is disposed in a doorway opened and closed in a construction/structure such as a house and a building, a warehouse, a factory, an underground shopping center, a tunnel, and a load-carrying platform of a vehicle, and can be applied as a balance door unit and a folding door unit, etc, that perform opening/closing operation by turning of the opening/closing body. An example constituted as a double-opening type folding door unit will be described as a particularly preferable aspect of the present invention.

[0039] As shown in Fig. 1, the opening/closing door unit 1 includes a folding door part 10 constituted of a plurality of continuously connected door bodies 11 and 12 for performing opening/closing operation; a frame body 20 that surrounds the folding door part 10 from right and left directions and from upper side; an axial end portion 30 that turnably supports the door-tail side (right side in Fig. 1) of the folding door part 10; and a movement support mechanism 40 that supports a door body 11 at the door-end side of the folding door part 10 so as to move in the turning direction and in the width direction of the opening part (in the right and left directions in Fig. 1), thus making the folding door part 10 perform opening/closing operation by a linear motor 49 provided in the movement support mechanism 40.

[0040] The folding door part 10 is constituted so as to be double-opened, by continuously connecting plural door bodies 11, 12 and connecting one of the adjacent door bodies 11 and 12 to other door body turnably in both directions.
Note that according to an example shown in the figure, although the folding door part 10 is constituted of two door bodies 11 and 12, three or more door bodies may be connected to each other similarly as described above. In addition, it is also possible to use a single door body, and the folding door unit is constituted as the balance door unit.

[0041] The door body 11 at the door-end side can be moved in the width direction (right and left direction in Fig. 1), by hanging an upper end portion thereof by a movement support part 41 of the movement support mechanism 40 as will be described later, and is supported so as to turn in both directions to intersect the opening part X.

[0042] A handle part 11a is provided in the front part and/or rear part at the door-end side of the door body 11. The handle part 11a is composed of an approximately cylindrical grip part 11a1 disposed so as to be spaced apart from the door body 11, and support members 11a2, 11a2 fixed to the surface of the door body 11 and unevenly and loosely engaged with upper and lower both end sides of the grip part 11a1, and a grip part 11a2 is turnably held by the handle part 11a.

[0043] According to the handle part 11a, an operator who performs opening/closing operation of the door body 11 can turn the door body 11 while turning the grip part 11a1 without turning the wrist, and therefore operability of the door body 11 is excellent.
In addition, an end portion at the door-tail side of the door body 11 is turnably connected to an end portion of the door-end side of the door body 12, via a turning mechanism of a hinge, a gear, and a link member, etc.

Note that a symbol 11a3 in the figure indicates a window part made of a transparent member such as glass and a transparent synthetic resin material, etc.

Also, symbols 13 in the figure indicate interposing prevention members 13 provided in each of the door-tail side end portion of the door body 11 and the door-end side end portion of the door body 12, for preventing an object, etc, from being interposed between these door bodies 11 and 12, and these interposing prevention members 13 are formed of rubber and an elastic resin material, etc, in a hollow shape.

[0044] In addition, the door body 12 at the door-tail side includes an axial end portion 30 at the end portion of its door-tail side, and is supported turnably in both directions by the axial end portion 30.

[0045] In addition, the frame body 20 is constituted in an approximately U-shape, including a door-end side frame part 21 opposed to a door-end part 10a of the folding door part 10 in the fully-closed state; a door-tail side vertical frame part 22 opposed to the door end part 10b of the folding door part 10 in the fully-closed state, and an upper frame part 23 to connect these vertical frame members 21 and 22 at its upper end side. Then, the movement support mechanism 40 and a full closure assisting means, etc, as will be described later are constituted in the hollow-shaped upper frame part 23.

Note that according to the example shown in the figure, although the lower side of the folding door part 10 is formed in a floor surface or a ground surface, etc, it may also be formed in a lower frame part extending between both vertical frame parts 21 and 22.

[0046] In addition, the axial end portion 30 is constituted of an upper side pivotally supporting member 31 for turnably supporting the upper end side at the door-tail side of the folding door part 10, and a lower side pivotally supporting member 32 for turnably supporting the lower end side at the door-tail side.

A part of the upper end side of the upper side pivotally supporting member 31 is fixed to the upper frame part 23, and a part of the lower end side thereof is turnably engaged with the door body 12.

Similarly, a part of the lower end side of the lower side pivotally supporting member 32 is fixed to the floor surface or the ground surface, and a part of the upper end side thereof is turnably engaged with the door body 12.

[0047] In addition, the movement support mechanism 40 is provided so as to move in the width direction of the opening part, including a movement support part 41 for turnably hanging the door body 11 at the door-end side; a guide rail 42 for guiding the movement support part 41 in the width direction of the opening part; and a linear motor 49 for moving the movement support part 41 in the width direction of the opening part along the guide rail 42.

[0048] The movement support part 41 is constituted of an axial part 41a (see Fig. 2) for turnably hanging the door body 11 at the door-end side, a supporting bracket 41b fixed to the upper side of the axial part 41a; and hangers 41c, 41c turnably supported by the supporting bracket 41b. Note that the axial part 41a is mounted on the door body 11 so as not to move in the width direction thereof.

[0049] The axial part 41a turnably supports the door body 11 so as to be opened and closed via a bearing, etc.

[0050] The supporting bracket 41b fixes the axial part 41a to a lower side thereof, and supports the hanger 41c to the upper side so as to turn along the width direction of the opening part.

The supporting bracket 41b is formed of a magnetic metal material, and therefore functions as an attraction object magnetically attracted by a magnetic attractor 43 as will be described later.

Note that as other example of the attraction object, it may be also preferable that the supporting bracket 41b itself is formed into a magnet in an attracting state with the magnetic attractor 43, or the magnet is provided in a part opposed to the magnetic attractor 43 of the supporting bracket 41b in the attracting state with the magnetic attractor 43.

[0051] In addition, the hanger 41c is supported by the supporting bracket 41b so as to roll on the guide rail 42, and according to a preferable example shown in the figure, the number of disposed hangers is set at two. However, it is also possible to provide a single hanger or three or more hangers.

[0052] Further, the guide rail 42 is disposed so as to receive the hanger 41c from the lower side and guide the hanger 41c in the width direction of the opening part, and is fixed to the upper frame part 23.

[0053] In addition, the magnetic attractor 43 is provided at the door-end direction side (left direction side in Fig. 2) from the supporting bracket 41b in approximately the fully-closed state of the folding door part 10.

The magnetic attractor 43 is a so-called permanent magnet, and is disposed so as to oppose to the end portion of the door-end direction side of the supporting bracket 41b, and is fixed to the upper frame part 23, being an immobile part, via a bracket, etc.

Then, an elastic body 43b (such as rubber and elastic synthetic resin, etc) is fixed to the end portion at the supporting bracket 41b side in the magnetic attractor 43, so as to alleviate the impact under abutment of the supporting bracket 41b.

[0054] Note that a symbol 44 in Fig. 2 indicates an abutted part on which the supporting bracket 41b is abutted, with the door body 11 set in the almost fully-opened state, and in the abutment part 44, a cushioning material such as an elastic body is fixed to an abutment surface, so as to alleviate the impact under the abutment.

[0055] In addition, the linear motor 49 is constituted of a stator 49a fixed to the upper frame part 23, being the immobile part, a movable element 49b fixed to the movement support part 41, and a controller part 49c for supplying power to the stator 49a to control the power.

[0056] The stator 49a is a coil unit including a coil for giving an impelling force to the movable element 49b in the width direction of the opening part, and the power is

supplied to the coil from the controller part 49c outside of the stator 49a.

The stator 49a is formed in a long shape extending in the width direction of the opening part, and is fixed to the upper frame part 23 in such a manner that one end side portion thereof is opposed to the movable element 49b, with the folding door part 10 set in the almost fully-closed state (state shown in Fig. 2(a)), and the other end side portion is opposed to the movable element 49b, with the folding door part 10 set in approximately the opened state (state shown in Fig. 2(b)).

[0057] Singular or plural sensors 49a1 capable of sensing a movable element 49b are included, at a longitudinal intermediate position of the stator 49a.

The sensor 49a1 is a proximity switch for sensing the movable element 49b when the door body 11 performs predetermined amount of opening operation from the fully-opened position and when the door body 11 performs a predetermined amount of closing operation from the fully-opened position. Then, the sensed signal is transmitted to the controller part 49c.

By providing a single sensor 49a1 in approximately longitudinal center of the stator 49a, it may be possible to sense both states of a state in which the door body 11 performs the predetermined amount of closing operation from the fully-opened position, and a state in which the door body 11 performs the predetermined amount of opening operation from the fully-closed position, at the same place. Alternately, by providing plural sensors 49a1 in a longitudinal intermediate place of the stator 49a, each one of the states may be sensed at separate places.

In addition, it may be also possible to replace the sensor 49a1, with a non-contact sensor other than the proximity switch (such as a photoelectric switch), and a contact switch (such as a limit switch) designed to sense a member (such as a supporting bracket 41b) integral with the movable element 49b in a contact state.

[0058] The movable element 49b is a stator of a linear motor constituted of a permanent magnet, and is fixed to the upper end of the supporting bracket 41b so as to extend in the width direction of the opening part, in such a manner as securing a suitable clearance between the movable element 49b and the stator 49a, when opposed to the stator 49a.

Note that as the clearance is smaller, a greater drive force by the linear motor is obtained, and therefore by suitably adjusting the clearance, consumption of a power for a necessary drive force can be suppressed.

[0059] In addition, the controller part 49c includes a control circuit (not shown) including a plurality of electronic components and an integrated circuit board, etc, and controls a power supplied from outside and outputs the power to the stator 49a.

More specifically, output power of the controller part 49c is controlled, so that moving speeds of the movable element 49a and the movement supporting part 41 are suitably maintained, and the moving direction of the movable element 49b is changed, or the movement of the movable element 49b is stopped.

[0060] Then, the controller part 49c having the structure is disposed outside of a moving range of the movement support part 41 so as not to inhibit the movement of the movement support part 41, and is fixed to the upper frame part 23 at the door-end side of the stator 49a and the guide rail 42, according to an example shown in the figure.

[0061] Next, characteristics of the opening/closing operation of the opening/closing door unit 1 will be described in detail, based on Fig. 2 and Fig. 3.

First, when slightly closing operation of the folding door part 10 set in the fully-opened state is performed by manual operation, etc, of a user, by the movement of the movement support part 41 and the movable element 49b accompanied by the slightly closing operation, the sensor 49a1 in the stator 49a senses the movable element 49b. Then, according to the sensed signal, the controller part 49c supplies the power to the stator 49a, so as to impel the stator 49a.

Accordingly, the closing operation of the folding door part 10 is continued by the drive of the linear motor 49.

When the folding door part 10 is fully-closed, the controller part 49c stops the supply of the power to the stator 49a.

Note that a means for sensing a state in which the folding door part 10 is fully-closed, may be constituted to sense the state by the contact or non-contact sensor not shown, or may be constituted to recognize a state in which a current value of electricity supplied to the stator 49a exceeds a predetermined value.

[0062] Then, the fully-closed state of the folding door part 10 is maintained by attracting the supporting bracket 41b by the magnetic attractor 43.

[0063] In addition, when slightly opening operation of the folding door part 10 set in the fully-closed state is performed by the user, etc, by the movement of the movement support part 41 and the movable element 49b accompanied the movement of the folding door part 10, the sensor 49a1 in the stator 49a senses the movable element 49b. Then, according to the sensed signal, the controller part 49c supplies power to the stator 49a, so as to impel the movable element 49b in an opposite direction to the direction in the case of closing the door body.

Accordingly, the opening operation of the folding door part 10 is continued by the drive of the linear motor 49.

[0064] When the folding door part 10 is almost fully-opened by abutment of the movement support part 41 on the abutted part 44, the controller part 49c stops the supply of the power to the stator 49a.

Note that the means for sensing the state in which the folding door part 10 is fully-opened may be constituted to sense the state by the contact or non-contact sensor not shown. Alternately, the means may be constituted to recognize the state in which the current value of the stator 49a exceeds the predetermined value.

In addition, in order to change an impelling direction of the movable element 49b, a means for changing the impelling direction in a general linear motor may be used.

However, according to the embodiment, a phase of the power supplied to the stator 49a from the controller part 49c is changed.

Note that the phase may be changed at a timing when the folding door part 10 is set in the fully-opened state or set in the fully-closed state. However, the timing can be delayed by using a timer, etc.

[0065] Thus, according to the opening/closing door unit 1 having the structure, the opening/closing operation of the folding door part 10 is performed by using the linear motor 49. Therefore, a space for including the drive source is saved, compared with a mechanism, etc, provided with pulleys, the belt, and the drive unit, etc. This eventually realizes reduction of the size of the upper frame part 23.

In addition, even when the supply power to the linear motor 49 is shut off due to power failure, etc, the resistance at the drive source side is relatively small, and therefore the opening/closing operation of the folding door part 10 can be easily performed manually.

Moreover, the folding door part 10 during the closing operation by the linear motor 49 can be stopped with a relatively light force, and also the impact generated if the folding door part 10 during the closing operation abuts on an object, etc, can be relative small.

[0066] Next, other example of the opening/closing door unit according to the present invention will be described. Note that the opening/closing door unit shown hereunder is constituted by partially changing the opening/closing door unit 1. Therefore, by assigning the same symbols to approximately the same place, overlapped detailed explanation is not repeated.

[0067] The opening/closing door unit 2 shown in Fig. 4 is constituted in such a manner that the movable element 49b is protruded in the moving direction (left direction according to Fig. 4) from the movement support part 41 to the opening/closing door unit 1, in the case of closing the door body, and the stator 49a is disposed closer to a protruding direction of the movable element 49b.

More specifically, the movable element 49b in the opening/closing door unit 2 is disposed so as to protrude in the moving direction from the supporting bracket 41b in the case of closing the door body, by being fixed to the supporting bracket 41b via other bracket, etc.

As shown in Fig. 4, a protruding amount of the movable element 49b may be an amount so that an entire body of the movable element 49b is positioned at a moving direction side from the supporting bracket 41b in the case of closing the door body, or the movable element 49b may be further protruded.

Then, the stator 49a is disposed so as to correspond to the moving range of the movable element 49b. Accordingly, the stator 49a and the movable element 49b are not positioned in a space S at the door-tail side in the upper frame part 23.

[0068] Thus, according to the opening/closing door unit 2, the stator 49a and the movable element 49b are not positioned in the space S at the door-tail side. Therefore, maintenance work, etc, for these stator 49a and the movable element 49b can be easily performed.

Namely, for example, as shown in Fig. 4(b), even in a state in which the folding door part 10 is set in an almost fully-opened state, the stator 49a and the movable element 49b are not positioned in the upper part of the folding door part 10 and the movement support part 41. Therefore, good maintenance work is performed for these stator 49a and the movable element 49b.

[0069] In the opening/closing door unit 3 shown in Fig. 5, the magnetic attractor 43 and the elastic body 43b are omitted in the opening/closing door unit 1, and when the folding door part 10 is almost fully-closed, the fully-closed state is maintained by the drive force of the linear motor 49, and further even when the folding door part 10 is almost fully-opened, the fully-opened state is maintained by the drive force of the linear motor 49.

As a specific means for maintaining the fully-closed state of the folding door part 10 by the drive force of the linear motor 49, it may be preferable that power supply to the linear motor 49 is not shut off, when the sensor 49a1 and a sensing means not shown recognize a state in which the folding door part 10 is set at an almost fully-closed position by the closing operation.

Approximately in the same way, as the specific means for maintaining the fully-opened state of the folding door part 10 by the drive force of the linear motor 49, it may be preferable that the power supply to the linear motor 49 is not shut off, when the sensor 49a1 and the sensing means not shown recognize a state in which the folding door part 10 is set at an almost fully-opened position by the opening operation.

Note that as a further preferable aspect, as described above, in the fully-opened state or the fully-closed state of the folding door part 10, when the power supply to the linear motor 49 is maintained, an output voltage and an output frequency of the controller part 49c are suitably adjusted, so that a power supply to the linear motor 49 is set at a necessary minimum value.

In addition, in the aspect, the power supply to the linear motor 49 is continuously maintained in the fully-opened state or the fully-closed state of the folding door part 10. However, as other example, when the fully-opened state or the fully-closed state of the folding door part 10 can be maintained by a friction force, etc, in each contact place, even if the power is shut off in the fully-opened sate or the fully-closed state of the folding door part 10, power supply time can be set as a temporal time within a predetermined time.

[0070] In addition, the structure of an opening/closing door unit 4 shown in Fig. 6 is different from the structure of the opening/closing door unit 1 in the point that by replacing the stator 49a with a stator 49a', the stator 49a' and the movable element 49b are not opposed to each other when the door body 11 is set at the fully-closed position and the fully-opened position, and the sensor 49a1 is omitted.

More specifically, the stator 49a' is constituted to be

shorter than the stator 49a in the opening/closing door unit 1, so that the stator 49a' is not opposed to the movable element 49b when the door body 11 is set at the fully-closed position or the fully-opened position, and is disposed closer to the center side in the moving range of the movement support part 41.

[0071] Namely, when the door body 11 is set at the fully-closed position or the fully-opened position, the stator 49a' is not positioned in the upper part of the movable element 49b, and when the door body 11 is set at a position other than the fully-closed position or the fully-opened position, the stator 49a' and the movable element 49b are set in a relation that the stator 49a' is positioned in the upper part of the movable element 49b.

Then, a drive power to the stator 49a' from the controller part 49c is always supplied to the stator 49a', regardless of whether or not the door body 11 is set at the fully-closed position or the fully-opened position.

In addition, when the door body 11 is set at the fully-opened position, supply of the drive power is switched so that the movable element 49b is impelled to the door-end direction (left direction of Fig. 6), and when the door body 11 is set at the fully-closed position, the supply of the drive power is switched so that the movable element 49b is impelled to the door-tail direction (right direction of Fig. 6).

[0072] Thus, according to the opening/closing door unit 4 shown in Fig. 6, for example, when the folding door part 10 set at the fully-closed position is opened, the movement support part 41 and the movable element 49b are moved in a door-tail direction along with the opening operation of the door body 11, if the door body 11 is slightly opened manually.

Then, when the movable element 49b is moved to a position opposed to the stator 49a', the movable element 49b further continues to move by an electromagnetical impelling force received from the stator 49a'.

Then, when the folding door part 10 is set at the fully-opened position, the movable element 49b and the stator 49a' are not opposed to each other any more. Therefore, the movable element 49b does not receive the electromagnetical impelling force any more from the stator 49a.

[0073] In addition, when the folding door part 10 set at the fully-opened position is fully-closed, the movable element 49b is moved to the position opposed to the stator 49a' along with a manual closing operation, and the movable element 49b further continues to move by the electromagnetical impelling force received from the stator 49a', if the door body 11 is slightly closed manually by an action opposite to the action.

Then, when the folding door part 10 is set at the fully-closed position, the movable element 49b and the stator 49a' are not opposed to each other any more. Therefore, the movable element 49b does not receive the impelling force any more from the stator 49a'.

[0074] Note that in the opening/closing door unit 4, the stator 49a' is always supplied with power. However, it is also possible to control in such manner that the sensor, etc, senses a state in which the stator 49a' and the movable element 49b are opposed to each other, and only when the sensed signal is given, the stator 49a' is set in a power-supply state.

[0075] In addition, according to the opening/closing unit 4 shown in Fig. 6, when the door body 11 is set at the fully-closed position and the fully-opened position, the stator 49a' and the movable element 49b are set not opposed to each other. However, as other example, it is also possible that when the door body 11 is set at either one of the fully-closed position or the fully-opened position, the stator 49a' and the movable element 49b are set not opposed to each other.

In this case, when the door body 11 is set in the fully-opened state or set in the fully-closed state, in order to change the impelling direction of the movable element 49b, the phase of the power supplied to the stator 49a is changed at a timing when the folding door part 10 is set in the fully-opened state or set in the fully-closed state. However, the timing can be delayed by using the timer, etc.

[0076] In addition, in the opening/closing door unit 5 shown in Fig. 7 according to the opening/closing unit 1, the sensor 49a1 is used as a means for sensing a state in which the movement support part 41 during being impelled in the door-tail direction is positioned within a predetermined range W of the door-end side (left side of Fig. 7), and according to the sensed signal of the sensor part 49a1, an impelling speed of the movable element 49b is decreased.

In the opening/closing door unit 5, the sensor 49a1 is disposed at a position away from the door-end side end portion in the stator 49a' by a predetermined distance (predetermined range W) to the door-tail side (right side in Fig. 7).

The predetermined range W is suitably set so as to decelerate the closing operation of the folding door part 10 at a position closer to the fully-closed position.

Note that it is possible that the sensor 49a1 has two functions such as a function of sensing the movable element 49b when a manual opening operation and a manual closing operation are performed, and a function of sensing a state in which the movable element 49b during being impelled to the door-tail direction is positioned within a predetermined range W, or it is also possible that a plurality of sensors 49a1 are provided and the functions are allocated to each one of them.

In addition, to which one of the door-end direction and the door-tail direction, the folding door part 10 and the movement support part 41 are impelled, may be judged by a driving direction of the linear motor 49, which is judged from the power phase or from the sensed signal obtained by the sensor, etc.

[0077] Fig. 8 is a flow chart showing a control operation performed by the controller part 49c during closing operation of the folding door part 10, in the opening/closing door unit 5.

In step 1 in the flowchart, whether or not the movement

support part 41 is positioned within the predetermined range W is judged during the closing operation of the door body 11. When the movement support part 41 is positioned within the predetermined range W, the processing is moved to the next step 2, and otherwise, the processing is awaited until the movement support part 41 is positioned within the predetermined range W. Namely, according to the step 1, when the movement support part 41 and the movable element 49b are impelled in the door-end direction along with the closing operation of the door body 11, whether or not the movable element 49b is sensed by the sensor 49a1, is judged.

[0078] Then, in step 2, by the power control performed by the controller part 49c, the impelling speed of the movable element 49b is decreased.

Specifically, regarding the power supplied to the stator 49a from the controller part 49c, by controlling the voltage and/or the frequency, the impelling speed of the movable element 49b is decreased.

[0079] Next, in step 3, whether or not the door body 11 is fully closed is judged, and when the door body 11 is fully-closed, the processing is moved to the next step 4, and the linear motor 49 is set in a non-power supply state. Otherwise, the processing of the step 3 is repeated until the door body 11 is fully-closed.

As the means for sensing the sate in which the door body 11 is fully-closed, it is possible that the movement support part 41 or a member integral with the movement support part 41 at the time of full closure is sensed by using the contact or non-contact sensor not shown, for example, or it is also possible to recognize a state in which the current value at the time of full closure exceeds a predetermined value.

[0080] Thus, according to the opening/closing door unit 5, when the door body 11 approaches the fully-closed position, the speed of the movable element 49b is decreased by the power control performed to the linear motor 49. Therefore, with decrease of the speed of the movable element 49b, the moving speed of the door-end part 10a of the door body 11 is adjusted to a suitable speed. Namely, as shown in Fig. 3, usually the speed of the door-end part 10a is accelerated, as the door body 11 during closing operation approaches the fully-closed position by composite motion of a motion in the width direction of the opening part and a rotating motion. However, according to the present invention, the acceleration of the door-end part 10a can be prevented, and eventually it is also possible to prevent a state in which the door body 11 during closing operation exceeds the fully-closed position, and further it is possible to alleviate the impact of the abutment, even if the door-end part 10a abuts on the object, etc.

[0081] Next, an opening/closing door unit 6 shown in Fig. 9 will be described.

A different point of the opening/closing unit 6 from the opening/closing unit 5 is that a mechanical type damper unit 50 is added in the opening/closing door unit 6.

The damper unit 50 is a well-known mechanism in which a piston part 51 is energized in a stretching direction. According to an example shown in the figure, the piston part 51 is energized in the stretching direction by a spring 52. However, as other example, a well-known structure is also possible, such that the piston part 51 is energized by a repulsiveness of a gas in a cylinder part 53.

Then, the damper unit 50 is fixed to the upper frame part 23, so as to receive the movement support part 41 by a protruded end portion of the piston part 51 from its door-end side, slightly before almost full closure of the folding door part 10.

[0082] According to the opening/closing door unit 6, in approximately the same way as the opening/closing door unit 5, the speeds of the movement support part 41 and the movable element 49b are decreased by the power control of the controller part 49c, slightly before the full closure of the folding door part 10. Further, by receiving the movement support part 41 by the piston part 51 also, the closing operation of the folding door part 10 is decelerated.

Then, the fully-closed state of the folding door part 10 in the case of the full closure is maintained, when the supporting bracket 41b is attracted by the magnetic attractor 43.

In addition, when the opening operation of the folding door part 10 in the fully-closed state is performed, the door body 11 is slightly moved in the opening direction manually by the user. Then, an initial drive force by the linear motor 49 is assisted by a repulsive force of the damper unit 50, and the movement of the movement support part 41 and the movable element 49b is smoothly continued in the door-tail direction (right direction in Fig. 9).

[0083] Note that in the opening/closing door unit 6, it is also possible that the control of decreasing the speed of the movable element 49b that is impelled in the door-end direction is omitted, and the speed of the folding door part 10 in the case of the closing operation is decreased by an action of only the damper unit 50, slightly before the full closure.

[0084] In addition, according to the opening/closing door units 1, 2, 4, 5 and 6 (see Figs. 2, 4, 6, 7 and 9), the supporting bracket 41b is attracted by the magnetic attractor 43, in the fully-closed state of the folding door part 10. However, as other example, in the fully-closed state of the folding door part 10, it is also possible that a gap is provided between the supporting bracket 41b and the magnetic attractor 43, so that an attraction force of the magnetic attractor 43 can act, and the elastic body 43b is omitted.

With the structure also, the fully-closed state of the folding door part 10 can be maintained by the attraction force of the magnetic attractor 43, and also the impact of the abutment can be alleviated when the supporting bracket 41b and the magnetic attractor 43 are abutted on each other.

[0085] In addition, as a structure added to the embodiment, it is also preferable that when the folding door part 10 during closing operation abuts on the object, etc, the

folding door part 10 is made to perform reverse operation (opening operation) or stop. Specifically, the folding door part 10 during closing operation abuts on the object, etc, and this is recognized from the change of the current value of the linear motor 49, and the folding door part 10 is made to perform reverse operation or stop.

With the structure, even if the folding door part 10 during closing operation abuts on the object, etc, the impact generated under the abutment can be alleviated and also it is possible to prevent a state in which the object, etc, is sandwiched between the door-end of the folding door part 10 and the door-end side vertical frame part 21.

[0086] In addition, according to the embodiment, when the slightly closing operation of the folding door part 10 in the case of a fully-opened state is performed manually, the closing operation of the folding door part 10 is performed. However, as other example, it may be also preferable that the folding door part 10 in the case of the fully-opened state is automatically closed after a predetermined time.

[0087] In addition, as a structure added to the embodiment, it is also possible that when the folding door part 10 is maintained in a manually partly-open state, the partly-open state is maintained.

[0088] As other structure, it is also possible that an operation pattern of the folding door part 10 is suitably changed by the change of the controller part 49c on a control circuit.

[0089] In addition, according to each aspect shown in Figs. 2, 4, 5, 7 and 9, slight movement of the folding door part 10 set in the fully-opened state or fully-closed state is sensed by the sensor 49a1 by manual operation, etc. However, as other example, it is also preferable that by detecting an induced electromotive force generated by a coil of the stator 49a in the non-power supply state, with the movement of the movable element 49b, the sensor 49a1 senses a state in which the movable element 49b is moved by an external force, namely a state in which the folding door part 10 set in the fully-opened state or set in the fully-closed state is slightly moved by manual operation, etc, and according to the sensed signal, the power is supplied to the stator 49a.

According to the structure, regardless of the position where the movement support part 41 starts to move by the external force, in other words, regardless of the position where the folding door part 10 starts the opening operation or the closing operation by the external force, namely regardless of any position, the change of the state is sensed and the linear motor can be activated.

[0090] In addition, according to each one of the aspects, the opening operation and the closing operation of the folding door part 10 are performed by the linear motor 49. However, only one of the operations can be performed by the linear motor 49 and the other operation can be made the operation performed by manual operation or performed by energizing means.

Moreover, the operation by the linear motor 49 may be performed in almost an entire area of the opening/closing range by the folding door part 10, or may be a partial area within the same opening/closing range.

Claims

1. An opening/closing door unit, comprising:

   a movement support part provided so as to move in
   a width direction of an opening part relative to an immobile part; and a door body supported by the movement support part so as to turn in a direction to intersect the opening part, with the opening part opened and closed by the movement and the turn of the door body,
   wherein a linear motor is constituted by providing a stator in the immobile part and providing a movable element in the movement support part, and by the linear motor, the movement support part is moved in a width direction of the opening part.

2. The opening/closing door unit according to claim 1, comprising:

   a sensor that senses one or both of a state in which a predetermined amount of opening operation of the door body is performed from a fully-closed position, and a sate in which a predetermined amount of closing operation of the door body is performed from a fully-opened position,
   wherein according to a sensed signal of the sensor, the linear motor is set in a power supply state from a non-power supply state, and movement of the movement support body is continued.

3. The opening/closing door unit according to claim 2, wherein
   a plurality of door bodies are continuously connected to each other in the width direction of the opening part, and out of the plurality of door bodies, one of the adjacent door bodies is connected to the other one so as to turn in both directions, and
   by supporting the door bodies at the door-end side by the movement support part, and also by turnably supporting the door bodies at the door-tail side relative to the immobile part, a folding door part capable of double-opening is constituted.

4. The opening/closing door unit according to claim 3, wherein the movable element is provided so as to protrude from the movement support part in a moving direction, at the time of a closing operation of each door body.

5. The opening/closing door unit according to claim 4,

wherein when the door body is fully-closed, the fully-closed state is maintained by a drive force of the linear motor.

6. The opening/closing door unit according to claim 5, wherein a controller part of the linear motor is disposed outside a moving range of the movement support part.

7. The opening/closing door unit according to claim 6, wherein the stator is disposed closer to the center side in the moving range of the movement support part so that the stator and the movable element are not opposed to each other, when the door member is set at a fully-closed position or set at a fully-opened position.

8. The opening/closing door unit according to claim 7, wherein when the movement support member is positioned within a predetermined range during closing operation of the door member, power control is applied to the linear motor so that a speed of the movable element is decreased.

9. The opening/closing door unit according to claim 8, wherein when the door member is set at a predetermined position within the predetermined range, a damper unit is provided so that the speed of the movable element is further decreased.

10. The opening/closing door unit according to claim 1, wherein a plurality of door bodies are continuously connected to each other in the width direction of the opening part, and out of the plurality of door bodies, one of the adjacent door bodies is connected to the other one so as to turn in both directions, and
by supporting the door bodies at the door-end side by the movement support part, and by turnably supporting the door bodies at the door-tail side relative to the immobile part, the folding door part capable of double-opening is constituted.

11. The opening/closing door unit according to claim 1, wherein the movable element is provided so as to protrude from the movement support part in a moving direction at the time of the closing operation of each door body.

12. The opening/closing door unit according to claim 1, wherein when the door body is fully-closed, the fully-closed state is maintained by a drive force of the linear motor.

13. The opening/closing door unit according to claim 1, wherein a controller part of the linear motor is disposed outside a moving range of the movement support part.

14. The opening/closing door unit according to claim 1, wherein the stator is disposed closer to the center side in a moving range of the movement support part so that the stator and the movable element are not opposed to each other when the door member is set at a fully-closed position or set at a fully-opened position.

15. The opening/closing door unit according to claim 1, wherein when the movement support member is positioned within a predetermined range during closing operation of the door member, power control is applied to the linear motor so that the speed of the movable element is decreased.

16. The opening/closing door unit according to claim 1, wherein when the door member is set at a predetermined position within the predetermined range, the damper unit is provided so that the speed of the movable element is further decreased.

FIG.1

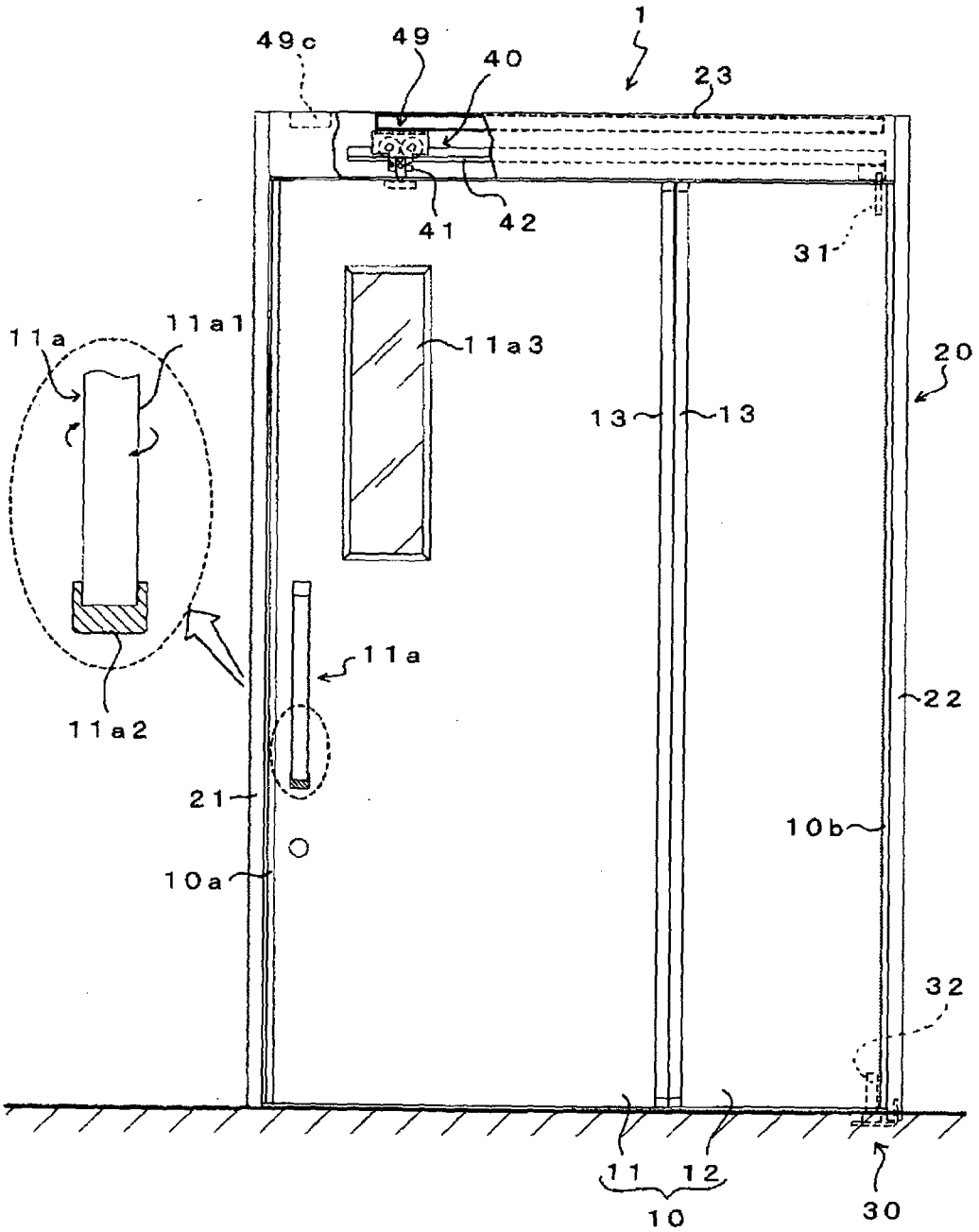

1
49c
49
40
23
41
42
31
11a
11a1
11a3
20
13
13
11a
11a2
21
22
10b
10a
32
11
12
10
30

FIG.2

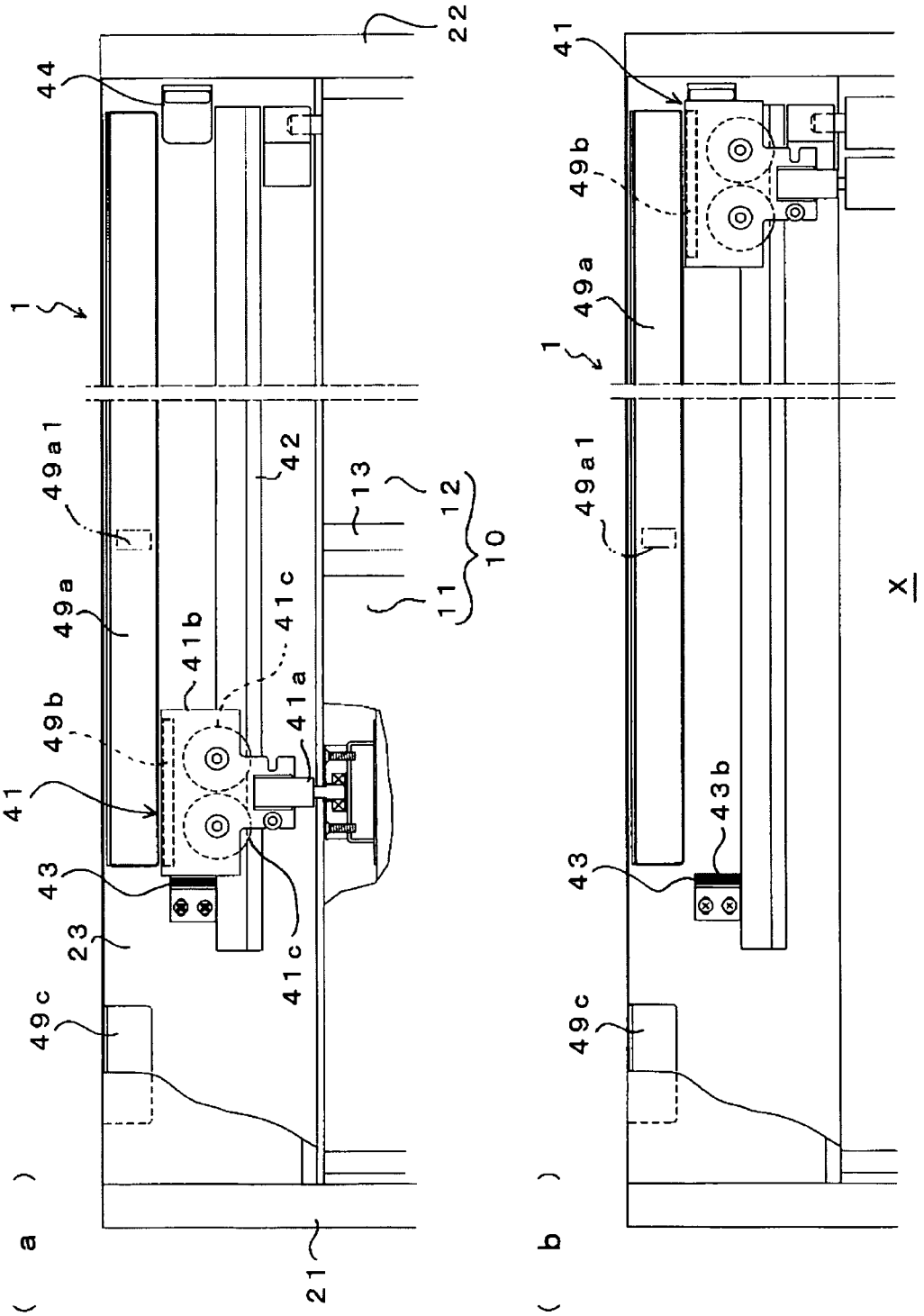

22
44
1
49a1
42
13
12
10
11
49a
41c
41b
41a
49b
41
43
23
49c
41c
21
(a)
41
49b
49a
1
49a1
43b
43
49c
(b)
X

FIG.3

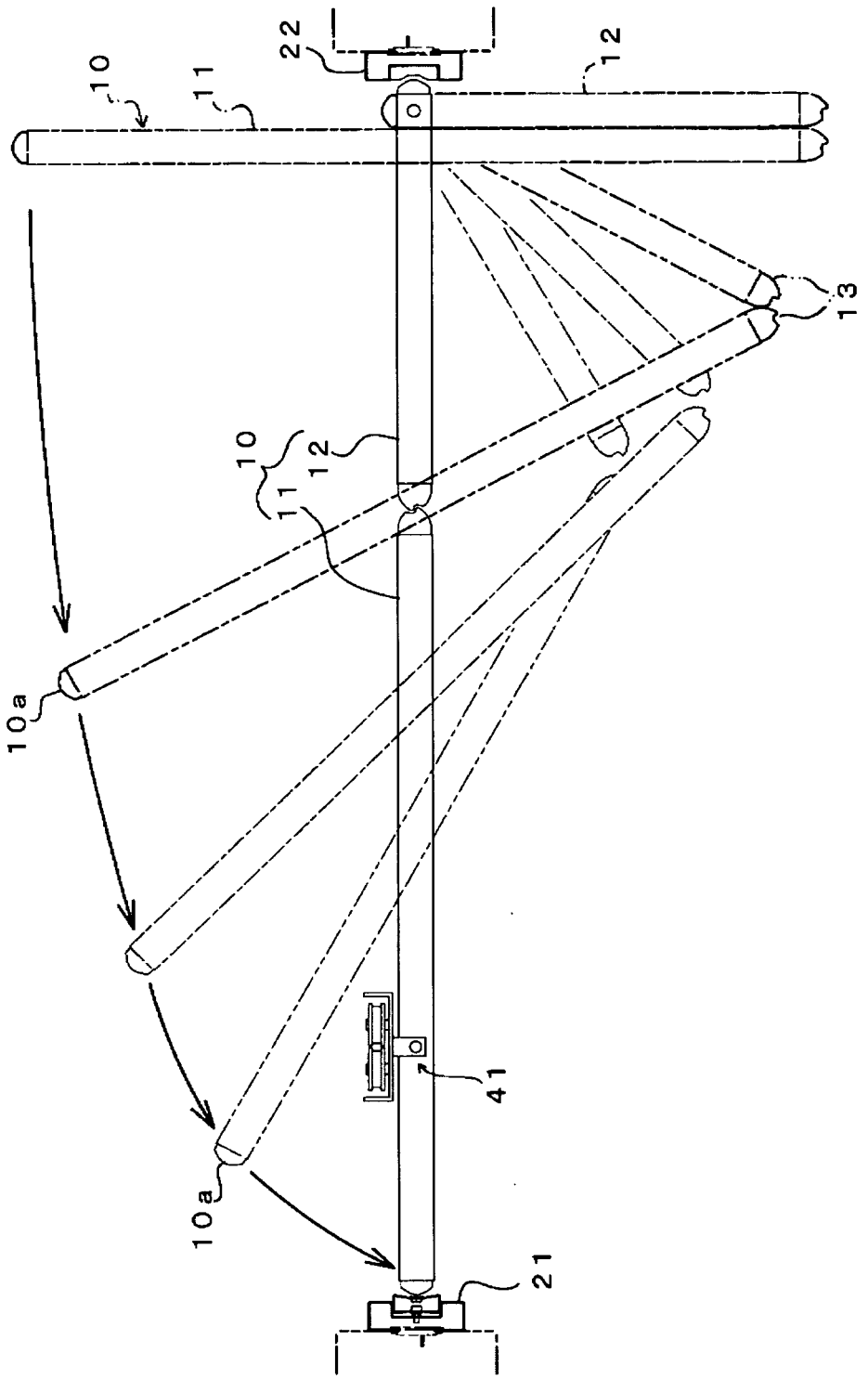


FIG.4

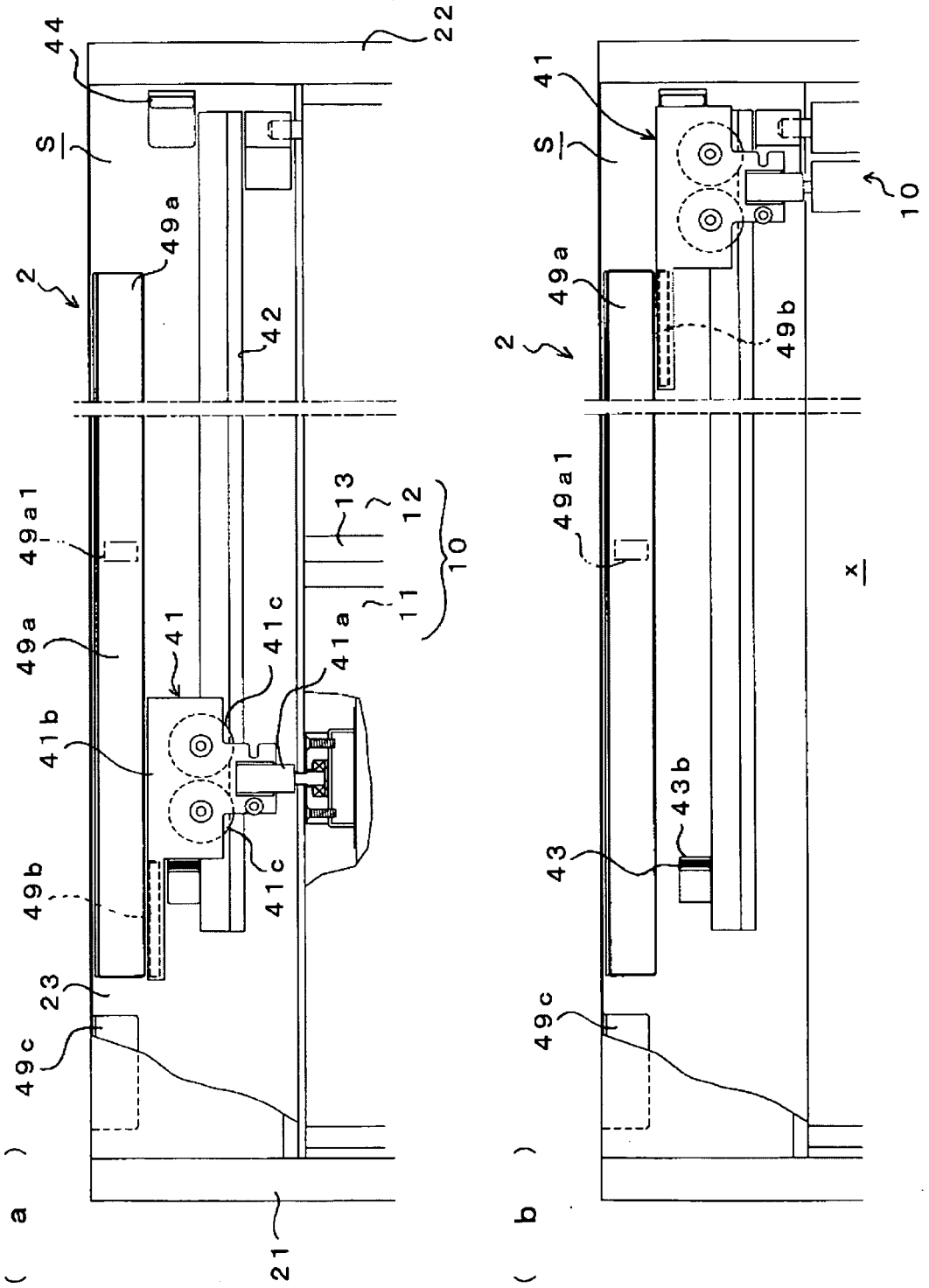

(a)
(b)
S
X
2
10
11
12
13
21
22
23
41
41a
41b
41c
42
43
43b
44
49a
49a1
49b
49c

FIG.5

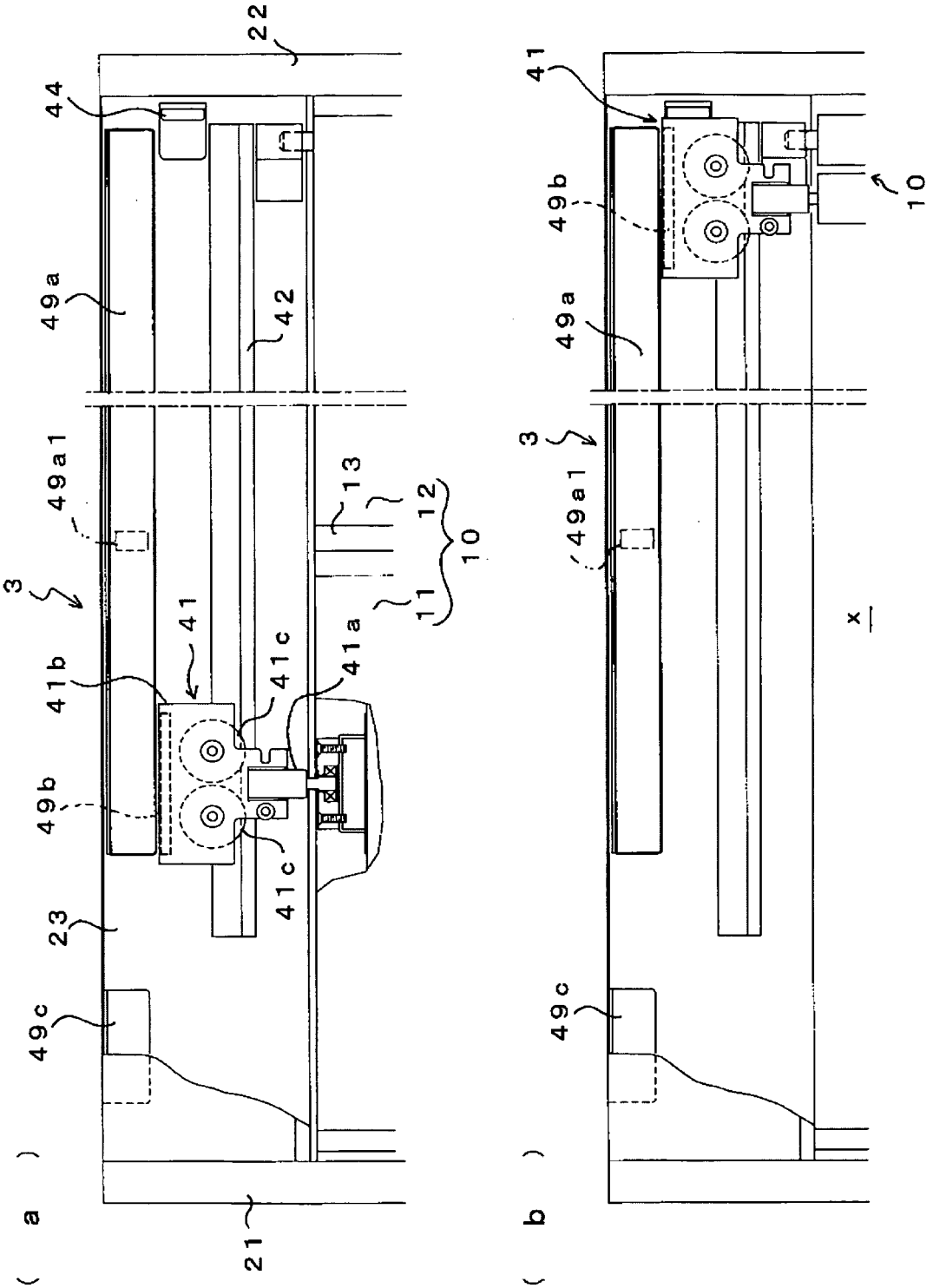

22
44
49a
42
49a1
13
12
10
3
41
11
41b
41c
41a
49b
41c
23
49c
21
(a)
41
49b
10
49a
3
49a1
X
49c
(b)

FIG.6

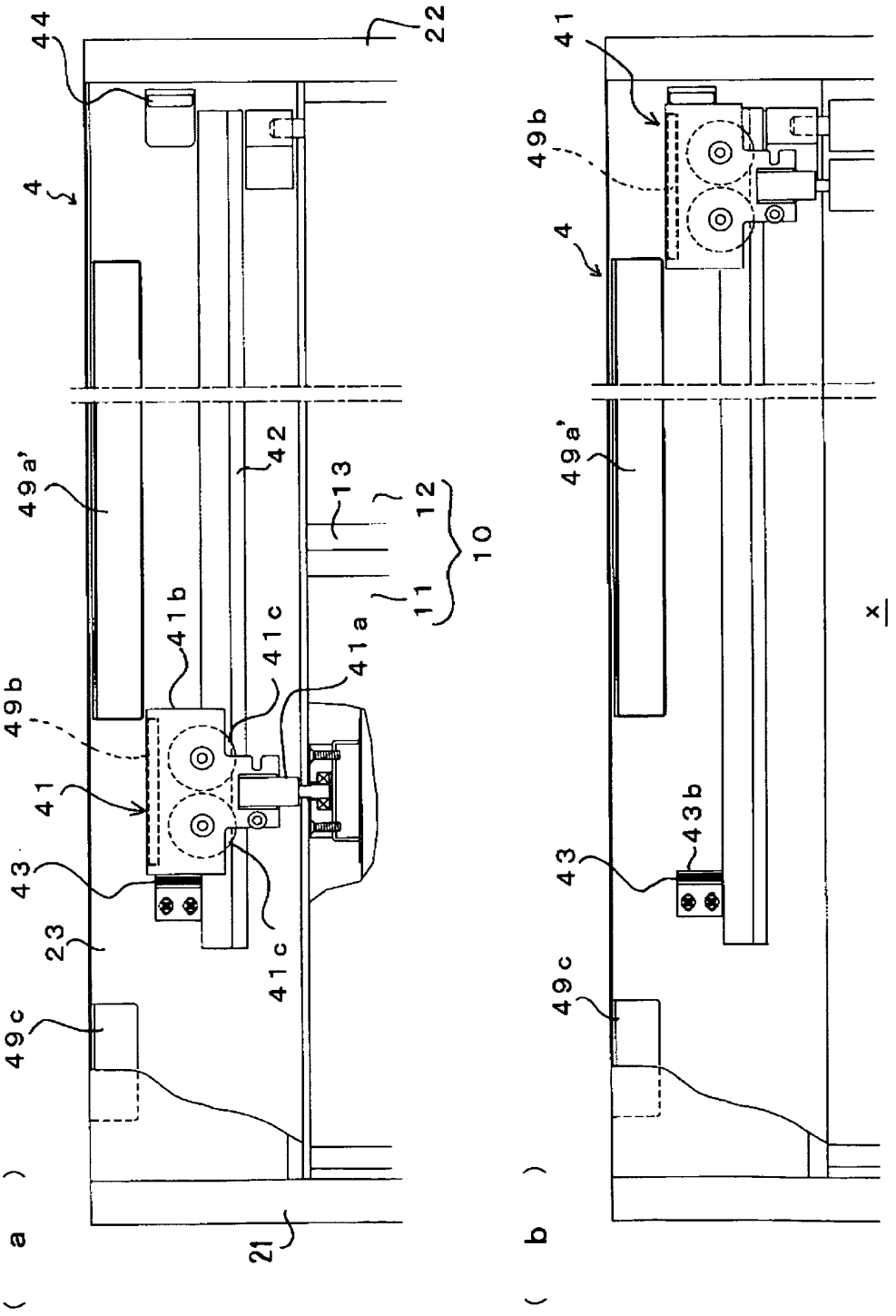

44
22
4
49a'
42
13
12
10
11
41b
41c
41a
49b
41
43
23
49c
41c
21
(a)
41
49b
4
49a'
43b
43
49c
(b)
X

FIG.7

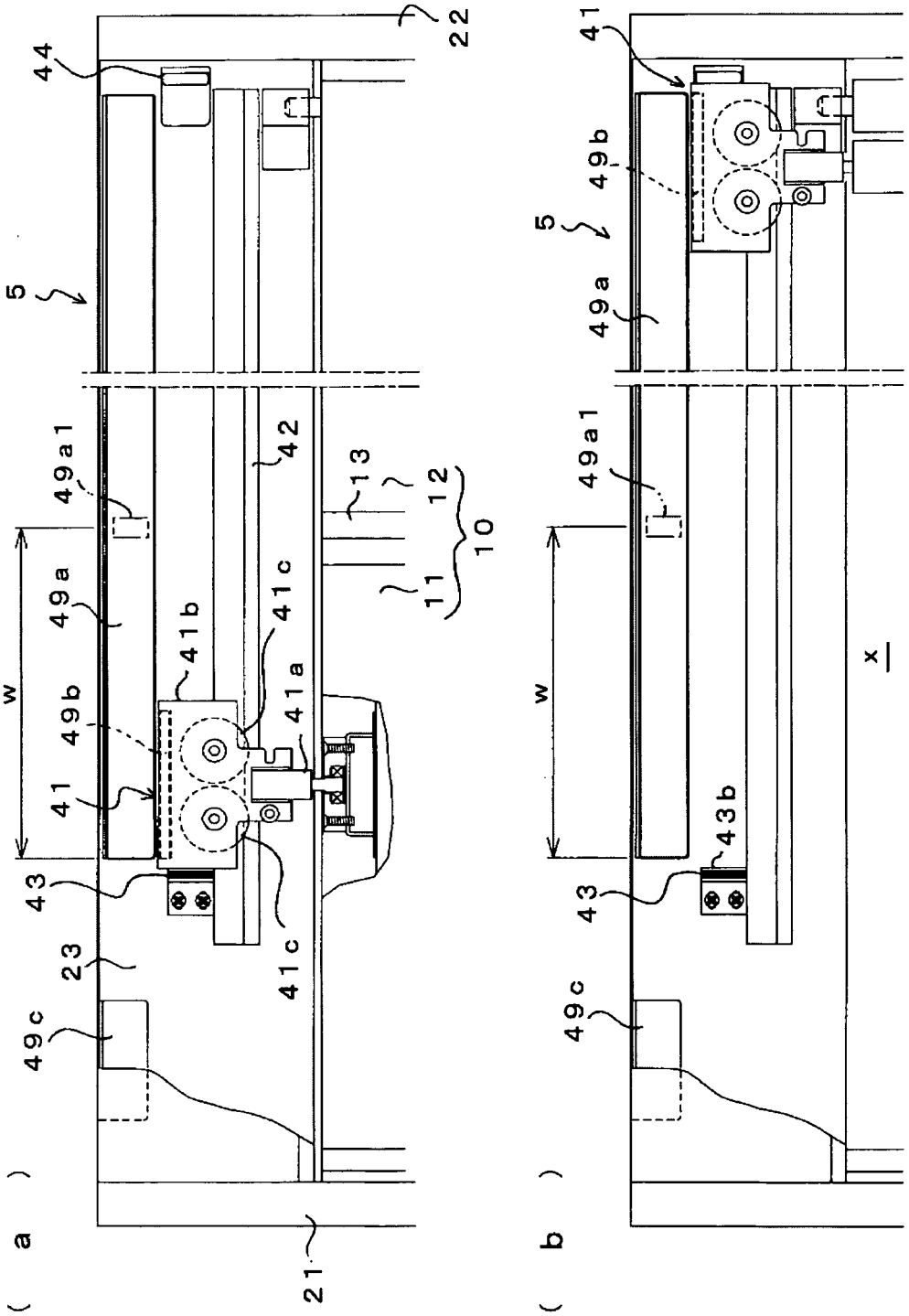

(a)
(b)
w
x
5
10
11
12
13
21
22
23
41
41a
41b
41c
42
43
43b
44
49a
49a1
49b
49c

FIG.8

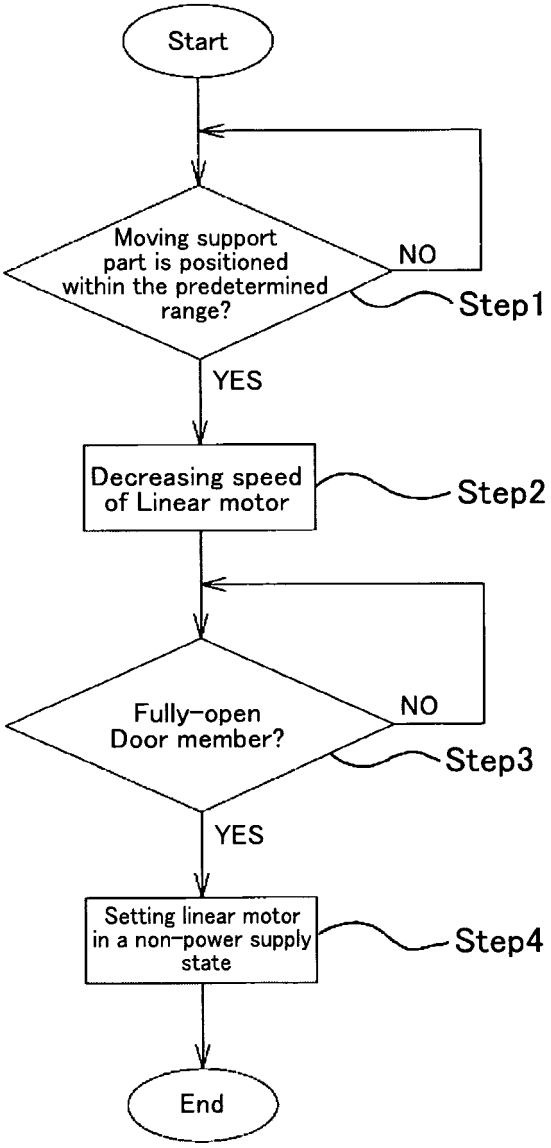
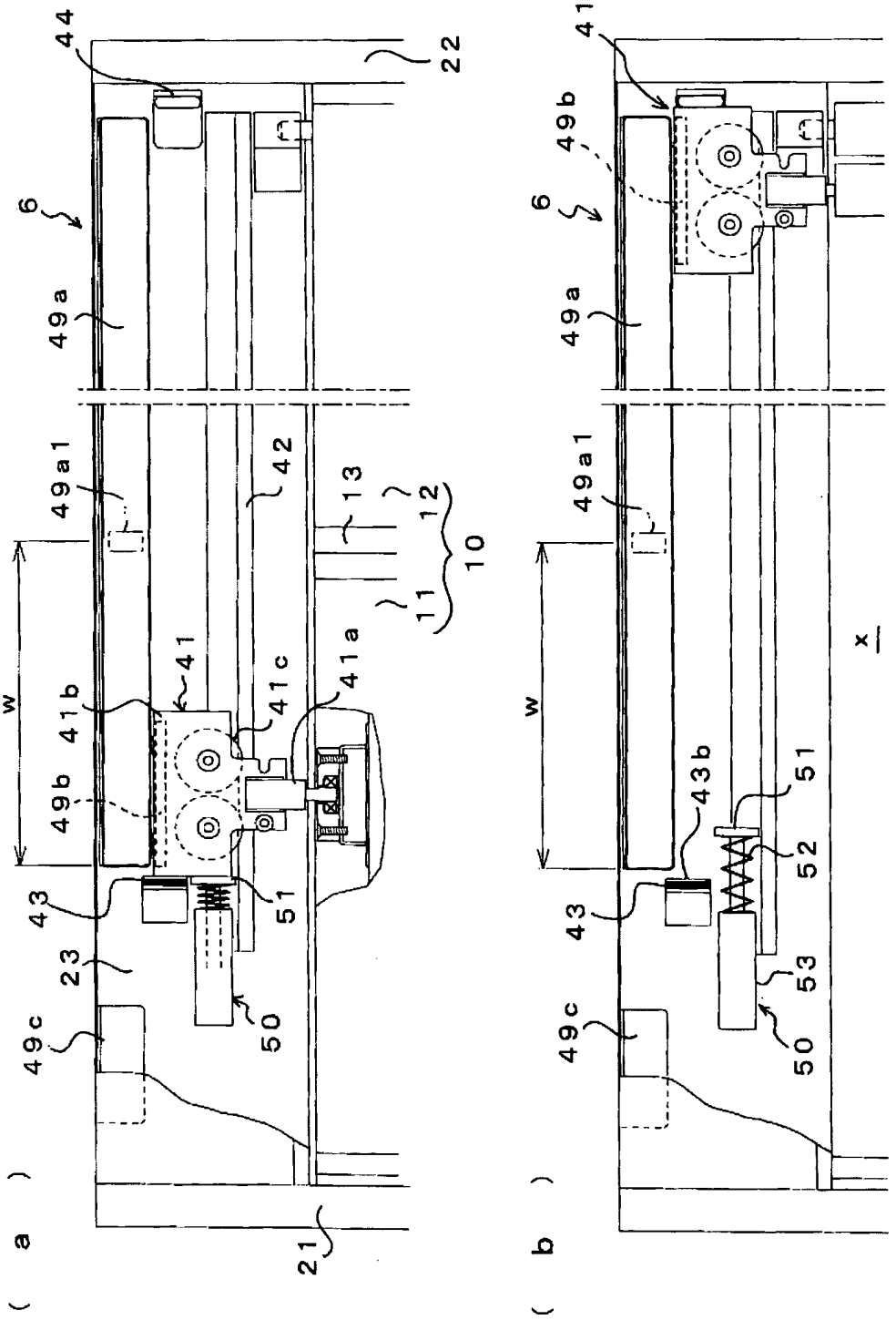

Start
Moving support part is positioned within the predetermined range?
NO
Step1
YES
Decreasing speed of Linear motor
Step2
Fully-open Door member?
NO
Step3
YES
Setting linear motor in a non-power supply state
Step4
End

FIG.9


(a)
(b)
w
x
6
10
11
12
13
21
22
23
41
41a
41b
41c
42
43
43b
44
49a
49a1
49b
49c
50
51
52
53

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/061517

A. CLASSIFICATION OF SUBJECT MATTER
E05F15/18(2006.01)i, *E05D15/26*(2006.01)i, *E05D15/30*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E05F15/18, E05D15/26, E05D15/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2007
Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2002-295118 A (Toyota Auto Body Co., Ltd.), 09 October, 2002 (09.10.02), Par. Nos. [0008] to [0017]; Figs. 1 to 5 (Family: none)	1,2,13,14 3-12,15,16
X Y	JP 2000-45630 A (Sekisui Chemical Co., Ltd.), 15 February, 2000 (15.02.00), Par. Nos. [0020] to [0028]; Figs. 6 to 8 (Family: none)	1 3-11
Y	JP 2961951 B2 (Fuji Electric Co., Ltd.), 12 October, 1999 (12.10.99), Par. No. [0012] (Family: none)	5-9,12

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 July, 2007 (17.07.07)	31 July, 2007 (31.07.07)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/061517

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004-242499 A (Fuji Electric Systems Co., Ltd.), 26 August, 2004 (26.08.04), Par. No. [0033]; Fig. 6 (Family: none)	8,9,15
Y	JP 2004-204595 A (Comany Co., Ltd.), 22 July, 2004 (22.07.04), Par. No. [0017] (Family: none)	9,16
A	JP 2003-239613 A (Miksy Limited Corporation), 27 August, 2003 (27.08.03), Full text; all drawings (Family: none)	1-16
A	JP 11-2070 A (Toyota Auto Body Co., Ltd.), 06 January, 1999 (06.01.99), Full text; all drawings (Family: none)	1-16

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/061517

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claim 1, claims 2-9, claim 10, claim 11, claim 12, claim 13, claim 14, claim 15, claim 16

(Reason) The result of search reveals that the invention in claim 1 is not novel since it is disclosed in JP 2002-295118 A (Toyota Auto Body Co., Ltd.), 09 Oct., 2002 (09.10.02) and JP 2000-45630 A (Sekisui Chemical Co., Ltd.), 15 Feb., 2000 (15.02.00).

Since there is no same or corresponding "special technical feature" between the invention in claim 1 and the inventions in claims 2-16, they do not fulfill the requirement of unity of invention (For the meaning of "the special technical feature", refer to the second sentence of PCT rule 13.2).

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

the

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, payment of a protest fee..

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

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 11236787 A **[0004]**
- JP 2000274105 A **[0004]**